Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
29927	0	0	0	0	Please ensure completeness and clarity with the term "natural respons" throughout the chapter.	reject, it was defined on p 13. The natural response of land to human-induced environmental changes is the response of vegetation and soils to 1 environmental changes such as increasing atmospheric CO2 concentration, nitrogen deposition, and climate change. The 2 estimate shown represents the average from 17 Dynamic Global Vegetation Models with 1SD uncertainty (Friedlingstein 3 et al. under review)	Government of Norway	Norwegian Environment Agency	Norway
45925	0	0	0	0	As in previous IPCC reports, it should be clearly differentiated between afforestation, reforestation and forest restoration. This is especially important when it comes to co-benefits and trade-offs of forest mitigation measures (Table 6.7, especially impacts for biodiversity and ecosystems functions are different) and influences the mitigation potential of the forest sector when environmental and social safeguards are applied (Table 7.5). Most differences regarding potentials and trade-offs exist between afforestation and the other two measures, why e. g. the SRCCL has looked at "afforestation" and "reforestation and forest restoration" separately. These categories should be maintained. To support the differentiation of the three concepts it would be helpful to add a definition for forest restoration in Box 7.2 for the full picture of forest mitigation measures.	reject, we clearly differentiate between afforestation an dreforestation. restoration is also in glossary as land restoration	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
52285	0	0			Impact of Renewables (Wind & Solar Farms, etc.) on Land and Land Use Change must be reflected throughout the Chapter.	reject, this was clearly done in SOD with extensive material on trade offs of land mitigation and renewables(bioenergy) wind and solar are in energy chapter	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
54325	0	0			This chapter is in good shape. Congratulations to the authors for a good job done.	thank you	Sabine Fuss	MCC Berlin	Germany
58517	0	0	0	0	The countries should be encouraged to develop MRV on the principle of REDD+. This will not only help in mitigation but would also contribute to making effective management and monitoring programme for their respective countries. I think there should be emphasis on promoting and adoption of REDD+ mechanism in a more aggressive way through finance from internal as well as external sources. The report does have mention of many REDD+ mechanisms across the globe but I would appreciate if it is highlighted more in the above mentioned context to unlock the complete potential of forestry sector.	noted, however, it would be policy prespcriptive if we would aggressively push REDD+ (as the reviewers suggests). On MRV we note e.g. in research questions that MRV needs to be further developed. , naturally based on exisiting work as e.g. developed for REDD+ and in IPCC guidelines	Bhaskar Sinha	Indian Institute of Forest Management	India
58519	0	0	0	0	I would also appreciate if the report has a separate section/Box on the role of trees outside Forests (TOFs) not to highlight the mitigation potential alone but also to highlight the adaption potential by significantly enhancing the income of forests (Ghosh and Sinha, 2016, 2018 A & B). There are some very well researched review/empirical data articles, mentioned below. There is a need to manage TOFs through a comprehensive plan and policies, which it lacks, especially in context to developing countries, including India. Ghosh, M. and Sinha, B. 2016.Impact of Forest Policies on Timber Production in India: A review. Natural Resources Forum (DOI: 10.1111/1477-8947.12094). Ghosh M. & Sinha A. 2018 Policy analysis for realizing the potential of timber production from Trees Outside Forests (TOF) in India, International Forestry Review Vol.20(1), 89-103. 31. Ghosh M. & Sinha B. 2018 Institutional Imperatives for Promoting Trees Outside Forests (TOFs) to Enhance Timber Production in India, Small Scale Forestry DOI: https://doi.org/10.1007/s11842-018-9407-4	agree, but we see this as part of agroforesry and various other manners of agricutlural forms.	Bhaskar Sinha	Indian Institute of Forest Management	India
66229	0	0	0	0	this chapter is opened very messy and chaotic. It is very hard to understand the flow of this chapter. I understand that the authors want to provide as many information as possible. But kindly explain why such information should be there? And how the flow of this chapter. As a person who review this chapter before, somehow it becomes slightly more confusing than before.	noted	Marissa Malahayati	National Institute for Environmental Studies	Japan
66231	0	0	0	0	Too much information on caption, some needs to be move to the paragraph.	noted	Marissa Malahayati	National Institute for Environmental Studies	Japan
66233	0	0	0	0	Kindly only put figure/ tables that related with the explanation. Or at least place it close enough the the related paragraph. I am often scroll for 2-3 pages just to see the pointed figures/tables.	noted	Marissa Malahayati	National Institute for Environmental Studies	Japan
11733	0				On one hand the agriculture sector accounts for 23% of global anthropogenic Greenhouse Gas (GHG) emissions. On the other the hand land and biomass are also an important sink estimated to absorb around 31% of anthropogenic CO2 emissions. Agriculture is and can become an even bigger part of the solution. This is especially true for LU. This needs to be highlighted in the report. To increase that insight, the carbon cycle and soil carbon pools needs to be better described in future reports. Carbon sequestration is dependent on nitrogen supply. Although nitrogen gives rise to emissions it also is a prerequisite for using photosynthesis for increased carbon binding. Much of the carbon bound by agriculture is not made visible in the report (Bolinder et al., 2020). The carbon is also treated too standardized, not least taking into account what is stable carbon versus easily decomposable carbon (Guenet et al, 2020). Stable carbon is protected in the soil. If the possibilities with photosynthesis are not highlighted, few outside the sector can understand how much of the potential available solution within AFOLU. Within the EU, the sector is a net contributor with is a promising fact. Bolinder M.A., Crotty F., Elsen A., Frac M., Kismanyoky T., Lipiec J., Tits M., Toth Z., Kätterer T. 2020. The effect of crop residues, cover crops, manures and nitrogen fertilization on soil organic carbon changes in agroecosystems: A synthesis of reviews. Mitigation and Adaptation Strategies for Global Change 25: 929–952. Guenet et al. 2020. Can N2O emissions offset the benefits from soil organic carbon storage? Global Change Biology 27: 237-256.	reject, we think we sufficiently describe the carbon cycle , sinks and sources.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
11735	0				General comment. An overall view of the entire chapter 7, is that it is unfortunate that agriculture and forestry, at least from a boreal perspective, are in the same chapter. The assessment of the existing research will be very brief when these two sectors, that have such different conditions in different parts of the world, are to be dealt with in the same chapter.	reject , this chapter contents are based on the chaper outline of WGIII AR6	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
11745	0				Biochar production – energy balance and alternative use of possible non-agricultural organic residues could be more discussed as I see it.	reject, biochar has its own section . we do note the use of residues for bioenergy , and soil C as well.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
14809	0		0		A very well written and organized chapter. Easy to find key conclusions in the 'critical assessment' sections and to understand key advances since AR5 and the AR6 special reports.	thank you	Elizabeth Bush	Environment and Climate Change Canada	Canada
16421	0				This is close to the structure of Methodology Report, rather than FOD. It would be better to subcategorize the assessment categories of AFOLU mitigation measure for better understanding.	reject, we have categorized accordig to best knwledge and literature	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
20287	0				Sections 7.4 and 7.6 excellent synthesis I appreciate the good link wth other IPCC products. Would be to linked with the other AR6 WG II related chapters.	agree, we try to link better to WGII	Avelino G. Suarez	Research Centre for the World Economy	Cuba
21607	0				Evaluations of GHG emissions from agricultural lands are based on Integrated Assessment Models (IAMs). They could benefit from being complemented by other approaches such as partial equilibrium models e.g Prudhomme et al. (2020) Assessing the impact of increased legume production in Europe on global agricultural emissions. Regional Environmental Change (20(3), 1-13.). Other studies have been carried out on the impact of dietary changes in Europe on emissions (e.g. 464 MtCO2eq in Westhoek et al, (2014) Food choices, health and environment: Effects of cutting Europe's meat and dairy intake. Global Environmental Change, 26, 196-205	Noted . However, it is unclear to which section or paragraph the reviewer refers	Government of France	Ministère de la Transition écologique et solidaire	France
21609	0				Evaluations of GHG emissions from agricultural lands are based on Integrated Assessment Models (IAMs). They could benefit from being complemented by other approaches such as partial equilibrium models e.g Prudhomme et al. (2020) Assessing the impact of increased legume production in Europe on global agricultural emissions. Regional Environmental Change (20(3), 1-13.). Other studies have been carried out on the impact of dietary changes in Europe on emissions (e.g. 464 MtCO2eq in Westhoek et al, (2014) Food choices, health and environment: Effects of cutting Europe's meat and dairy intake. Global Environmental Change, 26, 196-206	noted and can be added	Government of France	Ministère de la Transition écologique et solidaire	France
21611	0				Evaluations of GHG emissions from agricultural lands are based on Integrated Assessment Models (IAMs). They could benefit from being complemented by other approaches such as partial equilibrium models e.g Prudhomme et al. (2020) Assessing the impact of increased legume production in Europe on global agricultural emissions. Regional Environmental Change (20(3), 1-13.). Other studies have been carried out on the impact of dietary changes in Europe on emissions (e.g. 464 MtCO2eq in Westhoek et al, (2014) Food choices, health and environment: Effects of cutting Europe's meat and dairy intake. Global Environmental Change, 26, 196-207	partly agree, we highlight trade offs often	Government of France	Ministère de la Transition écologique et solidaire	France
21613	0				Evaluations of GHG emissions from agricultural lands are based on Integrated Assessment Models (IAMs). They could benefit from being complemented by other approaches such as partial equilibrium models e.g Prudhomme et al. (2020) Assessing the impact of increased legume production in Europe on global agricultural emissions. Regional Environmental Change (20(3), 1-13.). Other studies have been carried out on the impact of dietary changes in Europe on emissions (e.g. 464 MtCO2eq in Westhoek et al, (2014) Food choices, health and environment: Effects of cutting Europe's meat and dairy intake. Global Environmental Change, 26, 196-208	accept, we do integrate IPBES results as well	Government of France	Ministère de la Transition écologique et solidaire	France
21615	0				Please consider the compatibility of the mitigation options together. The knowledge presented in the document and all the levers identified are very promising, but what seems to be missing is an assembly of the levers in a global, realistic and contextualized reflection (at the country/region level), because activating all the levers in the same time could or could not be feasible. An attempt could be to build a world prospective, with regional specifications, as for example Afterres2050 for France (Deconchat et al, 2015) or TYFA (Ten Years For Agroecology) for Europe (Poux and Aubert, 2018), see also Van Zanten et al (2018) for sustainable livestock. Once the production systems are qualified, it is possible to identify the adequate levers and policies to reduce GHG emissions and to evaluate the best trade-offs between productive, environmental (biodiversity, GHG, water quality…) and social (poverty, employment…) indicators	reject, we have done this, but wil try to do this even better thtoughout measures	Government of France	Ministère de la Transition écologique et solidaire	France
47737	0				A local protected area would be one of the	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47739	0				solutions in increasing the carbon stock	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47741	0				Strategic Environmental Assessment would	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
47743	0				be very useful as interdisciplinary studies	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47745	0				in land use management	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47747	0				Lack in technologies, human resources,	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47749	0				funding and supervision will lead to	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47751	0				incomplete target of the program	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47753	0				in reducing the carbon emission	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47755	0				Inconsistency data between provinces and	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47757	0				national level would lead to an	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47759	0				inaccuracy of the target completion	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
47761	0				in NDC	reject, unclear how these all link	Yulizar Yulizar	Universitas Pertamina	Indonesia
52283	0				Implications of Biofuels on Land and Crops should be addressed	accept, we do this with a lot of trade offs mentioned	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
63037	0				Some under review papers have been cited for many times. Please pay attention to the deadline for references in AR6.	accept, we will update	Changke WANG	National Climate Center, China Meteorological Administration	China
64855	0				Links between adaptation and mitigation are critical (speaking as CLA for WGII ecosystem chapter). Co-benefits are recognised. However, I think you need to some short statements about how adaptation of mitigation measures is essential. E.g. if planting trees, it is essential they are species adapted to present and likely future climates if they are to be effective migitation measures. Similarly agricultural practice needs to be adapted to future climates including e.g. in some places more frequent or severe droughts. This will be picked up in WGII in detail but more recognition and signposting here is important.	agree, and noted that we do already pay a lot of attention to impacts and adaptation	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)
64857	0				Throughout the chapter there needs to be a clear distinction between afforestation of areas which are not naturally covered in trees and re-afforestation of areas which do naturally support tree cover. In recent years, there has been extensive controversy about approaches to tree planting that target savannas, which are naturally only sparsely covered in trees which is damaging to biodiversity and maladaptive (WGII, chapter II flags up this risk and contains references - I can supply if you get in touch). Afforestation / reafforestation should not be used interchangeably. This is a problem because in some contexts (e.g. UK where I'm from) afforestation is used for tree planting in places where trees once grew, but not for 100s or 1000s of years but in IPCC we need to be careful to make the distinction because of the impacts on e.g. savannas and open peatlands. I have not highlighted all of the areas where this is an issue specifically but it is important.	agree, but also noted we pay a lot of attention already to reforestation and restoration, and locally adapted measures	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)
66823	0				Andrew Tylecote: Biotechnology, plant breeding and AFOLU. The AFOLU chapter draft (which I shall refer to as AFOLU) is in general very well argued and researched, and very up to date. As one would expect. There is just one respect in which I find fault with it: its treatment, or lack of treatment, of plant breeding in general and modern biotechnological plant breeding in particular. 'The wide-scale adoption of next-generation sequencing technologies has revolutionized the plant sciences….the availability of genomic resources (sequence-based genetic maps and genome and transcriptome sequences) opens up vast possibilities for accelerating the breeding process'. (Kantar et al 2016 quoted by Tylecote (2019). It is surely clear by now that plant breeding could and should play a crucial role in climate mitigation. Now I can imagine that the authors might wish to avoid the more 'conflicted' aspects of this area - particularly transgenic genetic modification; perhaps (with less excuse) even genome editing in the narrower sense of the term. But biotechnology is also used to assist and accelerate quite traditional forms of plant breeding – notably wide hybridisation – which attract little if any opposition from the conservative wing of the green movement. I will confine myself to three areas where the potential for mitigation is clearly enormous, and where the probability of early success is high. Perennialisation. There is one application of wide hybridization which is particularly attractive for climate mitigation: perennialization. Most crop plants are annuals, unfortunately. Fortunately the most important crop plants are grasses, and there are many perennial grasses, some of which are close kin to major crop plants. This gives excellent opportunities for cross-breeding. Obliquely, AFOLU has pointed out many of the gains to be had from perennialization: Specifically, a growing body of literature investigates opportunities for strategic integration of biomass production systems (commonly perennial plants) into agricultural landscapes to provide biomass for energy and other biobased products while providing co-benefits such as enhanced landscape diversity, habitat quality, retention of nutrients and sediment, erosion control, increased soil carbon, pollination, pest and disease control, and flood regulation (p.97). (my italics). All these gains arise not only from perennial plants useful as 'biomass production systems' but from perennial plants in general (Crews et al 2018). It happens that the first main 'grass' plant to be sequenced, in 2005, was rice. Rice is given more treatment than any other crop plant in AFOLU, and for very good reason: it is responsible for far more GHG emissions than any other crop, because (in addition to the usual N2O) it produces huge quantities of CH4. And it is unusually thirsty. But now: 'In the subtropical Yunnan Province of China, a perennial rice cultivar called PR23 has been successfully developed and was released in fall 2018 to farmers in China. PR23 and a number of other selections were developed through a wide hybrid cross between annual, cultivated rice, Oryza sativa, and a perennial cousin of rice from Africa, Oryza longistaminata. This wide hybridization approach is the same one being employed by breeders at The Land Institute to perennialize sorghum and wheat. Rice production is a very labor-intensive activity for farmers, and perennial rice would greatly reduce these labor inputs. It is a common practice for growers to cultivate their rice in steep hillside terraces. These terraces reduce erosion but are vulnerable to natural disasters or inadequate maintenance. Year-round perennial rice root systems holding soil in place would further stabilize these slopes. Reducing the frequency of tillage could allow soil structure to recover, improving the water-holding capacity, microbial community and rooting depth of rice fields.' https://landinstitute.org/our-work/perennial-crops/perennial-rice Accessed 10 March 21.	something to discuss. and maybe for new tech section	Andrew Tylecote	University of Sheffield	United Kingdom (of Great Britain and Northern Ireland)
71773	0				This chapter requires a clear statement near the beginning on Nature-Based Solutions. Like it or not, the call for NBS in the policy community is relentless. It is therefore important to state how the NBS concept relates to different options discussed in this chapter. Are all the measures in this chapter NBS, or only a subset that meet certain 'nature-based' criteria? It is also relates to the SRCCL debate regarding the terminology Eco-system Based Approaches vs Nature's Contribution to People. The term 'natural climate solutions' is also used at times in this chapter. Is it possible to synthesise the views of the scientific community on this framework taxonomy mess, given that there has been an IPCC-IPBES expert workshop in the meantime?	reject, many new buzz words are going around. we stick to an overview of all land based mesures. glossary has definition of nature based solutions. all the measures are nature based	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
71775	0				Blue carbon - The ES should provide a figure for the potential mitigation from blue carbon / coastal ecosystems (mangroves, marshes, seagrasses). The limitations of their mitigation potential (spatial limits, lack of permanence, slow growth of removals over time…) should also be stated clearly. There is high policymaker interest in this area, so it is important that the scale of its potential mitigation contribution is well understood.	reject, we summarise main measures in exe summary. blue carbon is taken up in main chapter	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73911	0				Please check all the units.	agree	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76673	0				Framing: It should be clarified up front what is meant by "AFOLU" in terms of: - Anthropogenic versus natural emissions/removals. Although it is mentioned that AFOLU is (supposed to) include anthropogenic emissions and removals, it is also mentioned that the "natural responses" are larger in magnitude than anthropogenic CO2 emissions, and the text often refers to "land" in terms other than AFOLU (like "land and land use"), which may or may or may not be synonymous with AFOLU and may or may not include natural fluxes. - Fluxes vs stock changes: in principle this would be fluxes between land an atmosphere, but it is often substituted by a stock change, and the differences are often ignored. E.g., HWPs or soil carbon are often presented as a potential "sink", but neither can absorb CO2 from the atmosphere, only receive carbon from other terrestrial pools. These lateral transfers of carbon (e.g., where the carbon of the HWP pool or "biochar" would come from) although they can be important. - Which activities are included. In general AFOLU seems to include agriculture and LULUCF, but then BECCS is presented as "negative emissions" part of AFOLU, although the carbon reservoir used for storage is not part of AFOLU and the land use part of BECCS is not different from other bioenergy, which is not included. - What is considered "mitigation". It is stated that it is a deviation from a cunterfactual baseline, but this convention is not always followed, or not transparently (as the baseline is not stated). For example, 7.1.1 mentions mitigation as "emission reductions" and "removals", with the latter apparently unqualified, suggesting that removals would be "mitigation" regardless of the counterfactual. Table 7.6 includes as "mitigation measures" activities that have been practiced for a long time and without regard to climate concerns (like afforestation/reforestation, sustainable forest management or grassland fire management). It is reasonable to assume that these would largely continue in a counterfactual baseline, therefore they should not be fully (unconditionally) included as "mitigation measures" or, if they are, then the framing of mitigation should be reviewed accordingly. Deviations from the general definitions/interpretations may be inevitable, but they should be clearly stated.	needs to be checked, but I dont think it is as vague as the reviewer states . further , the variety in literature is not always so clear about counterfactuals and such	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76675	0				General comment on non-anthropogenic sinks: The chapter generally divides removals between (direct) anthropogenic and "natural response" (to human impact), which is also anthropogenic in the broad sense (would not exist in the absence of perturbance caused by humans). It does not seem to consider any natural sink that would exist in the absence of human action. This is a significant omission, as biogenic processes have accumulated a considerable amount of carbon (including all fossil carbon and peat deposits as well as deposits of organic matter in the ocean originating from land), and there is no reason to believe that such processes would not continue in the absence of human action. In particular, mires are well documented to be natural sinks of carbon regardless of human action. Even if such natural sinks are small or negligible compared to direct impacts and "natural response", it would need to be stated.	partly agree, but is outside scope of ch 7	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81229	0				The chapter has been strengthened significantly from the FOD and I congratulate the authors for their hard work on this. Some sections have become a bit long and could be shortened in my view - section 7.4 in particular could be reduced without losing essential substance. I would like to suggest the addition of two more boxes though: one on MRV issues; these are mentioned repeatedly, and flagged in the executive summary, but not really brought together in the chapter. A brief discussion of the importance and limitations of MRV approaches (including the extent to which Tier1 and Tier2 methods might constrain policy formulation for mitigation) would be useful in my view. The other box would be on sustainable intensification - the SRCCL had a box on this, but this was more normative, whereas here it would be good to complement this with an assessment of how much 'sustainable' intensification we're actually seeing, what essential preconditions are for this, and how to avoid intensification being simply that without any sustainability. Again this would provide a useful pointer for policy implications.	Following consideration, it was decided not to include a box on MRV. A box on sustainable intensification has been included (currently Box 7.11), largely following the reviewers suggested format.	Andy Reisinger	Ministry for the Environment	New Zealand
85317	0				Understanding the land requirements for bioenergy embedded in different scenarios / pathways would be of high importance & policy relevant. Could you consider producing a graph on this?For example: Creutzig et al (2021) have a very illustrative graph in their fresh article at GCB Bioenergy (https://doi.org/10.1111/gcbb.12798), where a "precautionary threshold value" has been drawn at 0.5 Mkm2, corresponding with the current amount of land used for bioenergy. The graph illustrates that out of 132 scenarios of the IACM database that present land use, 97 % are above this threshold (i.e. above current amount of land used for bioenergy).	reject, we have land requirements already often , e.g in IAM section in their hgraphs	Kaisa Kosonen	Greenpeace	Finland
47869	1	1	151	1	Inconsistence in use of abbreviation IAM v integrated assessment models	reject	Aidan Farrell	The University of the West Indies	Trinidad and Tobago
63675	1	1	152	12	Protected areas and conserved areas have a role to play in meeting the goals of the Paris Agreement and protected areas are often a part of national strategies for mitigation (e.g., Asner et al 2014, Dinerstein et al 2020). There is a lack of inclusion of this aspect in the report. A section on it in Chapter 7 and/or other appropriate chapters (Ch. 13?) may be valuable.	noted	Government of Canada	Environment and Climate Change Canada	Canada
72619	1	1	201	45	Thank you so much for this comprehensive review!	thank you for the compliment	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
75529	1	1	201	31	References to land management as a cheap mitigation option need to consider the limitations of deployment of measures such as foresty and bioenergy and that widespread use at the scale of several millions of square kilometres globally could increase risks for land degradation, water resources, food security and sustainable development.	we mention limits already often	Government of Ireland	Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division	Ireland
247	1	7			Katharyn A. Duffy et al, 2021, How close are we to the temperature tipping point of the terrestrial biosphere?	reject, we refer to WG II at several places	edvin aldrian	BPPT Indonesia	Indonesia
255	1	7			How to chieve the net zero emission for development pathways especailly developing countries	good point: more info on developing countries needed	edvin aldrian	BPPT Indonesia	Indonesia
5145	1	14	1	14	I read the negative global value of AFOLU. Yet I think that the working group 2 report states that global land, on 5 continents, has become a source and is not anymore a sink. How does this fit with this chapter values for AFOLU carbon budget	reject, the afolu graphs mostyl hold a net source Fig. 7.6	Dorota Retelska	FIBL Biological Agriculture Research Laboratory	Switzerland
4433	2	12	2	12	pt. 7.2.3 .. Follow same system 'AFLOU'	Accepted. The title has been changed.	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
4435	2	13	2	13	pt.7.2.4 correct'forces'	agree	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
4437	2	15	2	16	pt.7.3.1 delete word 'other'	agree	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
8455	2	15			Don't overlap page number	agree	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10227	2	15	2	16	Don't overlap page number	agree	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
4439	2	17	2	17	pt. 7.3.2 ... keep it open 'Anthropogenic Direct Drivers'	accept, editorial	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
8579	2	28	2	29	Don't overlap page number	agree	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
49879	3	3	3	5	It is key here to add the time dimension of the migitation potential. BECCS and BE have high potentials, but on short term the potentials are usually very small due to the mobilization of carbon stocks that need to be "repaid" with flows. See eg. Hanssen 10.1038/s41558-020-0885-y, Creutzig https://doi.org/10.1111/gcbb.12798). Following Norton et al. (10.1111/gcbb.12643), the explicit consideration of short and long-term effects is important and the chapter should follow this suggestion. Important is also to state if the implementation of BECCS occurs on agricultural land, or seminatural ecosystems (like savannas) or forest ecosystems, this is key for th	we already deal with time dimensions. literature varies on this a lot	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
55903	3	9	3	10	Should this be TOTAL global GHG emissions?	wrongly placed comment	Government of United States of America	U.S. Department of State	United States of America
9601	4	1	7	14	This entire summary completely misses the larges GHG reduction potential in land systems which could be leveraged by changing the demand for land-based products, e.g. through dietary change, through reductions of losses in supply chains and through raising the efficiency of biomass utilization cascades, including increased circularity (circular economy). This is a big oversight, and actually a step back from AR5, where these options had received large attention for the first time in IPCC assessments. I am aware that there is the new Ch5, and some of these issues are covered there, but in my view this message must be send loud and clear also from the AFOLU chapter. Many studies confirm that these are the largest potentials in this sector (Smith et al. 2013, Global Change Biol, doi 10.1111/gcb.12160; Creutzig et al. 2016, Ann. Rev. Env. Res., doi 10.1146/annurev-environ-110615-085428, Theurl et al. 2020, Sci Tot Env, doi 10.1016/j.scitotenv.2020.139353 and many more). This point was also made in the SRCCL, and except if it has meanwhile been proven wrong, I don't see how such an important message could be left out here. This omission also seems strange given that these options are discussed in section 7.4, Table 7.4 and in section 7.4.5	only partly agree . we have demand change included. now more realistic than in AR5	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
11747	4	1	7	14	Even if LUC is not included the link between reduced animal production and higher food plant production will effect the land use and the potential for arable land to work as a potential carbon sink. Should that discussion be included I Executive Summary? I believe this relevant at the same place for balance	reject, not in exe summ, we have it in main text.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
15725	4	1	7	16	The executive summary lacks any substance on the design of policies and policies and policy instruments/incentives. The current version just focusses on physical measures. Appropriately designed policies and policy instruments are necessary for the mitigation potential of the sector to be realized.	reject, we do mention policies. but here it as to stay short	Katarina Elofsson	Aarhus University	Denmark
64859	4	1	7	14	Peatlands are critical terrestrial carbon stores with very high emissions from degradation and land use change. It would be good to explicitly include their protection and restoration in the ES as well as forests.	reject, we cannot include all measures in . further; we do mention wetlands	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
71777	4	1	7	14	Executive Summary: The ES mentions the potential tradeoffs of mitigation options in the AFOLU sector in passing only. This does not sufficiently reflect the strong criticism some mitigation options (eg large-scale BECCS, Re/Afforestation) received in the SRCCL. The line of arguments is generally too technocratic and mitigation-centric and does not capture the barriers described in section 7.6 well enough. It is not sufficient to deflect legitimate critique of some mitigation measures with 'poor implementation'. There are often systemic problems that cannot just be removed through better management (although there is certainly great potential for that) and would need to be better reflected in the report. The ES should also go into greater detail about some of the mitigation options in agriculture. Their existence is mentioned on page 5, lines 11-23, but more about their deployment and co-benefits would be useful. For example making use of Box 7.5 on sustainable rice management.	accept, we will try to improve and balance	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
77109	4	1	152	9	Comment #8 above on methane metrics particularly applies to this entire Chapter.	strange placed comment	Jim O'Brien	Expert Reviewer AR6 SOD WG1	Ireland
81231	4	1			All bold executive summary statements should have confidence ratings; right now, some do and some don't, some have a confidence rating only at the end of the non-bold text. For example, I would expect a "high confidence" at the end of line 3, not just at the end of line 7.	agree, will improve	Andy Reisinger	Ministry for the Environment	New Zealand
1347	4	2	4	7	This sentance let think that the population growth is reponsible of the pressure on land. This is partly true, but it is not the only driver, diet, losses and waste are also important drivers. I would replace it by:" As the demand to feed the projected population of around 9 million by 2035, pressure on land ..."	agree, will include	Rémi Prudhomme	CIRED	France
21097	4	2	4	3	It is problematic to focus only on population growth as the main driver of pressure on land ressources : land grabbing and low-income peasant exclusion are as important as population growth to explain this pressure.	agree, will include affluence	Government of France	Ministère de la Transition écologique et solidaire	France
76341	4	2	4	2	Please revise the start of the ES ("As the global human population approaches a projected nine billion by 2035,..") in a way that a) better reflects the range of population projections discussed in this Chapter and throughout the report, and b) avoids the impression that population growth is the sole driver of pressure on land. While population is an important determinant of pressure on land, singling it out in this way neglects the important role of e.g. affluence and consumption patterns, but also drivers such as increasing demand for terrestrial carbon storage or bio-materials for non-food uses unduely skews the picture.	agree, will include affluence	Gerrit Hansen	Robert Bosch Stiftung	Germany
77111	4	2	4	3	Unwarranted constraining of agriculture output based on a clearly inappropriate GWP metric when ~1bn people on the planet are under-nourished is simply not acceptable.	agree that 1 billion people are stil under nourished, but the notion here of increasing pressures remains valid	Jim O'Brien	Expert Reviewer AR6 SOD WG1	Ireland
79801	4	2	4	7	The word land is used as a substitute for soil, I understand it was possible discussed exaustively before, but as a member of ITPS I have to bring it back. The term soil is more adequate. Thus, it should be soil degradation and not land degradation.	Better to keep land	Lucia Helena ANJOS	UFRRJ	Brazil
83863	4	2	4	3	Not only increased population, but also increased affluence (Wiedmann et al., 2020) https://doi.org/10.1038/s41467-020-16941-y	agree, will include affluence	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
18295	4	3	4	7	This paragraph highlights the competition between AFOLU and biodiversity conservation as well as other land uses that provide other ecosystem services. I think it also needs to mention that AFOLU is also in competition with urban development and infrastructure development for land and provide supporting evidence.	reject, most competittion s with biodiversity	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
18313	4	3	4	4	Should these things be compared? Reads like a justification for anthropogenic CO2 emissions because other natural responses of land mitigate the issue.	reject, this sentice summarises SRCCL, and IPBES. there is a lot of pressure . it is not justification of afolu emissions	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
8283	4	4	4	4	just wondering about the use of the word 'preserve' in this context and its potential to imply keeping something the same. how does this incorporate inevitable (climate) change?	Habitat preservation means maintenance of ecosystem or habitat functionning as well and preventing habitat distruction and helping biodiversity consevation as well. All are related to climate change adaptation and mitigation	Ceris Jones	National farmers union/ world farmers organisation	United Kingdom (of Great Britain and Northern Ireland)
18293	4	4	4	5	The sentence references both 'preservation of natural habitats' and 'biodiversity conservation'. This seems to be a bit repetative as they are essentially the same thing.	agree, we change	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
18311	4	4	4	4	"food, feed, fuel and Fibre" - Would be more explicit about feed for animal consumption but it refers to a formulation of multiple, diverse crops.	4F is commonly used	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
19699	4	4	4	4	add wood	agree, we change	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21099	4	4	4	6	In view of the health context and recent related scientific work, it's important to add the issue of health (especially in the view of the fact that wild animals and humans must more and more share common territories, a source of pandemic). It also contributes to considering the holistic, systémic approach mentioned in the SPM as being underdeveloped (line 12, p. 10).	reject, space limitations of exe summary. we cannot list everything	Government of France	Ministère de la Transition écologique et solidaire	France
19701	4	6	4	6	and these includes supportings services such as nutrient cycling ,primary production and soil formation after millenian goods services clasification	agree, rephrased	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
10673	4	7	4	7	It would be fair to point out that all three threats are actually due to the global human population itself.	reject, space limitations of exe summary. we cannot list everything	Philippe Waldteufel	CNRS	France
3825	4	8	4	34	It would be worth to mention the real source of emissions / storages: is it the aerial biomass? Underground biomass? Soil? Animal-source emissions? Otherwise just mentioning "land" is too abstract and gives little room for action. In any case, GHG fluxes from soil are strongly depending on soil type besides the other factors mentioned in the paragraph.	reject, space limitations of exe summary. we cannot list everything	Rosa M Poch	ITPS and UdL	Spain
11749	4	9	4	12	The bould text should be increased to also include line 11 and 12 for better balance.	agree, we change	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
11751	4	9	9	12	Why does the IPCC see forestry and agriculture, in the global model, as man-made anthropogenic emissions, while uptake is a natural sink? Many national models do not do this.	direct human induced from KP	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
15721	4	9	4	12	I think it is strange that the first sentence in bold present land as an important emission source whereas the following sentence makes clear it is a net sink. Most important facts (largest effects) should be said first.	good comment	Katarina Elofsson	Aarhus University	Denmark
18315	4	9	4	10	The message in bold is AFOLU is a significant CO2 emissions source. But the preceding text has a mixed and confusing message. Good to be detailed and balanced but overarching message in this paragraph is unclear.	agree, we improve	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
56191	4	9	4	26	LULUCF and Agriculture should be addressed sepately in this section. Because assessment bases are different; LULUCF is assessed by land base approach but Agriculture is assessed by activity based in the national GHG inventories, mitigation policies.	reject, they are al taken up in NGHGIs. various estimates are in fig 7.6	Eray Özdemir	General Directorate of Forestry	Turkey
56241	4	9	4	19	About global CO2 emissions from AFOLU, concluding text might benefit from more clarity in terms of net positive emissions (5.7 Gt) but then sentence about net deforestation rate declined. This might induce confusion and some level of complacency in readers, when the overall situation is uncertain in data quality and serious in terms of global tropical forest loss. Specific clear, straightforward wording might help.	reject, FAO FRA was clear about reduced deforestation	Reyes Tirado	Greenpeace and University of Exeter	Spain
63677	4	9	4	26	What about natural disturbances such as wildfires that contribute to GHG emissions?	reject, we cannot include all processes here. distiurbances are part of the balance , see fig 7.6 and that section	Government of Canada	Environment and Climate Change Canada	Canada
72623	4	9	4	26	It is important to report the CH4 and N2O values in comparable units of GtCO2 per yr here. Table 7.1 shows that these contributions to emissions are greater than CO2. But here the reader cannot see this. Also, what is the uncertainty range of these values? Also note that the repeated estimates of land contributing 23% of anthropogenic emissions includes CH4 and N2O, so this total number of 12.9 should be reflected here also.	reject, we cannot include this here	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
81233	4	9	4	26	I find it very confusing for a single para to discuss anthropogenic emissions and removals, and natural removals, in a single paragraph. It mixes fundamentally different concepts. I suggest having one para on anthropogenic emissions and removals, and a separate one discussing natural fluxes, including indirect ones, and perhaps other issues such as albedo changes.	it is complex, we try to rephrase	Andy Reisinger	Ministry for the Environment	New Zealand
84793	4	9	4	15	Suggest clarification is made to the source and sink content at lines 9 - 15 (AFOLU is a source of emissions (23%) but also a sink (31%), however only the comment regarding AFOLU as a source is bolded (emphasised) in the finding at lines 9 and 10. Further clarity would assist.	agree, we improve	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
1333	4	11	4	14	I miss here (or somewhere around here) the inclusion of the concept SOIL in place of LAND or besides to it. The idea that could enrich this part will be in the line of " Agriculture has become a turn into a source of GHG emissions when it has an enormous potential to be a C sink by both soil and biomass (Albaladejo et al., 2013; Chabbi et al ., 2017). In this sense agricultural soils present an unique opportunity for carbon sequestration and compensating emissions for restoring SOC of historical losses, because they are already managed for food production and because organic residues of various sources can be used to build SOM (Chabbi et al., 2017) ". References: Albaladejo, J., Ortiz, R., Garcia-Franco, N., Navarro, A.R., Almagro, M., Pintado, J.G., Martínez-Mena, M., 2013. Land use and climate change impacts on soil organic carbon stocks in semi-arid Spain. J. Soils Sediments 13, 265–277. https://doi.org/10.1007/s11368-012-0617-7 Chabbi, A., Lehmann, J., Ciais, P., Loescher, H.W., Cotrufo, M.F., Don, A., Sanclements, M., Schipper, L., Six, J., Smith, P., Rumpel, C., 2017. Aligning agriculture and climate policy. Nature.. 7, 307–309. https://doi.org/10.1038/nclimate3286	accept, included soils	Carolina Boix-Fayos	CEBAS-CSIC	Spain
29629	4	11	4	12	Comment: What is meant by "natural sink" in this respect. Do we know if it is natural, indirect or partly antropogenic? Please consider including and simplify information from page 20 line 14-16. The number -12,5 seem to include both managed and unmanaged land? Also consider including and simplify information from page 21 line 2-3. "Worldwide atmospheric measurements of CO2 corroborate that the entire land surface (land-atmosphere flux) is a net sink due to a combination of all natural and anthropogenic processes (high confidence)".	Noted. This has been used in many publications.	Government of Norway	Norwegian Environment Agency	Norway
31311	4	11			Not clear how land and biomass are sinks for CH4?	accept, changed to soils	Ralph Sims	Massey University	New Zealand
76677	4	11	4	11	The land sink of CH4 is repeatedly mentioned, but not elaborated. It should be explained whether it is relevant to mitigation at all and, if so, how.	accept, taken out	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
85801	4	11	4	11	Suggest clarification: This text states "... land and biomass are also an important sink of CO2 and CH4." This is true for CO2, but for CH4 the major sink (~94% of total removal) is reaction with hydroxyl radicals in the atmosphere. It may be useful to make separate statements here for CH4 versus CO2. For the latter, land and biomass are major sinks. The statement also may be at odds with Table 7.1 (p. 7-12) which seems to indicate no 'natural response' of a land sink for CH4 (this may still be true if the sink terms do not respond to anthropogenic perturbations).	accept, taken out	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
72627	4	12	4	12	Is the term "emissions and removals" standard? What does removals mean? Is it removals from the atmosphere, or removals from the land, which are emissions? This is a confusing term and is used later also. Here I couldn't figure out wheter the positive number was an emission or a sink. I think "net emissions" is more clear here, and it allows that there could be some sequestration, with positive values being emissions. In general, "removal" is an ambiguous term, and should be replaced with "sequestration", or "land uptake", or something more specific.	reject, yes i sstandard text	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
76679	4	12	4	15	"Anthropogenic net CO2 emissions and removals from AFOLU are estimated to be 5.7 ± 2.6 GtCO2 yr-1 between 2009 and 2018, but when considering natural responses of land and land use is estimated be a net sink of -6.9 ± 4.0 GtCO2 yr-1 (medium confidence)." The residual sink (or "natural responses") is not sufficiently addressed in the chapter. At least two key factors seem missing: - It is not explained where the carbon accumulated by this sink resides. It must be accumulating somewhere, most likely in the soils and/or forests. Given that most LULUCF emissions/removals are not estimated directly, but using stock change as a proxy, it would be important to give clarity how much of the monitored/modelled stock change in the different pools is due to this response, and how it is (or could be) separated from the anthropogenic component. - Linked to the above, as the chapter only considers anthropogenic emissions/removals, it remains unclear whether or how the "natural responses" would be affected by the different actions/pathways. E.g., to the extent the carbon resulting from the "natural response" accumulates in the soil, measures affecting soils would likely have an impact on this sink, for better or worse.	agree, we improve	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
14791	4	13	4	14	Uunclear what is meant by "considering natural responses of land and land use". Responses to what?	means non-anthropogenic processes	Elizabeth Bush	Environment and Climate Change Canada	Canada
64843	4	13	4	13	clarify that 5.7 refers to a net source (don't rely on positive / negative alone)	agree, included 'net'	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)
18309	4	14	4	14	A net negative sink is a positive emission. Is this statement saying land is a net sink or has negative net sink effects?	It means net removal	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
30737	4	14	4	14	["a net sink of -6.9"] - Negative values usually mean "net sinks", so it's difficult to understand what a negative value "net sink" means. Please clarify.	It means net removal	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
30739	4	15	4	17	The first sentence could start from a summarzing phrase such as, "land-based mitigations such as" in order to distinguish it from the agricultural sector in the second sentence. It might be better to explain that the potential of the LULUCF and Agriculture are based on the IAM model, as the aggregated value (=10Gt) is not equivalent to the value mentioned in line 1 of the same page (=9Gt, which is derived from the sectoral approach).	wrongly placed comment. this section was nt about mitigation potential	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
83361	4	15	4	19	The focus on deforesstation trends alone fails to report the importance of fores degradation, and that as deforestation has declined forest degradation has increased, and is itself a significant source of emissions. This includes emissions from harvesting forests for commodity production, which are as extensive as deforestation (Bullock et al. 2019 Global Change Biology DOI: 10.1111/gcb.15029) with comparable emissions (Matricardi et al. 2020 Science 369, 1378–1382). Recognising the significance of emissions from forest degradation is vital to explicitly refer to the condition of forests when considering mitigation actions. To prioritise actions that maximise mitigation benefits and optimise co-benefits for biodiversity conservation and other ecosystem services, the difference between Primary forests, which store more carbon than logged, otherwise degraded, and plantation forests, is crucial. This vital difference has been demonstrated in all forest biomes (e.g. tropical – Mackey et al. 2020 Mitigation and Adaptation Strategies for Global Change https://doi.org/10.1007/s11027-019-09891-4; boreal - Malcolm et al. 2020 Climate Change https://doi.org/10.1007/s10584-020-02711-8; temperate – Keith et al. 2015 PLOS ONE DOI:10.1371/journal.pone.0139640). Forest degradation is significant for emissions and the loss of carbon reservoirs and thus vital to policy development. Reliance on forest cover alone denies these important realities.	partly agree	Margaret Putt	Enviromental Paper Network International	Australia
76681	4	17	4	17	"overall total global forest growing stock reported to be stable": Does this mean that the overall net land sink (reported above to be 6.9 GtCO2/yr) is NOT accumulating in forest biomass? Can it be then stated that it is mostly (or fully) captured in soils? How does this relate to the statement in line 22, page 20, that forest inventories corroborate a modelled land sink?	reject, depicted by the wide variety of lines in fig 7.6.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
18297	4	19	4	19	It would be useful for policy makers to explain what albedo is and spell out VOCs	noted. albedo is commonly known and VOC stands for Volatile Organic Compounds. we cannot explan in exe summ	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
21101	4	19	4	19	Please explain acronym VOC when first encountered in chapter	agree. . VOC stands for Volatile Organic Compounds.	Government of France	Ministère de la Transition écologique et solidaire	France
28795	4	19	4	19	VOC: Spell acronym	agree	naikoa aguilar-amuchastegui	WWF-US	United States of America
61385	4	19	4	19	As to the abbreviation "VOCs", the full name should be given.	accept	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
11461	4	20	4	22	The source of the statement "Average AFOLU CH4 and N2O emissions are estimated to be 144 MtCH4 yr-1 and 6.8 MtN2O yr-1 respectively between 2009 and 2018" cannot be found in the main text. Please check.	reject, is clearly in table 7.1.	SAI MING LEE	Hong Kong Observatory	China
14735	4	20	4	21	Putting the climate effects of albedo and of BVOC on equal footing in this chapter is an important issue as it may affect how boreal forests are used for climate change mitigation in years to come. Albedo as measured by satellite-borne sensors is an actual measurement of solar irradiance reflected back to space and therefore of the solar energy retained within the earth's climate system. Local changes in albedo can clearly have a global climate impact. Betts et al (2000) is only one of many studies on this issue. By contrast, the radiative effects of BVOCs can only be estimated with complex atmospheric chemistry and physics models, and the results of these models are unconstrained by measurements. Although I was impressed by the thouroughness of the Kalliokoski et al 2020 study, it is still a modelling study and therefore can only suggest effect. It is also a local study, with for example a much earlier spring snow melt and therefore lower albedo effect than in the north american boreal forest (see Fig 2 in Kalliokosky paper vs Fig 3 in Bernier et al doi:10.1016/j.agrformet.2010.12.013). The closing sentence (p.170) of the section on BVOC in the 2019 IPCC SRCCL report was: "In summary, the magnitude and sign of net effect of BVOC emissions on the radiation budget and surface temperature is highly uncertain." Has the science on BVOC improved to that extent since then? I see only one study on Finland forests to support the current position of this document.	reject, we cannot go int detail here. we mention briefly VOCs etc. there is section on this topic in chapter.	Pierre Bernier	Natural Resources Canada	Canada

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
14737	4	20	4	21	I would suggest inserting p64, l. 4-6 statement on albedo here: "A/R activities may change the surface albedo, producing net cooling in the tropical and subtropical latitudes for local and global climate and net warming at high latitudes". This would be in line with Griscom et al 2017 Fig S1, Panel a. If this is done, you then need to remove albedo from the next sentence "The role of... evapotranspiration and VOCs (and their mix)..." Justification for this is provided in my other comment on the same portion of text.	reject, we cannot go int detail here. we mention briefly VOCs etc. there is section on this topic in chapter.	Pierre Bernier	Natural Resources Canada	Canada
18299	4	20	4	20	Instead of 'per bioclimatic region' it should read 'by bioclimatic region'	agree, taen out	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
21103	4	23	4	23	Similarly to page 36, It shoud be specified here "paddy rice cultivation", because rainfed rice is not associated to CH4 emission.	agree, added 'paddy'	Government of France	Ministère de la Transition écologique et solidaire	France
49817	4	24	4	24	principal, not principle	agree	Arthur Lee	Chevron Corporation	United States of America
76683	4	25	4	26	It would be good to give an indication of the magnitude of the different N sources and/or list them in the order of declining significance (starting with the highest).	reject, not here. it is emissions section in detail	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
8101	4	28	4	31	Please replace "unsustainable forest mangement" with "deforestation" when you refer to land use change.Unsustainable management alone does not constitute LUC.	agree, changed	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
9541	4	28		34	Executive summary: AFOLU emission fluxes are driven by land use change and agriculture: I will include industrialized livestock production systems, as well as the globalized commercialization of feed for animals, and food exports and imports	reject, extensive listings cannot be done here	Blanca Casares Guillén	EfecTo TP	Spain
11753	4	28	4	31	"Peatland drainage" should be explicitly mentioned as one of the drivers of direct land use change.	reject, peatland drainage is not a land use change per se	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
21619	4	28	4	31	It is suggested to better explain why the increase in animal productivity is considered as a driver of AFOLU emission fluxes. There are studies that propose the increase in animal productivity as a strategy to reduce methane emissions in ruminants. Perhaps it would be convenient to better define the term "animal productivity" or include other terms that help to qualify it, such as "greenhouse gas emission intensities", "animal efficiency" or "production efficiency" (Grossi et al., 2019; Herrero et al., 2015; http://www.fao.org/gleam/results/en/#c303616). Citations: "There is a direct link between greenhouse gas emission intensities and animal efficiency. The more productive the animal is, the lower the environmental impact will be (on a per unit of product basis). Both management quality and expression of full genetic potential are necessary to increase production efficiency." (Grossi et al., 2019) "In addition to improved feed quality, there are several animal management options that can also improve animal and herd productivity. These include a combination of genetics, animal health, nutrition, and modern reproductive management to raise reproductive efficiency, reduce the burden of "unproductive" animals in herds, raise the productive lifespan of animals, and reduce mortality rates of calves and adult animals. These measures can reduce the breeding herd overhead and raise the production efficiency at the herd and animal levels, thereby reducing GHG emissions of per unit of product." (Herrero et al., 2015) References: Grossi G, Goglio P, Vitali A, Williams AG. 2019. Livestock and climate change: impact of livestock on climate and mitigation strategies. Animal Frontiers, 9(1):69–76. DOI: https://doi.org/10.1093/af/vfy034 Herrero M, Wirsenius S, Henderson B, Rigolot C, Thornton P, Havlik P, de Boer I and Gerber P. 2015. Livestock and the environment: what have we learned in the past decade? Annu. Rev. Environ. Resour. 40:177–202	reject, too much detail, section on drivers was shortened	Ainara Artetxe	NEIKER-Basque Institute of Agricultural Research	Spain
45927	4	28	4	34	It would be helpful to specify if the drainage of peatlands and water table management in drained areas are included in the direct land use change drivers and omitted in this section, or if they are accounted for in a different way.	reject, too much detail, section on drivers was shortened	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
66029	4	28	4	28	Change to: "...land-use change..." & "...land-use change..."	section on drivers was shortened	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
76685	4	28	4	28	"AFOLU emission fluxes are driven by land use change and agriculture." : It should read "AFOLU emission fluxes are driven mostly by forestry and agriculture."	section on drivers was shortened	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76687	4	28	4	31	It is unclear why only "smaller-scale agriculture expansion" is mentioned as a direct driver of land-use change, and agriculture in general is not, although large-scale agriculture (livestock, arable and perennial) is well-established as a major driver or LUC.	section on drivers was shortened	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76689	4	28	4	34	Forest management is recognised as an activity with any impact on AFOLU emissions, except for "unsustainable" management for LUC (presumably referring to deforestation). In contrast, both historic and current forest management is a major determinant of the anthropogenic land CO2 flux, whether or not it is deemed "sustainable".	section on drivers was shortened and rewritten	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81235	4	28	4	34	Please try to quantify emissions attributable to agriculture from those from FOLU - it provides a very diffuse picture if AFOLU is only ever reported as a single block, given that policies and stakeholders can be quite different, even if obviously interacting. The SRCCL stated that 21% of emissions are from agriculture, with 23% from AFOLU, whereas this chapter seems to say that one can't do that simple attribution. This is important and the authors should think hard whether they really can't give a number (or rather, a useful range) for the emissions attributable to agriculture, specifically broken down into non-CO2 and CO2 from land-use change.	reject, too much detail, section on drivers was shortened	Andy Reisinger	Ministry for the Environment	New Zealand
83665	4	28	4	34	Emissions fluxes are also driven by the uses to which forests are put, and in particular by industrial scale logging. "Sustainability" is not a meaasure of carbon neutrality, as implied. In fact, AFOLU emissions fluxes can also be driven by management practices cliamed as "sustainable". Modification of natural ecosystems is inevitably associated with release of ghgs to atmosphere and a loss of ecosyste stbility that is causally related to ongoing ecoligical modification and loss that itself entails ghg emissions. This is occuring incomplex feedback loops, and particularly starkly illustrated in Australia where a complex interaction between past and current forest management and increased risk of severe/catastrophic fire resulting in huge GHG fluxes has been well documented for at least a decade (e.g. Lindenmayer et al. 20011 PNAS 108, 15887-91; McDowell et al. 2020 Science 368, 964 (2020). The Executive Summary should highlight the interaction between ecosystems degraded by human activities and climate change.	reject, too much detail, section on drivers was shortened	Margaret Putt	Enviromental Paper Network International	Australia
56243	4	29	4	29	"commercial and smaller-scale agriculture expansion" could be change for "agriculture expansion". The distinction commercial and smaller-scale seems out of place since it does not come supported for any specific evidence or data in the underlying chapter. If data is available, it might be important to present it specifically, whicih percetage of agriculture expansion is due to commercial agricutlure compared to small-scale? Presented in the current way, assumes an equal contribution that is not supported by evidence.	section on drivers was shortened	Reyes Tirado	Greenpeace and University of Exeter	Spain
1095	4	31	4	31	change "animal productivity" to "animal production" as increasing productivity would decrease the pressures being described instead of increase them.	section on drivers was shortened	Reid Miner	Private Consultant	United States of America
18301	4	31	4	31	The statement that increased animal productivity is a source of emissions increase is factually inaccurate. Productivity increase (defined as the technical efficiency of conversion on inputs to outputs) is an important source of mitigation since it can reduce methane emissions per unit of system output. This is distinct from production (the volume of material produced) - increases in production without increased productivity will drive increases in emissions. I believe the authors may have confused the terms.	section on drivers was shortened	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
18303	4	31	4	31	Why the focus on rice here? Agriculture drivers of AFOLU emission fluxes includes listing rice cultivation specifically, opposed to crops generally or listing other mass produced crops.	section on drivers was shortened	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
21105	4	31	4	31	Similarly to page 36, It shoud be specified here "paddy rice cultivation", because rainfed rice is not associated to CH4 emission.	agree, done	Government of France	Ministère de la Transition écologique et solidaire	France
55905	4	31	4	31	The reference to "animal productivity" here seems to imply that higher productivity would increase AFOLU emissions, but increases in animal productivity may reduce global emission fluxes by decreasing the number of animals required to produce a given amount of output, though it could potentially increase regional emissions if global production shifts towards areas with rising productivity.	section on drivers was shortened	Government of United States of America	U.S. Department of State	United States of America
70179	4	31	4	31	include abandoned field	reject, too much detail	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
18305	4	33	4	33	Changes in affluence' should be changed to 'changes in wealth' or 'changes in income', whatever is most approriate.	reject	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
56245	4	33	4	33	"consumption patterns": given the relevance of diets on this, n specific metion of "dietary patterns" or "high meat diet" is possibly more effective and reflects better the great body of evidence on this regard.	the terms will be considered	Reyes Tirado	Greenpeace and University of Exeter	Spain
9589	4	36	4	43	This text misses the important point that there are systemic interactions between the ability of land to act as C sink, and ist ability to provide renewable energy, in particular biomass for combustion. This important insight is missing in this statement, which can send misleading messages to policy-makers and other stakeholders, who might conclude from this statement they could have the cake and eat it too, while in reality they must decide between different options of using the land for C mitigation (no double counting of C). Simple mass balance considerations dictate that C extracted and combusted is not available as C to be additionally stored in biota and soils. If more C is extracted and burned in forests, less C is stored in biomass or SOC, except if the C would have decayed at the same rate as if extracted and burned, or if it results from addition C taken up by growing plants (trees). The same holds true for any ecosysystem, although most non-forested ecosystems hold less C in long-lived plants. See Searchinger 2010, Env Res Lett, doi 10.1088/1748-9326/5/2/024007; Haberl et al. 2012, Energy Policy, doi 10.1016/j.enpol.2012.02.051, Haberl 2013, Global Change Biol. Bioenergy, doi 10.1111/gcbb.12071, Kalt et al. 2019, GCBB doi 10.1111/gcbb.12626, Kalt et al. 2020, Env Res Lett, doi 10.1088/1748-9326/ab6c2e	reject, too extensive here. it is a complicated balance between management and C storage	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
71779	4	36	4	43	The mentioning of 1/3 of global mitigation is striking here. Please be more precise about the rationale behind this figure. This is important particularly in the light of IPBES's widely-cited finding that (rightly or wrongly) concluded that NBS can provide more than 1/3 of global mitigation - seemingly based on Griscom et al. 2017.	reject, we keep it as it is. one third is in the NDC from afolu. furthermore, our analyses indicates upt 13 Gt mitigation. which is indeed more that one third, we mainly refer here to NDCs	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81237	4	36	4	39	Unhelpfully long headline sentence - please decide what you consider to be the headline and aim to make this a single sentence.	accept, imporved	Andy Reisinger	Ministry for the Environment	New Zealand
84795	4	36	4	43	Suggest the finding at lines 36-38 should be further clarified in relation to two items: (i) the chapter discusses some of the potential negative impacts of nature based solutions (reforestation in particular), which relate to comments regarding scale (and land based removals at scale) - the draft chapter appears to indicate that AFOLU mitigation at large scales presents a risk to SDGs and environmental matters (co-benefits), so it is suggested this be clarified in this finding. And (ii) it is suggested that reference to greenwashing be further contextualised. The limitations of AFOLU are important, however the discussion about greenwashing needs to be more pronounced in the cross-referenced (there appears to be a clear and strong finding in this executive summary, without the same clear and strong discussion in the corresponding sections cross-referenced).	only partly agree	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
21107	4	37	4	37	We recommend to consider biogeochemical effects (i.e. albedo) as well	reject, too much here	Government of France	Ministère de la Transition écologique et solidaire	France
19703	4	38	4	38	natural renovable resources	reject, 'renewables' is OK	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21109	4	38	4	39	It is also important here to also have a holistic view of the environmental issues associated with agriculture. Stressing that AFOLU can reduce greenhouse gas emissions while producing renewable energy can lead to confusion about which agricultural model should ultimately be favoured to fight climate change and involve agriculture more directly. Indeed, producing renewable energies can also be an exit for a dominant agricultural model that will ultimately not be compatible with the fight against climate change (cf. in this sense, the previous IPCC report on land use).	reject, good thought but too much detail here	Government of France	Ministère de la Transition écologique et solidaire	France
1335	4	40	4	41	"...at relatively low cost (high evidence, high agreement).." it could be added : by applying sustainable managment of agricultural and forest ecosystems	Agree we can add	Carolina Boix-Fayos	CEBAS-CSIC	Spain
11235	4	40	4	41	I would more say "... nor can it an opportunity to compensate for delayed emission reductions in other sectors	agree, rephrased	Bertrand Guenet	CNRS	France
14793	4	40	4	43	The statement about limits on the mitigation potential of the AFOLU sector in 1.5C and 2C pathways is a substantive conclusion and yet it does not have a confidence qualifier. Suggest one be provided. The statement about greenwashing could be better worded, perhaps by stating more explictly that the assessed limits to AFOLU mitigation make clear that stringent mitigation in other sectors is needed and that avoided emissions and CO2 removal through AFOLU measures need to lead to secure, long term sequestration of CO2, if low temperature targets are to be met. We did not find the term greenwashing used in the main chapter.	agree, rephrased	Elizabeth Bush	Environment and Climate Change Canada	Canada
18319	4	40	4	43	Could rephrase to make it more of a positive that the AFOLU sector could provide up to a third of the reduction in emissions for a 1.5 to 2 C pathway-e.g. Significant near-term mitigation is available ...AND the AFOLU sector can provide approximately up to a third of ...BUT it should not act as a cheap 'greenwashing'...	agree, rephrased	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
45929	4	40	4	43	It would be appropriate to hint in this summary to the difficulties as well, with which the provision of a third of global mitigation through the AFOLU sector can be associated (see risks described in chapter 7 and 12.5).	agree, rephrased	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
60115	4	40	4	43	The two part of the sentences seems to contradict each other	reject, no contradiction	Bhaskar Sinha	Indian Institute of Forest Management	India
66031	4	41	4	41	Change to: "...agreement), but..."	agree, rephrased	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
81239	4	41	4	43	This sentence is needlessly emotive and assumes all sorts of intentions of the reader - this doesn't belong in an IPCC executive summary in my view. It seems to be be based on the assumption that no climate policy is happening in other sectors and AFOLU is expected to do miracles - whereas the reality described elsewhere in this chapter is the by and large absence of effective mitigation policies in agriculture and the limited investment in forestry. Please describe the factual situation not your assumptions about the readers' intentions.	agree, rephrased	Andy Reisinger	Ministry for the Environment	New Zealand
1097	4	42	4	43	The part of this sentence discussing "cheap greenwashing opportunities" is gratuitous, and not supported by material in sections 7.1, 7.4 or 7.5. I suggest removing the phrase beginning with "nor" and starting a new sentence which actually reflects the findings of the chapter (based on a similar sentence in section 7.6.6. of this report) as follows - "Furthermore the AFOLU sector is highly diverse, with considerable variation involving complex interaction between multiple factors and drivers, and a significant number and range of stakeholders. Therefore, the feasibility of mitigation options is highly context specific and high-level mitigation assessments presented below must be used with caution."	agree, rephrased	Reid Miner	Private Consultant	United States of America
8285	4	42	4	42	does 'cheap' in this context actually mean at low finanical cost or does it imply of little (non-finanical) worth or both?	agree, rephrased	Ceris Jones	National farmers union/ world farmers organisation	United Kingdom (of Great Britain and Northern Ireland)
18307	4	42	4	43	Can the language of "...nor can it act as a cheap 'greenwashing' opportunity for (delayed) emissions in other sectors' be replaced with 'nor should it divert efforts from the need to quickly reduce emissions in other sectors'. I think this tone of language is more appropriate.	agree, rephrased	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
45931	4	42	4	42	"...nor can it act as a cheap 'greenwashing opportunity" for other sectors..." rethink to replace "act" by "serve"; "act" implies that the AFOLU soil carbon sink (potential) is actively 'offering' itself to the other sectors; while "serve" would imply that the other sectors would (want to) make use of the AFULO soil carbon sink (potential) for greenwashing	agree, rephrased	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
55907	4	42	4	42	"Cheap" is a poor choice of words, possibly use 'inexpensive' or 'gratuitous'. The definition of 'greenwashing' is not universally understood. Should not be in Executive Summary without definition.	agree, rephrased	Government of United States of America	U.S. Department of State	United States of America
55909	4	42	4	43	The language "cheap 'greenwashing'" is overly editorialized. Text should remain objective and convey the finding that land-used based offsets need to coincide with decarbonization of other sectors.	agree, rephrased	Government of United States of America	U.S. Department of State	United States of America
55911	4	42	4	43	The 'cheap greenwashing' phrasing isn't used elsewhere in the document and there isn't other indication of this discourse in the text. Please use more directly relevent or traceable language for continuity and traceability between this summary and the sections below that are identified to cover this topic.	agree, rephrased	Government of United States of America	U.S. Department of State	United States of America
64845	4	42	4	43	I strongly agree with the point this sentence is making and it should be kept in the Exec summary. It does however need rewording as clearly it 'can' act as a cheap greenwashing opportunity and this is an approach that the IPCC must warn against. Suggest re-wording: ' .... pathway; treating it as a cheap 'greenwashing' opportunity to delay emission reductions in other sectors, jeopardises achieving these pathways.	agree, rephrased	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76345	4	42	4	43	revise "nor can it act as a cheap 'greenwashing' opportunity for (delayed) emission reductions in other sectors" to read sth along the lines "nor can it substitute for emission reductions/offset high proportions of emissions in other sectors". It may be helpful to include a reference to "absolute" vs "relative" emissions reductions in this context, and point to the risk of malincentives (as discussed in .	agree, rephrased	Gerrit Hansen	Robert Bosch Stiftung	Germany
15723	4	43	4	44	The statement "nor can it act as a cheap 'greenwashing' opportunity for The statement "nor can it act as a cheap 'greenwashing' opportunity for (delayed) emission reductions in other sectors" seems wrong as there is actually a risk that it will be used that way.	agree, rephrased	Katarina Elofsson	Aarhus University	Denmark
3827	4	45	4	47	This sentence is long and unclear	agree, rephrased	Rosa M Poch	ITPS and UdL	Spain
9591	4	45	5	9	Very technically written, in particular lines 45-48. These are methodological concerns primarily, which are perhaps not so interesting for policy-makers and the general public. The question is, what do these differences mean? What are the caveats, what are the robust insights?	agree, rephrased	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
18317	4	45	5	9	I would consider removing this total paragraph from the executive summary. The key message that AFOLU can make an important contribution to global mitigation can be insterted in to above paragraph. The level of detail on IAM and baseline scenarios is probably not necessary for an exec sum.	we keep it, but rephrased	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
49873	4	45	4	48	This para is too redundant with the message before ("can make an important contribution). It should also be rephrased so it is not targeted at IAMs against other approaches, but related more to the content (which measures / assumptions make which difference)	we keep it, but rephrased	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
55913	4	45	5	9	This paragraph is hard to follow. Since this is the summary, it is not yet defined what is meant by sectoral studies versus integrated assessments.	we keep it, but rephrased	Government of United States of America	U.S. Department of State	United States of America
64847	4	45	4	48	The two sentences in bold are not clear when taken together - why does the second sentennce start 'nonetheless' and which 'assessment' is it refering to: the overall 6th Assessment, or a specific integrated assessment. A confidence statement would also be useful. (The difference between the IAMs and the sectoral studies has important implications for policy and shows the need to stimulate creative solutions in specific circumstances rather than 'one size fits all' approaches)	we keep it, but rephrased	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)
11463	4	49	5	1	The source of the statement "Global sectoral studies indicate AFOLU has supply-side (up to USD100/tCO2-eq) mitigation potential of approximately 9 (± 3) GtCO2-eq yr-1 between 2020 and 2050" cannot be found in the main text. Please check.	we keep it, but rephrased	SAI MING LEE	Hong Kong Observatory	China
63039	4	49	5	1	There is not '9 (± 3) GtCO2-eq yr-1 ' in the text of chapter 7. '8.7±3.1 GtCO2-eq yr-1' is better here.	we keep it, but rephrased	Changke WANG	National Climate Center, China Meteorological Administration	China
63041	4	49	5	1	The confidence level was drawn from only one reference. Please give the basis for 'medium confidence'.	all confidence levels are given here as one statement	Changke WANG	National Climate Center, China Meteorological Administration	China
8287	4		7		a bit suprised at the balance in the exec summary - much more about land use than agriculture but perhaps that's right	agree, rephrased to give agri more focus	Ceris Jones	National farmers union/ world farmers organisation	United Kingdom (of Great Britain and Northern Ireland)
9903	5	1	20	16	Must be consistent in how to write it. Which one do you want to use (6.1 (±2.9) GtCO2-eq yr-1 or 3.9 ± 0.2 GtCO2-eq yr-1) method.	we keep it, but rephrased	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
15727	5	2	5	2	The concept "economic potential" needs explanation, and the cost level needs motivation.	reject, too much detail,	Katarina Elofsson	Aarhus University	Denmark
9905	5	3	20	2	Must be consistent in how to write it. Which one do you want to use 0.8 (0– 6.3) GtCO2 yr-1 or 4.1 (-0.1 to 9.5) GtCO2-eq yr-1 method.	reject, seems claear	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
21111	5	5	5	6	We suggest to name some examples of measures included in sectoral estimates but not in IAMs	reject, too much detail,	Government of France	Ministère de la Transition écologique et solidaire	France
14795	5	6	5	7	the word 'seeing' here is unclear. Replace with "include"?	rephrased	Elizabeth Bush	Environment and Climate Change Canada	Canada
81241	5	8	5	9	This doesn't follow logically. The mitigation that is assumed in sectoral or IAM scenarios is largely a function of the (implicit or explicit) carbon price. IAMs don't "assume" an overshoot, they (often, not always) have end-of century targets, which together with discounting means that carbon prices are not as high as they might be in 2050 and hence result in less mitigation than they might do. But if the purpose here is to compare sectoral and IAM abatement then to avoid comparing apples and oranges we have to assume the same carbon prices or the same temperature goals, otherwise the comparison here is meaningless. The other two points make sense from an "apples and apples" perspective, but this third point does not.	partly agree	Andy Reisinger	Ministry for the Environment	New Zealand
54327	5	9			Delete "of"	agree	Sabine Fuss	MCC Berlin	Germany
77659	5	9	5	26	•Lines 9-26: Focussing on global deforestation trends, while important, ignores the emissions from forest degradation, including from harvesting forests for commodity production, which are as extensive as deforestation (Bullock et al. 2019 Global Change Biology DOI: 10.1111/gcb.15029) with comparable emissions (Matricardi et al. 2020 Science 369, 1378–1382). •The significant of emissions from forest degradation points to the need to explicitly refer to the condition of forests when considering mitigation actions. Distinguishing between forests of different condition is critical in order to prioritise actions that maximise mitigation benefits and optimise co-benefits for biodiversity conservation and other ecosystem services. Primary forests store more carbon than logged, otherwise degraded and plantation forests, and this has been demonstrated in all forest biomes (e.g. tropical – Mackey et al. 2020 Mitigation and Adaptation Strategies for Global Change https://doi.org/10.1007/s11027-019-09891-4; boreal - Malcolm et al. 2020 Climate Change https://doi.org/10.1007/s10584-020-02711-8; temperate – Keith et al. 2015 PLOS ONE DOI:10.1371/journal.pone.0139640). •The FAO recognises the needed to account for primary forests and distinguish these from other forest types and provides guidance to national governments in their reports for the Global Forest Resource Assessments (http://www.fao.org/forest-resources-assessment/2020/en/). The FAO is currently developing improved guidance for national reporting on primary forests (see Mackey et al. 2021. https://www.griffith.edu.au/__data/assets/pdf_file/0028/1293454/Primary-Forest-Report-Final-March-2021.pdf). •It is also long established that primary forests are more stable and resilience to extreme weather events and climate change impacts than forests logged for commodity production, otherwise degraded forests, and plantations (Thompson et al. 2009 CBD Technical Series no. 43 https://www.cbd.int/doc/publications/cbd-ts-43-en.pdf). Therefore, the condition of the forest is also highly relevant to the longevity of its carbon stock. It follows that risk of increased GHG release to the atmosphere is directly related to forest condition This is a critical point given WG1 has emphasised the importance of maintaining stable ecosystem reservoirs. Failure to account for forest condition means that the differences in the mitigation benefits of different forests – primary forest, secondary forest, commodity production forest, mono-species plantation forest - are ignored thereby limiting consideration of the full scope of mitigation options including avoiding emissions trough forest protection and ecological restoration of degraded and secondary natural forests. •The IPBES 2019 noted that loss and degradation of primary forests in temperate biomes are severe. The consequent implications for stable long-term carbon storage and increased risk of GHG release are significant. In Australia, for example, deforestation rates remain high (Evans 2016 Pacific Conservation Biology 22(2) 130-150 https://doi.org/10.1071/PC15052) and native forest logging has been shown to increases the severity at which forests burn. This is likely because such operations increase the volume of coarse woody debris, and the density of elevated and vertically oriented live fuels. In addition, by opening up the forest canopy, logging operations alter microclimate conditions, causing drying of soils and fuel, and allowing stronger wind to affect fires on the forest (Keith et al 2014 Ecosphere 5, Article 75; Taylor et al. 2020 Conservation Letters, https://doi.org/10.1111/conl.12766; Zylstra 2018 Austral Ecology, 43, 578-591). Thus, general statements about increased forest cover in temperate regions that do not distinguish differences in forest condition and ignore the current high rates of deforestation and degradation are highly misleading. It is true there is substantial regrowth in eastern USA forests from abandonment of agricultural land. However, this ignores ongoing forest degradation including loss of primary forest elsewhere in North America (Price et al. 2020 https://sierraclub.bc.ca/wp-content/uploads/bcs-old-growth-forest-a-last-stand-for-biodiversity-report-2020.pdf). These are significant emissions given the mitigation benefits from avoiding emissions through forest protection and the additional sequestration benefits from enabling natural regrowth of secondary and degraded forests (Moomaw et al. Front. For. Glob. Change, 11 June 2019 | https://doi.org/10.3389/ffgc.2019.00027). •It is important to unpack net fluxes to reveal gross emissions in relation to forest condition as it is important to know if emissions are arising from primary forests with their relatively long and stable carbon storage (Keith et al 2021 Science of the Total Environment 769 (2021) 14434114.). Therefore, trends in primary forest loss, all forms of forest degradation, including	partly agree. some useful and can be used in chapter	Virginia Young	Australian Rainforest Conservation Society	Australia
1349	5	11	5	13	I would distinguish here GHG mitigation from CO2 offset.	reject, too much detail,	Rémi Prudhomme	CIRED	France
11755	5	11	5	15	KSLA has argued in other fora that it is unreasonable to reckon that the uptake of 1 kg of CO2 in the circular biological system can compensate for 1 kg CO2 of fossil carbon. Storage of carbon in forests or agricultural land is unsafe (due to e.g., fire, storm, insect damage). This is not accounted for in the EU "LULUCF model". For example, in New Zealand this has been accounted for by a system where 1 kg of fossil fuel CO2 corresponds to 2 kg CO2 storage in the forest ecosystem. Similar systems are used in Australia and California, USA.	reject, too much detail,	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden

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21591	5	11	5	13	Between 2020-2050, mitigation measures in forests and other ecosystems provide the largest share of (up to USD100/tCO2-eq) mitigation potential in AFOLU, followed by agriculture and demand side measures" . Mitigation is indeed as much by reduction as by sequestration.	agree	Government of France	Ministère de la Transition écologique et solidaire	France
19705	5	13	5	13	protection and conservation	dont understand	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
55915	5	13	5	16	In this write up here of the most prevalent forestry-related options, there is no mention of afforestation or reforestation, only restoration. Per this chapter's definitions, these are distinct efforts, and most models (sectoral or IAM) include AF/RF but not restoration. Most of the sectoral models cited in the chapter do include AF/RF so it is not clear if this omission is an oversight/typo. Make clear the role of AF/RF in overall estimates provided (same comment provided for same text in Section 7.4.1.3).	agree, need to add	Government of United States of America	U.S. Department of State	United States of America
64849	5	13	5	13	it would be clearer to replace 'reduced conversion (protection)' with 'protection'. I think 'reduced conversion' could be interpretted to allow loop holes e.g. converting high carbon natural forest to degraded plantations, with major emissions (as well as loss of biodiversity).	accept, rephrased paragraph	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)
9593	5	14	5	14	In my view it is necessary to explain what "enhanced management" means. Some might interpret that as "increased logging", which certainly reduces rather than raises C sequestration in forests. This text should, in my view, convey these important systemic feedbacks, and not hide that many forms of more intensive use of forests reduce rather than raise C stocks in forests (and may have other important side-effects such as adverse biodiversity impacts), and that only an integrated strategy of forest management and cascadic use of the products, including efforts to raise the longevity of products from wood, can really maximize the potential of forest management to contribute to climate-change mitigation and biodiversity conservation	accept, rephrased paragraph	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
76691	5	14	5	14	"enhanced management" of forest is recognised to have a mitigation potential. This is correct, but seems to contrast with other parts of the text that ignore the impact of forest management on emissions (e.g., AFOLU emission fluxes on p.4 do not mention forest management as a driver of emissions, unless it leads to LUC).	accept, rephrased paragraph	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
19707	5	15	5	15	protection and conservation	accept, rephrased paragraph	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
49875	5	15	5	15	"enhanced management" is ambigous, what is meant here? More management, ie. Higher harvest pressure? Or Improved management that allows to maintain stocks while delivering goods? Rephrasing required	accept, rephrased paragraph	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
18323	5	17	5	20	The very first paragraph of the executive summary singles out feed as a high emitter yet it is not mentioned here or anywhere else in the executive summary. needs to be a bit more consistent in messaging. Probably should have a paragraph on feed alone, bring some of the text from the body of the report on maize and soy here. For policymakers awareness of these crops is essential	reject, too much detail, and we mention any drivers in beginning	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
19709	5	17	5	17	soil organic carbon (soc)	accept, rephrased paragraph	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
14797	5	18	5	18	Please clarify if bioenergy/BECCS is included in the term 'agroforestry'. It would be good to make clear whether or not the mitigation potentials provided in this paragraph include the potential from bioenergy/BECCS or not, since there are subsequent paragraphs in the ExSumm dealing with those options specifically.	reject, we combine bioenergy often wirth all managed systems	Elizabeth Bush	Environment and Climate Change Canada	Canada
18321	5	18	5	18	It is unclear why rice cultivation in particular is being specified as opposed to the broader term of 'mass produced crops' or suitable alternative. Could the authors consider re-wording?	reject, paddy rice leads to significant CH4 emissions	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
11757	5	19	5	23	Demand-side measures related to forest products deserve to be mentioned – This involves both increasing demand for products that substitute wood for fossil carbon (such as wood in buildings), but also the quality of what is demanded. Using the example wood buildings, the strength of the substitution effect can vary several fold depending on how wood is utilized in building	accept, rephrased paragraph	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
56247	5	19	5	23	demand side value given is 1.9 Gt as it acknowledges it does not include land use change. However, this seems inconsistence with the framing, values and evidence presented in the chapter, where the much higher values on demand side (eg. Diets) are reflected due to their direct effect on land use change. For consistency and to reflect current analysis and policy options given in the SRCCL, the higher values including LUC and specific to dietary changes should be reflected. High LUC, protection and reforestation, could not be enabled without dietary changes due to land competition, as it is well reflected in the current scientific evidence. This is key, as it is the only mention to diets when a growing and strong body of scientific knowledge have provided convincing evidence on its clear mitigation potential, as it was reflected in the SRCCL.For example, later on page 101: The total technical mitigation potential of changes in human diets and consumption patterns was estimated as 0.7 - 8 GtCO2-eq yr−1 by 2050 (SRCCL, Chapter 2; Springmann et al. 2016; Hawken 2017; Tilman and Clark 2014). And in the conclusion in page 102: "Specifically, based on studies to date, shifting toward sustainable healthy diets has a technical potential ranging from 0.5 to 9.4 GtCO2-eq yr-1 (median = 4.3) based on a range of GWP100 values for CH4 and N2O." This should be reflected in the summary.	maybe, tthe analysis is as it is. demand side measures are very theoretical	Reyes Tirado	Greenpeace and University of Exeter	Spain
81243	5	19	5	21	I find it somewhat misleading to report only direct mitigation and not land-use change for demand-side measures; the whole point of demand-side measures is that they also reduce the carbon opportunity cost of livestock systems. I realise the next sentence says acknowledges this but leaves it without quantification.	reject, this often would lead to double counting, because we have afforestation seperate	Andy Reisinger	Ministry for the Environment	New Zealand
81681	5	19	5	23	Suggest amend the sentence so it reads "Demand-side measures including dietary shifts [including shifting away from livestock foods and towards a higher proportion of plant-based foods] and reducing food waste, can provide 1.9 GtCO2-eq yr-1 20 potential (accounting only for diverted agricultural production and excluding land-use change)." What constitutes a "healthy" diet is a matter of international debate at the moment. Many types of diet could be considered "healthy" but they don't necessarily have a lower climate impact than the reference diet as this depends significantly on the reference diet, which varies between regions. Conversely, a diet with a lower climate impact may not necessarily be more healthy than the reference diet. It is important to be explicit about both aspects. Also, we suggest providing a bit more information around the 1.9 Gt CO2-e figure, including a confidence interval or confidence statement.	reject, too long	Government of New Zealand	Ministry for the Environment	New Zealand
83865	5	19	5	23	What is the reason to exclude land-use changes? Most of the mitigation potential of shifting diets and reducing waste comes from freeing millons of km2 of land and reducing pressure on natural ecosystems, with a mitigation potential of up to 8 GtCO2eq yr-1. SRCCL (Jia et al. 2019)	reject, this often would lead to double counting, because we have afforestation seperate	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
3829	5	21			reduce	agree	Rosa M Poch	ITPS and UdL	Spain
81245	5	25	5	35	It would be useful to clarify whether this is for sectoral bottom-up studies, or IAMs, and the extent to which they agree about the regional aspects. It's not clear what type of approach (sectoral or IAM) is the basis for the statement.	reject, it is fro both methods	Andy Reisinger	Ministry for the Environment	New Zealand
81711	5	25	5	25	Suggest remove "economic" from "greatest economic mitigation potential" as many developing countries face high economic trade-offs from choosing to maintain forests rather than cut them down to generate income.	reject, also in economic terms developing countries have largest potetnial. even when taking into opportunity costs	Government of New Zealand	Ministry for the Environment	New Zealand
12673	5	26	5	26	Run-on sentence correction: "…deforestation and degradation; however, there…"	agree, rephrase	Donald Falk	University of Arizona	United States of America
9595	5	27	5	30	It is not really clear to what these percentages refer. For this to be included in an assessment would require that there had been an assessment of various studies on the economic potential (of what exactly? Under what boundary conditions or assumptions?) that were thoroughly assessed and then interpreted. This is not visible here, and the meaning of the numbes is consequently not clear.	rephrased and shortened, but these percentages come form section 7.4.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
77661	5	28	5	43	•AFOLU emissions fluxes are also driven by current management practices assumed to be 'sustainable'. For example, we are now witnessing a complex interaction between past and current forest management and increased risk of severe/catastrophic fire resulting in huge GHG fluxes; interactions which have been well documented for at least a decade (e.g. Lindenmayer et al. 20011 PNAS 108, 15887-91; McDowell et al. 2020 Science 368, 964 (2020). The interaction between ecosystems degraded by human activities and climate change therefore warrants highlighting in the Executive Summary. •So too should the functional role of biodiversity as a pillar of ecosystem integrity and stability. Many factors reduce the integrity and stability of ecosystems and thus stability and longevity of carbon storage. The more we shift along a continuum from 'natural' to 'highly modified' the greater the risk of GHG release to the atmosphere and loss of other crucially important ecosystem services. It would be worth including a paragraph in the Executive Summary on the Nexus between biodiversity and climate change to explain the functional importance of biodiversity in stable long term carbon sequestration and storage. Grasp of the two way flows or spiral relationship between loss of biodiversity and climate change is poor and warrants far greater elaboration. So too does the point made on p 7-65 about differences in sequestration potential depending on the type of restoration pursued, viz "A regional study quantifying natural and assisted regeneration in 240 Mha of a second growth tropical forest in Latin America showed sequestration of 8.48 Pg C in above ground biomass over 40 years or 0.8 Mgha- 1 yr-1 (Chazdon 2016)." This backs in analysis from Australia in (Keith et al 2009) and North America (Moomaw 2019) on the superior mitigation potential of fostering natural forest recovery in forests degraded by logging. This pathway will be increasingly important given the escalating threats to successful tree planting and young forests	reject, too much detail here, we balance this in the section, and trhoughout chapter in trade offs etc.	Virginia Young	Australian Rainforest Conservation Society	Australia
1391	5	34	5	35	Giving some examples of such countries would be informative	reject, no countryspecific info here	Julien Demenois	Cirad	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
64853	5	37	5	50	important paragraph. Thankyou	noted	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)
81713	5	37	5	41	Really important message about co-benefits and trade-offs here - suggest is retained through the editing process and ensure is in the SPM.	noted	Government of New Zealand	Ministry for the Environment	New Zealand
81247	5	38	5	41	This reads policy-prescriptive ("it is critical that...") and presumptive. In every sector, misguided and inappropriate actions can do significant damage. Please try to phrase this in a neutral, factual way. E.g. "AFOLU mitigation that is pursued in … way can maximise co-benefits and avoid inadvertent negative side-effects, which can be significant (in which way?)."	rephrased and shortened	Andy Reisinger	Ministry for the Environment	New Zealand
74743	5	39	5	40	It is being proposed that Create IPCC Bank and allocate interest-free bank loans or low-interest loans to countries in the need of financial resources with the aim of constructing, equipping, educating, rehabilitating, equipping with the aim of reducing resources and increasing polluting sinks such as forestry. From land-use change, the forest protection for the prevention, the monitoring and the protection against unintentional disasters such as spontaneous forest fires, the drought, water shortages, floods, erosion, etc. Other factors affecting the climate change been allocated and budgeted. This bank need to be supported from polluting sources in prosperous countries that have not tried to the reduction consumption of fossil fuels for their products.	thank you, noted	Mahnaz Ahmadi Namin	Meteorology Organization of IRAN	Iran
45933	5	41	5	41	In the context of AFULO mitigation measures it is unfortunately impossible to "avoid trade-offs" with other SDGs; therefore better change to "minimize trade-offs" or "reduce trade-offs".	agree, done	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
55917	5	41	5	41	In land use, there are always trade-offs. There is no way to avoid them, so perhaps changing this to "limits risks and trade-offs" is more accurate.	agree, done	Government of United States of America	U.S. Department of State	United States of America
14739	5	42	5	46	This long sentence is very poorly worded. In an effort to compact everything in this ES paragraph, the authors start that sentence with "have potential to positively or negatively impact" after which they have jammed a long list or items for which the opening bit mentioned above may not make any sense. Can land degradation be negatively impacted? What is a negative or positive impact on albedo? What is a negative impact on land use change? The reader will have a vague sense of the overall meaning, but the authors could do much better. Maybe break up the sentence in relatable items. Items related to ecosystem quality together. Items that have no intrinsic value together (albedo, transpiration, land use change)...Just suggestions...	agree, done	Pierre Bernier	Natural Resources Canada	Canada
3831	5	44			... air, soil and water quality,... [add soil]	reject, long listings are avoided	Rosa M Poch	ITPS and UdL	Spain
19711	5	44	5	44	land degradation and soil erosion	agree, done	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
66033	5	45	5	45	Change to: "...land-use change..."	agree, done	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
56249	5	46	5	46	"humand wellbeing": human and public health is excluded from the list, but it should be incorporated as one of the key elements of intersection among impacts, as reflected later in the chapter (section 7.4.5.1). This sentence from page 102 should be in the summary: "Shifting to sustainable healthy diets has significant potential to achieve global GHG mitigation targets as well as public health and environmental benefits (high confidence)."	reject, long listings are tavoided	Reyes Tirado	Greenpeace and University of Exeter	Spain
56251	5	46	5	49	Given an specific example to this sentece will be greatly benefitial, in terms of response options with multiple positive outcomes.	reject, long listings are tavoided	Reyes Tirado	Greenpeace and University of Exeter	Spain
19713	5	48	5	48	land degradation and soil erosion	reject, long listings are tavoided	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21113	5	49	5	49	Please develop the meaning of SDGs 3 lines above when firts invoked	reject, becomes too long	Government of France	Ministère de la Transition écologique et solidaire	France
81249	5	49			Please try to avoid prescriptive phrases such as "will be crucial" if there is a more neutral way to say this (not with less confidence).	agree, done	Andy Reisinger	Ministry for the Environment	New Zealand
83867	6	1	6	4	"...in conflict with environmental and social sustainability dimension". These conflicts could be addressed in the paragraph. e.g. bionergy competing with land for food production or ecosystems conservation	agree, done	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
1099	6	2	6	3	This statement is largely unrelated to the material in the same paragraph that it is intended to summarize. In addition, it misrepresents the material in the report. It should be replaced with a heading reflective of the findings in the body of the report, something like - "Increased afforestation and biomass energy production offer significant mitigation potential but need to be undertaken with attention to impacts on overall carbon stocks as well as environmental and social sustainability dimensions. (high confidence)"	agree, rephrased totally	Reid Miner	Private Consultant	United States of America
3833	6	2	6	17	The caption in bold of this paragraph is not in accordance with its content: the caption indicates likely conflicts that are not explained further in the paragraph, rather just the benefits of carbon by afforestation and bioenergy production without mentioning the conflicts referred in the caption.	agree, rephrased totally	Rosa M Poch	ITPS and UdL	Spain
9909	6	2		3	Very large-scale deployment of afforestation or biomass production for bioenergy is likely to be in conflict with environmental and social sustainability dimensions. Based on information from (Teuling et al. 2017; Ellison et al. 2017) it is advisable to change the sentence to Very large-scale deployment of afforestation or biomass production for bioenergy (when it is not well planned) is likely to be in conflict with environmental and social sustainability dimensions.	agree, rephrased totally	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
18327	6	2	6	17	Could the link between biofuels and food prices be made more explicit?	reject, not here, but section rephrased totally	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
18331	6	2	6	3	It would be worth drawing out what those tradeoffs might be and their situation specificity - as drafted I think this overstates the likely downside risks: A key consideration is the counterfactual - what are biomass crops replacing in the landscape. In some caes that substitution will hae negative impacts but in many cases there will be multiple benefits.	agree, rephrased totally	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
18333	6	2	6	16	The top message is about the conflict between afforestation/biomass vs enviro/social sustainability issues. the text underneath does not explain this. No explanation of social sustainability. Could link this to conflict, political economy of natural resources etc	agree, rephrased totally	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
21115	6	2	6	17	This paragraph is essential	thanks	Government of France	Ministère de la Transition écologique et solidaire	France
29035	6	2	6	17	The message needs to be clearer/more consistent. This section, as other parts of the report, splits up potential for BECCS among AFOLU and other sectors. The potential in terms of CDR for the AFOLU sector is quantified but comparative quantifications for the other sectors are not presented, or rather some are but in EJ/a instead of GtCO2/a.	we avoid duplication in this way. we in ch 7 only deal with CDR and biomass supply. fig 12 gives some subset effect as well.	Jasmin Kemper	IEAGHG	United Kingdom (of Great Britain and Northern Ireland)
30325	6	2	6	17	In the first sentence in this para it is not completely clear what is meant by very large-scale, it also focuses on the risks associated with BECCS in very large scale. However, in the sentences below you seem to describe mostly the potential and co-benefits associated with BECCS. Please consider to make two separate paragraphs in the excecutive summary. One that describes BECCS in general with co-benefits, synergies and trade-offs. Including its sustainability on project to project basis. The other paragraph should be more focused around opportunities and trade-offs connected to scalability in the dependency of BECCS.	agree, rephrased totally	Government of Norway	Norwegian Environment Agency	Norway
45935	6	2	6	17	Since a reduction of animal-sourced food enables large amounts of carbon sequestration through restoration of ecosystems with several positive side-effects (health, global food security, biodiversity, lowering risk of zoonotic diseases etc., see explanations in 7.4.5.1) it should be quoted here at least as equally "crucial" as bioenergy, since bioenergy entails many sustainability risks as opposed to plant-based diets.	agree, rephrased totally	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
45937	6	2	6	17	In this paragraph, risks and trade-offs of bioenergy are briefly mentioned in the headline, but the following text only refers to the mitigation potential of bioenergy. Please do explain further the existing conflicts of bioenergy with environmental and social sustainability dimensions and add information on mitigation potential if environmental and social safeguards are included (as explained in 7.4.4). In addition, please mention that plant-based diets are a precondition to use large-scale bioenergy/ biobased materials or reforestation, if pressure on land resources and hence risks for food security, biodiversity etc. are to be kept small.	agree, rephrased totally	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
45939	6	2	6	3	The formulation used here might be open for a wide range of interpretation: "Very large-scale deployment of afforestation or biomass production for bioenergy is likely to be in conflict with environmental and social sustainability dimensions (high confidence)." The expression "very large-scale" appears vague and could dilute the argument. It is difficult for the reader to assess, which dimensions would fall under the quantification "very large scale". Just to use "large-scale" or a more concrete/quantified formulation might prevent misunderstandings, or if possible provide an estimate of the range of the area.	agree, rephrased totally	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
48011	6	2	5	3	The message "Very large-scale deployment of afforestation or biomass production for bioenergy is likely to be in conflict with environmental and social sustainability dimensions (high confidence)" is misleading as it suggests only negative effects of afforestation and BECCS. More importantly, the use of the term "large-scale" is ambiguous and could confuse readers, since here it refers to projected expansion at the upper bound of the estimated potentials. Those extreme cases of severe and rapid expansion at the maximum technical potential should not be confused with a common use of the expression 'large-scale'. Indeed, large scale change to accelerate BECCS and reforestation in abandoned lands, degraded pastures, and by means of integrated production systems and practices such as double cropping and multi-system agro-forestry practices should be actively encouraged. The text should be improved by also mentioning the positive outcomes of afforestation and BECCS in several SGDs when proper practices and approaches are adopted. Readers would benefit from clarification and examples on how AFOLU can generate benefits to SDGs. The text should be improved as follows: "Very large-scale (at the upper bound of IAM models) deployment of afforestation or biomass production for bioenergy is likely to be in conflict with environmental and social sustainability dimensions, highlighting the need for good management practices and approaches to provide afforestation and bioenergy with environmental and social co-benefits (high confidence)."	do not agree, we specify this further in main text	Marcelo moreira	UNICAMP - Agroicone	Brazil
49877	6	2	6	2	what is "very large"?	do not agree, we specify this further in main text	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
50931	6	2	5	3	The message "Very large-scale deployment of afforestation or biomass production for bioenergy is likely to be in conflict with environmental and social sustainability dimensions (high confidence)" is misleading as it suggests only negative effects of afforestation and BECCS. More importantly, the use of the term "large-scale" is ambiguous and could confuse readers, since here it refers to projected expansion at the upper bound of the estimated potentials. Those extreme cases of severe and rapid expansion at the maximum technical potential should not be confused with a common use of the expression 'large-scale'. Indeed, large scale change to accelerate BECCS and reforestation in abandoned lands, degraded pastures, and by means of integrated production systems and practices such as double cropping and multi-system agro-forestry practices should be actively encouraged. The text should be improved by also mentioning the positive outcomes of afforestation and BECCS in several SGDs when proper practices and approaches are adopted. Readers would benefit from clarification and examples on how AFOLU can generate benefits to SDGs. The text should be improved as follows: "Very large-scale (at the upper bound of IAM models) deployment of afforestation or biomass production for bioenergy is likely to be in conflict with environmental and social sustainability dimensions, highlighting the need for good management practices and approaches to provide afforestation and bioenergy with environmental and social co-benefits (high confidence)."	do not agree, we specify this further in main text	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
55919	6	2	6	17	Though the title calls it out, there is no explicit discussion of afforestation or its potential negative consequences if used at large scales in this paragraph at all. Most of the focus is on bioenergy and secondarily on wood products. Either change the paragraph to better reflect afforestation or change the title sentence, and be sure to address the possible consequences of large-scale afforestation elsewhere.	do not agree, we specify this further in main text	Government of United States of America	U.S. Department of State	United States of America
55921	6	2	6	17	Very problematic incongruity here. The summary sentence says "Very large-scale deployment of afforestation or biomass production for bioenergy is likely to be in conflict with environmental and social sustainability dimensions" yet there is no discourse on this conflict; rather, this paragraph seems to only tout the benefits of using biomass for energy or substitution. If this is meant to be a paragraph focused on biomass/bioenergy benefits, change the title. If this is supposed to focus on the potential environmental and social conflicts of large-scale biomass (and afforestation, though that isn't mentioned at all in the paragragh) then reduce or remove the bioenergy benefits text and actually focus on the potential conflicts.	The report provides an extensive discussion of land based mitigation options building on the SRCCL report. This is addressed chapters 7 , 12, and 6. The text has been ammended to better illustrate both the role and trade-offs associated with land based option, and emphasises the need for approaches that are sensitive to context.	Government of United States of America	U.S. Department of State	United States of America
55923	6	2	6	17	This paragraph only focuses on the benefits of biomass for energy/BECCS and substitution. There are substantial potential negative outcomes from large-scale biomass deployment, which should be mentioned here as well to provide a more balanced perspective. Otherwise, this comes off as rather biased toward bioenergy as it does not offer a full picture of potential negative outcomes as well as potential benefits.	The report provides an extensive discussion of land based mitigation options building on the SRCCL report. This is addressed chapters 7 , 12, and 6. The text has been ammended to better illustrate both the role and trade-offs associated with land based option, and emphasises the need for approaches that are sensitive to context.	Government of United States of America	U.S. Department of State	United States of America
55925	6	2	6	17	The overview here of biomass topics does not reflect the chapter text in a balanced manner. The extensive caveats and text surrounding net GHGs from biomass applications depend largely on circumstance and how there are substantial challanges in implementing large-scale biomass adoption for energy in ways that safeguard food security and other enironmental and social/cultural aspects (see, e.g., page 100). Strongly urge revisions to make this better reflect actual text and not simply tout biomass benefits.	The report provides an extensive discussion of land based mitigation options building on the SRCCL report. This is addressed chapters 7 , 12, and 6. The text has been ammended to better illustrate both the role and trade-offs associated with land based option, and emphasises the need for approaches that are sensitive to context.	Government of United States of America	U.S. Department of State	United States of America
55927	6	2	6	17	This summary section references the potential for large-scale afforestation to be in conflict with environmental and social sustainability dimensions, but the paragraph seems to focus only on bioenergy without specifically identifying the conflicts posed by afforestation.	The report provides an extensive discussion of land based mitigation options building on the SRCCL report. This is addressed chapters 7 , 12, and 6. The text has been ammended to better illustrate both the role and trade-offs associated with land based option, and emphasises the need for approaches that are sensitive to context.	Government of United States of America	U.S. Department of State	United States of America
64851	6	2	6	17	The first highlighed sentence of this point - which is essential - is not expanded, the point moves onto the justication for bionery. The two points need to be held in tension. Can you suggest how much would be too much? And how much too little? It is also critical to distinguish between the re-afforestation of deforested areas and afforestation of areas which are not naturally forested e.g. savannas. Tree planting represents maladpation with a host of harmful side effects e.g. risks to water supply and native biodiversity and the potential that the trees will not grow well (at least without taking water supplies from elsewhere)	The report provides an extensive discussion of land based mitigation options building on the SRCCL report. This is addressed chapters 7 , 12, and 6. The text has been ammended to better illustrate both the role and trade-offs associated with land based option, and emphasises the need for approaches that are sensitive to context.	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)
77663	6	2	6	17	•The comments on the role of bioenergy and wood products are puzzling. Particularly puzzling is the statement that the substitution benefits (fossil fuels/other products) are not credited to AFOLU but other sectors. Many argue that the reverse is true, i.e., that the increased emissions associated with substituting wood pellets for coal are not adequately accounted in any sector. Worse, the bioenergy market creates perverse incentives to increase energy emissions by encouraging replacement of coal with an energy source that is more emissive per unit of energy than coal; and increases AFOLU emissions by creating a new market driver to reduce the age at which forests are logged (reducing the sink) and make it economic to log forests that would otherwise be commercially non viable. At no point is the opportunity cost of allowing forests to keep sequestering carbon to recover their long-term carbon storage potential ever considered. See analysis and discussion in Booth 2018 Environ. Res. Lett. 13 (2018) 035001and Malcolm et al. 2020 Climatic Changehttps://doi.org/10.1007/s10584-020-02711-8. •The text fails to acknowledge the inherent tension between growing trees for bioenergy and growing trees for long lived wood products. Furthermore, the opportunity costs of preventing natural forests from reaching their carbon carrying capacity need to be acknowledged (Keith et al. 2015 PlosOne DOI: 10.1371/journal.pone.0139640. Interestingly in 2000 BIS Schrapnell noted that the global demand for sawn timber had not increased since 1976 and that all the growth in demand for wood products was for short lived composite products. The small (1%) annual increase in global demand for wood noted elsewhere in the chapter does not reveal the products for which demand is increasing.	we avoid duplication in this way. we in ch 7 only deal with CDR and biomass supply. fig 12 gives some subst effect as well.	Virginia Young	Australian Rainforest Conservation Society	Australia
79093	6	2	6	3	What constitutes large-scale bioenergy systems? Is there a threshold that can be identified?	no, there is no threshold. we specify this in general terms as locally specific this will have to be determined	Edith Juno	National Wildlife Federation	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
80651	6	2	6	17	Bioenergy with carbon capture and storage (BECCS) is being marketed as a green energy source, but in the critical 10–year window to 2030 BECCS is neither carbon neutral nor a viable carbon removal strategy (Booth, 2018; European Academies, 2020). When biomass burns, it releases carbon dioxide and black carbon into the atmosphere, leaving a carbon debt that will not be paid back for decades to centuries (Leturcq 2020; Bjart 2012). Burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels (Sterman et al., 2018; Searchinger et al., 2018; Ford 2021). Hundreds of scientists and economists have also openly expressed their opposition against replacing fossil fuel combustion with burning trees to generate energy (Raven et al., 2021). CITATIONS: Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, ENVIRON. RES. LETT. 13 (21 February 2018); European Academies' Science Advisory Council (2020) Commentary on Forest bioenergy, carbon capture and storage, and carbon dioxide removal: an update, 6 ("A key question raised in our earlier analysis [5] was the degree to which the [carbon dioxide removal (CDR)] assumed in climate scenarios is likely to be achievable in practice. Extensive work has been performed on BECCS, and its overall efficiency in removing CO2 from the atmosphere comprehensively reviewed [30]. The simplistic vision of BECCS (Figure 3A) is that one ton of CO2 captured in the sequestered geologically—which we can regard as a carbon efficiency of 1. However, as with the simplistic concept of carbon neutrality in the bioenergy debate, this is far from the reality. GHG emissions throughout the biomass supply-chain 'leak' carbon, which reduces the carbon efficiency (Figure 3B). Some life cycle analyses [e.g. 31] of the entire process chain for a BECCS crop to final carbon storage in the ground have shown leakage of CO2 to be greater than the CO2 captured at the point of combustion, thus resulting in carbon efficiencies of less than 50%."). Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, NATURE SCIENTIFIC REPORTS 10:1–9, 7 ("The substitution of wood for other fuels or other materials, which some believe to be more efficient in limiting the greenhouse effect than carbon capture and its direct storage in live trees, may be in reality counterproductive or, to say the least, its effects are greatly overestimated. Energy substitution has an immediate adverse greenhouse effect since the emission factor of wood is higher than that of any other fuel. The possibility of regeneration for the exploited stands, and, in that case, the existence of a time delay beyond which a GHG benefit may be expected, cannot hide this inescapable physical reality. The time horizons set for the achievement of greenhouse gas emission reduction objectives (30 to 80 years) are, in most cases, less than this time to sequestration parity."); Bjart, H. (2012) Harvesting in Boreal Forests and the Biofuel Carbon Debt, CLIMATIC CHANGE 112:415-428 ("Owing to the extensive critique of food-crop-based biofuels, attention has turned toward second-generation wood-based biofuels. A question is therefore whether timber taken from the vast boreal forests on an increasing scale should serve as a source of wood-based biofuels and whether this will be effective climate policy. In a typical boreal forest, it takes 70–120 years before a stand of trees is mature. When this time lag and the dynamics of boreal forests more generally are taken into account, it follows that a high level of harvest means that the carbon stock in the forest stabilizes at a lower level. Therefore, wood harvesting is not a carbon-neutral activity. Through model simulations, it is estimated that an increased harvest of a boreal forest will create a biofuel carbon debt that takes 190–340 years to repay. The length of the payback time is sensitive to the type of fossil fuels that wood energy replaces."). Sterman, J. D., et al. (2018) Does Replacing Coal with Wood Lower CO2 Emissions? Dynamic Lifecycle Analysis of Wood Bioenergy, Environ. Res. Lett. 13:1–10, 1 ("Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clearcut, depending on forest type—assuming the land remains forest."); Searchinger, T. D. et al. (2018) Europe's Renewable Energy Directive Poised to Harm Global Forests, Nature Communications 9: 1–4, 2 ("Wood that reaches a power plant can displace fossil emissions but per kWh of electricity typically emits 1.5x the CO2 of coal	do not agree , we clearly mention risks . we have to reflect all the ins and outs which we do in the BECCS section and in ch 12 in bioeconomy box.	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80795	6	2	6	17	Bioenergy with carbon capture and storage (BECCS) is being marketed as a green energy source, but in the critical 10–year window to 2030 BECCS is neither carbon neutral nor a viable carbon removal strategy (Booth, 2018; European Academies, 2020). When biomass burns, it releases carbon dioxide and black carbon into the atmosphere, leaving a carbon debt that will not be paid back for decades to centuries (Leturcq 2020; Bjart 2012). Burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels (Sterman et al., 2018; Searchinger et al., 2018; Ford 2021). Hundreds of scientists and economists have also openly expressed their opposition against replacing fossil fuel combustion with burning trees to generate energy (Raven et al., 2021). CITATIONS: Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, ENVIRON. RES. LETT. 13 (21 February 2018); European Academies' Science Advisory Council (2020) Commentary on Forest bioenergy, carbon capture and storage, and carbon dioxide removal: an update, 6 ("A key question raised in our earlier analysis [5] was the degree to which the [carbon dioxide removal (CDR)] assumed in climate scenarios is likely to be achievable in practice. Extensive work has been performed on BECCS, and its overall efficiency in removing CO2 from the atmosphere comprehensively reviewed [30]. The simplistic vision of BECCS (Figure 3A) is that one ton of CO2 captured in the sequestered geologically—which we can regard as a carbon efficiency of 1. However, as with the simplistic concept of carbon neutrality in the bioenergy debate, this is far from the reality. GHG emissions throughout the biomass supply-chain 'leak' carbon, which reduces the carbon efficiency (Figure 3B). Some life cycle analyses [e.g. 31] of the entire process chain for a BECCS crop to final carbon storage in the ground have shown leakage of CO2 to be greater than the CO2 captured at the point of combustion, thus resulting in carbon efficiencies of less than 50%."). Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, NATURE SCIENTIFIC REPORTS 10:1–9, 7 ("The substitution of wood for other fuels or other materials, which some believe to be more efficient in limiting the greenhouse effect than carbon capture and its direct storage in live trees, may be in reality counterproductive or, to say the least, its effects are greatly overestimated. Energy substitution has an immediate adverse greenhouse effect since the emission factor of wood is higher than that of any other fuel. The possibility of regeneration for the exploited stands, and, in that case, the existence of a time delay beyond which a GHG benefit may be expected, cannot hide this inescapable physical reality. The time horizons set for the achievement of greenhouse gas emission reduction objectives (30 to 80 years) are, in most cases, less than this time to sequestration parity."); Bjart, H. (2012) Harvesting in Boreal Forests and the Biofuel Carbon Debt, CLIMATIC CHANGE 112:415-428 ("Owing to the extensive critique of food-crop-based biofuels, attention has turned toward second-generation wood-based biofuels. A question is therefore whether timber taken from the vast boreal forests on an increasing scale should serve as a source of wood-based biofuels and whether this will be effective climate policy. In a typical boreal forest, it takes 70–120 years before a stand of trees is mature. When this time lag and the dynamics of boreal forests more generally are taken into account, it follows that a high level of harvest means that the carbon stock in the forest stabilizes at a lower level. Therefore, wood harvesting is not a carbon-neutral activity. Through model simulations, it is estimated that an increased harvest of a boreal forest will create a biofuel carbon debt that takes 190–340 years to repay. The length of the payback time is sensitive to the type of fossil fuels that wood energy replaces."). Sterman, J. D., et al. (2018) Does Replacing Coal with Wood Lower CO2 Emissions? Dynamic Lifecycle Analysis of Wood Bioenergy, Environ. Res. Lett. 13:1–10, 1 ("Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clearcut, depending on forest type—assuming the land remains forest."); Searchinger, T. D. et al. (2018) Europe's Renewable Energy Directive Poised to Harm Global Forests, Nature Communications 9: 1–4, 2 ("Wood that reaches a power plant can displace fossil emissions but per kWh of electricity typically emits 1.5x the CO2 of coal	do not agree , we clearly mention risks . we have to reflect all the ins and outs which we do in the BECCS section and in ch 12 in bioeconomy box.	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
81251	6	2	6	3	I doubt that this statement reflects a true quantitative probabilistic assessment of outcomes in the real world, and the word "likely" therefore should not be used. Also I cannot help but feel that without some more information, the statement is either inconsistent with the conclusions of the SRCCL (which did not say unequivocally that "big is bad"); it needs some more information on what sort of scale (and is this only globally, or scale relative to a given region). Of course the authors may feel that they do want to sharpen a conclusion from SRCCL, but I would like to make sure that this would be a deliberate and explicit step, not inadvertent wording.	we change this to ill planned	Andy Reisinger	Ministry for the Environment	New Zealand

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
83667	6	2	4	17	The claim that bioenergy forms a crucial mitigation option requires substantial qualification , and is simply incorrect in many circumstances. Forest bioenergy is adding increasingly large amounts of carbon dioxide to the atmosphere and reducing the capacity of forests to absorb atmospheric carbon dioxide, making it more difficult to reach net zero carbon as the stated goal for limiting global temperature. Adding carbon capture and storage (CCS) technology to a bioenergy plant does not resolve this issue. Bioenergy with Carbon Capture and Storage (BECCS) has not been demonstrated at scale, and based upon existing CCS for coal, it would remove relatively little of the life cycle emissions and add substantially to the cost of electric power generation. Utilizing incomplete accounting systems, it has been claimed that replacing fossil fuels with burning wood is carbon neutral. It is argued that replacement trees will eventually remove the carbon dioxide that was emitted at the time of burning. these claims fail to account for foregone removal of atmospheric carbon dioxide by harvested trees, the loss of carbon and nutrients from soils and soil compaction due to harvest, and the substantial fossil fuel emissions associated with harvesting and processing wood into forms suitable to burn for commercial scale heat and electricity (Sterman et al. 2018 Environmental Research Letters https://iopscience.iop.org/article/10.1088/1748-9326/aaf354). Commercial scale bioenergy electric power emits more CO2 per unit of electricity than does coal and more than twice as much as natural gas fueled facilities. That the CO2 emittd from bioenergy is biogenic is not a magic bullet, as implied. Even if forest regrowth were to remove the previously emitted carbon dioxide from all sources, proper carbon accounting shows it cannot do so during the short climate mitigation window of one to three decades from now (Sterman et al. 2018 https://iopscience.iop.org/article/10.1088/1748-9326/aaa512; Biomass Energy Resource Center, the Forest Guild, and Spatial Informatics Group 2012 https://www.southernenvironment.org/uploads/publications/biomass-carbon-study-FINAL.pdf: Bensen 2017 https://www.sciencedirect.com/science/article/abs/pii/S1364032117302034; Buchholz etal. 2019 https://www.southernenvironment.org/uploads/publications/2019-05-27_Drax_emissions_-_SIG_report_Phase_II.PDF; Booth 2018 https://iopscience.iop.org/article/10.1088/1748-9326/aaac88). The adverse impacts of increased carbon emissions over even the next couple of decades was affirmed by the EU Joint Research Centre's recent report on biomass, which concluded that of the 24 biomass sources evaluated in the study, 23 pose a risk to climate, biodiversity or both. Their concept of "short term" carbon impacts is defined as biomass that increases carbon emissions compared to fossil fuels for 10 – 20 years, then may show a reduction relative to fossil fuels, if certain conditions are met.(https://publications.jrc.ec.europa.eu/repository/bitstream/JRC122719/jrc-forest-bioenergy-study-2021-	do not agree , we clearly mention risks . we have to reflect all the ins and outs which we do in the BECCS section and in ch 12 in bioeconomy box.	Margaret Putt	Enviromental Paper Network International	Australia
9597	6	3	6	17	The upper boundary of the sustainable BECCS potential exceeds the value of a recent study (Creutzig et al., 2021, GCBB, https://doi.org/10.1111/gcbb.12798). This whole para misses the point that systemic interactions between different land uses, in particular between using the land to produce more biomass, and C sequestration in biota and soils (i.e. raising C stocks in biota and soils) exist and need to be balanced, see e.g. Kalt et al. 2019, GCBB doi 10.1111/gcbb.12626, Kalt et al. 2020, Env Res Lett, doi 10.1088/1748-9326/ab6c2e	do not agree , we clearly mention risks . we have to reflect all the ins and outs which we do in the BECCS section and in ch 12 in bioeconomy box.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
56253	6	5	6	6	The reference to BECCS should include some measure of caution about its temporal availability and potential conflicts and risks.	we rephrased this section, more details only in main text	Reyes Tirado	Greenpeace and University of Exeter	Spain
76693	6	5	6	5	Delete "especially". Bioenergy cannot "provide CDR" and much more likely to do the opposite (increase emissions from land). It can contribute to net removals "only" if it is combined with the capture and permanent storage of the carbon harvested. However, that would be an option with or without the energy production: it would be feasible to harvest biomass and sequester (in geological formations or otherwise) regardless of the energy use. "Biochar" is a case in point.	we rephrased this section, more details only in main text	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
55929	6	6	6	8	Make it clear that the IAMs' CDR reduction potential from BECCS assumes that burning biomass is carbon neutral if that is indeed assumed (it must be).	we rephrased this section, more details only in main text	Government of United States of America	U.S. Department of State	United States of America
21117	6	11	6	12	It would be interesting to nevertheless give here an estimate of the mitigation potential for this bioenergy and consumer or construction sink	we rephrased this section, more details only in main text	Government of France	Ministère de la Transition écologique et solidaire	France
55931	6	11	6	12	This statement "However, such additional mitigation is not credited to AFOLU, but rather other sectors like energy and buildings" is overly prescriptive and incorrect as written. There is not only one way to account for/give credit for potential mitigation from biomass use for energy, so to say that such mitigation is not credited to AFOLU is NOT appropriate. In IPCC accounting, which is comprehensive across all sectors, biogenic emissions from biomass for energy ARE attributed to AFLOU. Though other crediting systems/subsector programs may choose to credit end users/energy producers for biomass use, that is not a universal truth and thus this statement should be removed as it is misleading and inaccurate.	we rephrased this section, more details only in main text	Government of United States of America	U.S. Department of State	United States of America
19715	6	12	6	12	Two fundamental criteria that must be incorporated into the decision-making process of each energy crop are that it has an efficient balance of greenhouse gas (GHG) emissions and that optimal recycling routes are created in all links of the chain.	we rephrased this section, more details only in main text	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21119	6	12	6	15	This figure could be linked to FAO estimates also for 2050, according to which food production will have to increase by 70%. In particular, arable land will need to increase by about 120 million hectares in developing countries, mainly in sub-Saharan Africa and Latin America.	we rephrased this section, more details only in main text	Government of France	Ministère de la Transition écologique et solidaire	France
28797	6	12	6	17	It would be good to comment on the likelihood of availability of 120-500 Mha for dedicated lignocellulosic crops	we rephrased this section, more details only in main text	naikoa aguilar-amuchastegui	WWF-US	United States of America
81253	6	12			Please avoid the word "credited" as this implies an accounting process, whereas the more correct word here would be that it is not "reported" as part of AFOLU. Who gets credit for what is a separate policy choice.	we used reporting now	Andy Reisinger	Ministry for the Environment	New Zealand
18325	6	13	6	13	Explain lignocellulosic or provide examples to help with understanding	we rephrased this section, more details only in main text	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
18329	6	14	6	16	It's difficult to understand the relevance and benefits of lignocellulosic crops when only compared against EJ over an area. The range is very broad too.	we rephrased this section, more details only in main text	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
76695	6	14	6	17	It is unclear whether the future potentials mentioned represent overall quantities or increases over current values. In either case, it would be useful to present the current values for transparency and comparison.	we rephrased this section, more details only in main text	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76697	6	14	6	17	It is unclear whether energy values represent the energy contents of biomass produced or the energy (from other sources) substituted, and whether it is primary or final energy. How are "materials in other sectors" taken into account in the energy figures? Is it through savings of fossil energy embedded in the materials substituted? Or material substitution would be in addition to the energy substitution?	we rephrased this section, more details only in main text	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
45941	6	15	6	17	"The capacity from agriculture and forestry residues is estimated to be 4-57 EJ yr-1 by 2050, increasing to 50-90 EJ yr-1 16 by 2100 (medium 17 confidence) {7.4}." If possible, evident trade-offs between soil carbon storage through increased crop residues left in the field and use of agricultural residues for energetic purposes may be stated somewhere in the summary of Ch7.	we rephrased this section, more details only in main text	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
55933	6	15	6	16	Add 'technical' before capacity, as this reflects technical capacity as presented in the chapter.	we rephrased this section, more details only in main text	Government of United States of America	U.S. Department of State	United States of America
55935	6	15	6	17	Is this residues capacity total or additional?	we rephrased this section, more details only in main text	Government of United States of America	U.S. Department of State	United States of America
85803	6	15	6	16	Suggest clarification: It would be useful to express these energy terms in their emissions equivalents (MtCO2) for easier comparison to the text in the same paragraph estimating the mitigation potential of BECCS.	we rephrased this section, more details only in main text	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
55937	6	16	6	17	Cannot find this "50-90 EJ yr-1 by 2100 (medium confidence)" {7.4} in the chapter. Reconcile or delete.	we rephrased this section, more details only in main text	Government of United States of America	U.S. Department of State	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
18335	6	19	6	43	These two paragraphs are impactful and very relevant to policymakers. Suggest putting on first exec summary page.	we rephrased this section, more details only in main text	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
72613	6	19	6	30	The highlighted info about increasing CH4 and N20 indicating lack of action and progress is not expanded upon in this paragraph. The source of these increases and why they indicate lack of progress should be included here, or the topic sentence should be changed to better reflect the stated limited contribution of forestry to progress, and presumably how low investment contributes to this small contribution. The referenced section (7.6) also highlights that agriculture has hardly any contribution to ghg reductions to date (here is the link to CH4 and N2O, correct?), with little to no investment, as most of the activities have been forest-related.	we rephrased this section, more details only in main text	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
76699	6	19	6	20	"AFOLU mitigation measures have been known for decades, although increasing emissions, notably CH4 and N2O, indicate a lack of action and progress." Without questioning the conclusion, the logic implied seems inconsistent with the stated interpretation of "mitigation". Absolute changes in emissions do not allow the evaluation of mitigation action, as emissions should be compared to a counterfactual (BaU).	we rephrased this section, more details only in main text	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76701	6	19	6	20	"Globally, the AFOLU sector has so far contributed modestly to net mitigation, as past policies have delivered 0.65 GtCO2 yr-1 of mitigation during 2010-2019 or 1.4% of global gross emissions.". It is unclear what this "mitigation" refers to. Is it reduced emissions or increased sinks? Does it include the sinks accounted by developed countries under the Kyoto Protocol? If so, does it refer to the accounted amounts or some other estimate (other baseline)?	we rephrased this section, more details only in main text	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81255	6	19	6	20	I don't think the rising trends in CH4 and N2O are the main or sufficient basis for this statement, but the simple fact that there are very few policies in place anywhere that seek to address those emissions from a climate perspective. I.e. we might have policies in place but emissions rise because policies aren't stringent enough (as is the case for CO2) - but we are in a situation where we don't even have policies in the first place. This deserves saying more clearly in my view.	we rephrased this section, more details only in main text	Andy Reisinger	Ministry for the Environment	New Zealand
84797	6	19	6	30	The finding and corresponding cross referenced sections (7.6) relaying to methane emissions are important. It is suggested these contextualise emerging discussion regarding 'short-lived' greenhouse gases (methane), for example work that has emerged from New Zealand, and whether accounting changes (to reflect this work regarding short-lived greenhouse gases, if broadly accepted) may influence the findings reported in this section.	we rephrased this policy section totally,	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
11759	6	20	6	22	During the same period the production of Food ,fibers and energy from the sector has increased and this productive development to support the demands could be argued as contribution in producing more with less GHG impact /kg	we rephrased this policy section totally,	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
21121	6	21	6	22	This 0.65 GtCO2 yr-1 is the amount of carbon offsets from the AFOLU sector. This is by no means representative of what "policies" in general have delivered. Estimating what policies have delivered (in good or bad) at global level would be very challenging and I'm not aware of any study attempting to estimate this. At national level and/or on specific policies, such studies exists but they are not reviewed in this report. This sentence should therefore be deleted.	we rephrased this policy section totally,	Government of France	Ministère de la Transition écologique et solidaire	France
76703	6	24	6	25	"effective policy interventions and financing will be required for AFOLU to contribute to mitigation": Does it mean that the mitigation already happening, as mentioned above, would stop in the absence of additional financing? Also, it is arguable that "effective policy interventions and financing" are needed for virtually any mitigation in any sector.	we rephrased this policy section totally,	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81257	6	24			add "more" before policies - what we have right now simply isn't effective enough	we rephrased this policy section totally,	Andy Reisinger	Ministry for the Environment	New Zealand
81715	6	24	6	25	Suggest change this sentence to say "Considering trends in population, income, excess consumption of foods (particularly from animal-sourced foods from inefficient production systems), and food loss and waste..." This acknowledges the huge variation in emisisons-efficiency of livestock systems around the world in line with the IPCC Land Report finding that "animal-sourced food produced in resilient, sustainable and low-GHG emission systems, present major opportunities for adaptation and mitigation..." Useful references with regard to the large variation of emission intensity across differnt livestock production systems include: Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A. & Tempio, G.2013. Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. Food and Agriculture Organization of the United Nations (FAO), Rome.	we rephrased this policy section totally,	Government of New Zealand	Ministry for the Environment	New Zealand
76705	6	25	6	25	What constitutes "sustainable investment"? Why is it smaller in AFOLU? Does it mean that the majority of forestry is unsustainable?	we rephrased this policy section totally,	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81259	6	25			not sure what "sustainable" investments means here	we rephrased this policy section totally,	Andy Reisinger	Ministry for the Environment	New Zealand
11761	6	27	6	30	The evidence of the following sentence: "Although from bio-physical and ecological perspective, the mitigation potential of AFOLU measures is large, its feasibility is mainly hampered by lack of public acceptance of some measures, uncertainty over long term additionality, and lack of institutional capacity and long-term continuation of certain measures (7.6)." needs to be substantiated – in particular the aspect on public acceptance.	we rephrased this policy section totally,	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
55939	6	27	6	30	One notable omission here is cost. Though it may be relatively cheaper than mitigation in some other sectors, it is still not cheap. Therefore cost is also a barrier for this option.	we rephrased this policy section totally,	Government of United States of America	U.S. Department of State	United States of America
55941	6	27	6	30	Add 'permanance' after 'additionality' as that is another main barrier.	we rephrased this policy section totally,	Government of United States of America	U.S. Department of State	United States of America
71781	6	27	6	30	I do not believe that this statement is true. The feasibility of AFOLU mitigation measures is mainly hampered by complexity, large numbers of stakeholders, long lag times, low returns on investment, high upfront costs, low signal to noise ratios, and, most importantly, diverging interests (eg food production).	we rephrased this policy section totally,	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21123	6	28	6	28	"hampered by lack of public acceptance of ..." it is too vague an expression to understand the extent of the hindrance	we rephrased this policy section totally,	Government of France	Ministère de la Transition écologique et solidaire	France
81261	6	28	6	30	add "and the absence of dedicated and effective climate policies outside measures to reduce deforestation"	we rephrased this policy section totally,	Andy Reisinger	Ministry for the Environment	New Zealand
11763	6	32	6	43	Mention the importance of creating incentives for forest owners to invest in sustainable forestry with high climate benefits. A summary of an international conference where active use versus leaving forests for free development is published in: KSLA, 2018: 6, Forests and the climate – KSLAT nr 6-2018. ISSN 0023-5350, ISBN printed edition 978-91-88567-21-5 digital edition 978-91-88567-22-2. https://www.ksla.se/wp-content/uploads/2018/12/KSLAT-6-2018-Forests-and-the-climate.pdf	we rephrased this policy section totally,	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
29705	6	32	6	35	The prognosis that AFOLU can provide 30 % of overall mitigation needs further clarification. Please consider to make the language here and the language in the technical summary on the same issues consistent with eachother e.g. by adding the sentence from TS page 74 line 19-22.	comes from own analyses .i.e. the 13 Gt CO2	Government of Norway	Norwegian Environment Agency	Norway
84799	6	32	6	43	The finding at lines 32-33 and corresponding context broadly capture indigenous peoples, however it is suggested that indigenous peoples be specifically referred to amongst 'stakeholders'. This could be done in a way that is inclusive (eg: "...from policy makers and inestors to land managers and indigenous peoples..."). The inclusion of indigenous peoples in discussions about land tenure is important (see the work of the WRI and others in relation to recognition of tenure and other rights and mitigation outcomes in AFOLU sectors). Similarly, see co-benefits having emerged in Australia via the inclusion of indigenous peoples and recognition of native title and Aboriginal land rights tenure interests (see < https://ecos.csiro.au/finding-win-wins-carbon-offset-schemes-and-indigenous-co-benefits/ >, <https://press-files.anu.edu.au/downloads/press/p175041/html/ch07.html?referer=&page=13 > and <Robinson, CJ., A. R. Renwick., T. May, E. Gerrard, R. Foley, M. Battaglia, H. Possingham, D. Griggs, D. Walker. Indigenous benefits and carbon offset schemes: An Australian case study, Environmental Science and Policy, 56, 129-134. DOI: 1016/j.envsci.2015.11.007 >	we rephrased this policy section totally,	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
21125	6	33	6	33	We suggest to replace "land managers" with "land users" which is more inclusive.	we rephrased this policy section totally,	Government of France	Ministère de la Transition écologique et solidaire	France
21127	6	33	6	35	This sentence is erroneous: 0.7 billion yr-1 corresponds to the amount spent on carbon offsets from the AFOLU sector which is not representative of total spending (agricultural policies and their green measures, conservation policies, ...). The sentence should be deleted.	reject, estimate is correct	Government of France	Ministère de la Transition écologique et solidaire	France
27765	6	33	6	33	Add "climte-related funds and financial mechanisms" after "policy makers".	we rephrased this policy section totally,	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
30741	6	34	6	35	Regarding the rationale for USD 400 billion yr-1, "that is estimated to be necessary to achieve up to 30% of global mitigation effort" seems to have the different nuance with the explanation in lines 20-21 of p131, "that would be needed to achieve the economic potential described in Section 7.4". It would be better to make revisions to have the consistency among the sections.	we rephrased this policy section totally,	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
28799	6	35	6	37	Data illustrating the cimparison mentioned would be of great value to make this point as it is of great relevance. Particularly as discourse is dominated by market approaches talking about "bankable project", resulting in perverse incebtives and hot air in many cases.	we rephrased this policy section totally,	naikoa aguilar-amuchastegui	WWF-US	United States of America
45943	6	35	6	40	1. Please consider changing "successful" into "promising" or "potentially successful", as the authors write later in that section that the potential success depends on the context. 2. Reconsider the order of policies and measures; first the authors write about (heavy) "subsidisation" of agriculture (and forestry); then the first option in the next sentence is "land tenure rights and community forests". This is a strong cut or jump. If the authors would place a potential "first world" measure like "agriculture improvement and sustainable intensification", "conservation", or "payments for ecosystem services" in the beginning of this "list" they would avoid this cut (or jump) from first world subsidisation to developing country's land tenure rights issue.	we rephrased this policy section totally,	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
75523	6	35	6	37	Sentence requires revision and It might be useful if possible to provide an estimation of current subsidies in agriculture to compare directly to the estimation spent on AFOLU mitigation.	we rephrased this policy section totally,	Government of Ireland	Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division	Ireland
18337	6	36	6	36	Can you add in an example on current subsidy expenditure - Common Ag Policy?	we rephrased this policy section totally,	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
72615	6	36	6	36	Please include the amount of these subisdies for comparison.	we rephrased this policy section totally,	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
8103	6	37	6	40	Please delete "and certification". "Forest management improvement" suffices, certification is neither necessary nor a guarantee for improvements.	we rephrased this policy section totally,	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
19717	6	37	6	37	royalty for natural renovable resources,create a global found for big companies	we rephrased this policy section totally,	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21129	6	37	6	43	What is the link with biodiversity and ecosystem services? In fact, it is the question of managing a global phenomenon with local effects that are themselves managed locally. This is much clearer in the detailed section.	we rephrased this policy section totally,	Government of France	Ministère de la Transition écologique et solidaire	France
81263	6	37	6	40	It is striking that this list is mainly about policies affecting emissions indirectly; I'm missing a clear statement that without bringing explicit or implicit emission prices into the picture, most of the mitigation potential (about a few dollars per tonne) will remain unrealised and will rely largely on co-benefits. This doesn't add up, given that assessment of the economic mitigation potential assumes prices of $100/tonne or more. I suggest that a clear statement is warranted here that makes clear that much of the mitigation potential presented in this chapter will remain theoretical and unrealised unless and until policies that directly address emissions, consistent with shadow prices in deep mitigation scenarios, are implemented.	we rephrased this policy section totally,	Andy Reisinger	Ministry for the Environment	New Zealand
1337	6	38	4	39	"…agriculture improvement and sustainable intensification…" I think this expression is a bit poor and it needs further definition to show all the potential of agricultural ecosystems for mitigation. So I would talk about "the implementation of Sustainable Land Management practices for extensive and intensive agriculture" or the implementation of Sustainable Land Management practices for extensive agriculture and sustainable intensification". The term SLM (Sustainable Land Management) is already used and accepted related to agricultural practices. References: http://www.fao.org/land-water/land/sustainable-land-management/slm-practices/en/ ; Ruiz, I., Almagro, M., García de Jalón, S., Solà, M.D.M., Sanz, M.J., 2020. Assessment of sustainable land management practices in Mediterranean rural regions. Journal of Environmental Management 276, 111293; Martínez-Mena, M., Carrillo-López, E., Boix-Fayos, C., Almagro, M., García Franco, N., Díaz Pereira, E., Montoya, I., de Vente, J., 2020. Long-term effectiveness of Sustainable Land Management practices to control runoff, soil erosion, and nutrient loss and the role of rainfall intensity in Mediterranean rainfed agroecosystems. Catena, 187: 104352; Eekhout, J.P.C. and de Vente, J., 2019. Assessing the effectiveness of Sustainable Land Management for large-scale climate change adaptation. Science of the Total Environment, 654: 85-93 09/02/2021Albaladejo, J., Díaz-Pereira, E., & de Vente, J. 2021. Eco-Holistic Soil Conservation to support Land Degradation Neutrality and the Sustainable Development Goals. Catena, 196, 104823.	we rephrased this policy section totally,	Carolina Boix-Fayos	CEBAS-CSIC	Spain
11765	6	38	6	43	The following statement and associated section (7.6) needs to be further substantiated with evidence to give more advice to policy-makers: "Successful policies and measures include establishing tenure rights and community forestry, agriculture improvement and sustainable intensification, conservation, payments for ecosystem services, forest management improvement and certification, voluntary supply chain management efforts, private funding and regulatory efforts. The success of different policies, however, will depend on numerous region-specific factors in addition to funding, including governance, institutions, long term consistent execution of measures, and the specific policy setting (7.6)."	we rephrased this policy section totally,	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
9545	6	39			payments for ecosystem services (based on results and/or sustainable practices applied)	we rephrased this policy section totally,	Blanca Casares Guillén	EfecTo TP	Spain
66035	6	42	6	42	Change to: "…long-term consistent…"	we rephrased this policy section totally,	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
55943	6	45	7	2	There are many issues in the AFOLU sector that could be focused on in 'Transparency, credibility and accuracy in estimating and reporting GHG fluxes is critical to incentivise action' including GHGI capacity building, more studies on GHG flux measurements and soils, MRV, etc., or how IAMs don't usually model soil carbon (a difference between NGHGIs and IAMs, as it is omitted in the latter, as stated in Chapter 12). But this section only focuses on a new/forthcoming modeling 'adjustment' to align GHGIs and IAMs post-processing. This seems to bandaid over the issue rather than improve model inputs and linkages with the detailed sectoral models cited in this chapter and beyond. The case has not been made here that"Adjusting global models results to be more compatible with countries' GHG inventories will enable a more accurate assessment of collective progress towards the Paris Agreement's climate goals." This does not improve accuracy in effect. If the IAMs are adding DGVM estimates to IAMs modeled outcomes post-processing, this pushes the estimated envelop of mitigation outcomes up or down, greatly increasing or decreasing the overall magnitude of the results without including that land base within the modeled context, which may be problematic as it does not improve accuracy. It improves the *appearance* of accuracy, as it aligns the two different enterprises. NGHGIs are compiled with different guidelines, assumptions, and goals than models/IAMs and each country differs in its approach. It seems that there are bigger issues, like where are bookkeeping models getting such different results and are those results used to inform models. Is that a driver here? To make this adjustment unilaterally without aligning the deeper drivers does not seem appropriate.	we rephrased this policy section totally,	Government of United States of America	U.S. Department of State	United States of America
55945	6	45	7	2	There are other reasons for why there is lack of alignment between the NGHGIs and models, as listed on page 21, lines 12-21 (where the remedy is is focused generaly on how "uncertainties that will decrease slowly over time through improvements of both models and NGHGIs") and page 22, lines 11-13 (bookkeeping models vs. NGHGIs). These should be inlcuded here.	we rephrased this policy section totally,	Government of United States of America	U.S. Department of State	United States of America
72617	6	45	7	2	This topic focuses on increasing accuracy of estimating and reporting GHG fluxes, but does not fully represent the referenced section (7.2). It presents an unclear comparison between global models and country inventories, then states that models need to change, but it isn't clear why models need to change or what direction the gap is, and does not mention at all the issues with reporting that contribute to this issue. The reporting needs to change also - it isn't just an issue for models to solve. While the proposed model adjustments seem to work well, they are not going to be accurate if the actual areas used in country assessments are not reported and used by models. If the goal is to do to accurate assessment and monitoring, then countries have to provide maps of the areas they include in their inventories. These locations matter in terms of carbon concseequences, and are key for both accountability and for robust modelling.	we rephrased this policy section totally,	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
14799	6	46	6	48	Can this be rephrased to make clear which approach has the larger flux estimate (rather than just stating the difference of 5GtCO2eq/yr)?	we rephrased this policy section totally,	Elizabeth Bush	Environment and Climate Change Canada	Canada
76707	6	50	7	2	It is unclear why models should be adjusted to fit the approach of the inventories. The inventories apply the "managed land proxy" since it was established that separating natural and indirect removals from anthropogenic ones was not feasible in the context of the inventories. If models will follow the same convention, it will be more difficult to transparently separate natural from anthropogenic fluxes. Introducing that approach in the future could limit comparability with earlier studies and assessments, such as AR6.	reject, this is Grassi issue. it is important to have baseline right	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81265	6	50			I wonder whether this chapter really should make such a recommendation, or whether it would not be better to spell out the options and leave policymakers to decide how to reconcile the gap (because this has distributional consequences, as some countries stand to gain more from others from making the choice one way or the other).	reject, this is Grassi issue. it is important to have baseline right	Andy Reisinger	Ministry for the Environment	New Zealand
3835	7	2			Similar gaps are encountered with estimation and monitoring of soil organic carbon, not only with afforestation. Soil is storing more carbon than above-ground and atmosphere, and has a high potential for SOC sequestration, so it should be mentioned here.	reject, this is Grassi issue. it is important to have baseline right	Rosa M Poch	ITPS and UdL	Spain
1393	7	4	7	9	The knowledge gaps are also social and cultural concerning the adoption and the implementation of mitigation measures. This should be also pointed out.	reject, this is Grassi issue. it is important to have baseline right	Julien Demenois	Cirad	France
9599	7	4	7	14	In my view this assessment of research needs critically misses crucial social dimensions, e.g. on future diets and the options to alter them into the direction of less animal product consumption which are clearly the prime driver of GHG emissions from food systems (see e.g. Theurl et al. 2020, Sci Total Env, doi 10.1016/j.scitotenv.2020.139353) and other demand-side measures such as reductions of losses in the food supply chain. Moreover, systemic feedbacks in land systems, which are of critical importance for land's GHG balance, are not adequately represented in this text.	we rephrased knowledge gaps, but it has to stay very short here	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
11237	7	4	7	14	One of the important gap of knowledge is also the absence of studies where AFOFLU mitigation options are combined (e.g. biochar + BECCS).	we rephrased knowledge gaps, but it has to stay very short here	Bertrand Guenet	CNRS	France
49881	7	4	7	14	A key knowledge gap also relates (still) to the "natural land sink", which is associated with much uncertainty related to the underlying mechanisms (https://doi.org/10.1111/nph.16866), which is maybe influence by managment (10.1038/nclimate2004, 10.1111/gcb.15004), and the fate of which in the light of CC is not well understood.	we rephrased knowledge gaps, but it has to stay very short here	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
49893	7	4	7	14	This passage ignores the plethora of studies that show that a key leverage point that- in contrast to produciton-side measures offers low-no regret options is changes in demand. Much literature exists with regard to diets and health issues (10.1038/nature13959, 10.1016/S0140-6736(18)31788-4), diets and the options space/resiliience(/low intensity (10.1038/ncomms11382, 10.1016/j.scitotenv.2020.139353, 10.1098/rsif.2015.0891, 10.1038/s41467-017-01410-w), and many others, e.g. reduciton in overall wood demand, and the systemic feedbacks in the land systems between production and C-fluxes that are decisiove for the overall performance of mitigation options)	we rephrased knowledge gaps, but it has to stay very short here	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
81267	7	4			Please reduce the policy-prescriptiveness of saying something is "crucial". Also, using this word implies that no progress can be made until the knowledge gaps have been addressed, and I don't think that is true or what the chapter wants to say. Please consider a more neutral wording that makes clearer where the knowledge gaps are indeed a critical barrier, and where they could support progress but progress can be made in the meantime (and where it's not a knowledge gap but a gap in the interface between knowledge and practice; e.g. for MRV, we know how to deal with uncertainty and it's much more a case of capacity building to develop better MRV systems than scientific knowledge as such).	we rephrased knowledge gaps, but it has to stay very short here	Andy Reisinger	Ministry for the Environment	New Zealand
81697	7	4	7	14	The reference to issues relating to MRV here is welcome, but we feel this deserves more dedicated attention within the chapter. MRV is not just a knowledge gap but also an important implementation gap, linked to limited capacity and capability. It would also be useful to highlight work done recently (by CCAFS and GRA) on how the choice of Tier 1 or Tier 2 approaches may limit the ability of countries to design policies that can deliver emission reductions and support productivity improvements. It would be useful to have a central point of information on this cluster of issues in this chapter (also recent work by FAO on MRV for soil carbon, and various standards being developed, e.g. by Verra and others). We would consider this as highly relevant and useful for policymakers. We would be happy to provide pointers to specific reports and literature if the authors decide to follow up on our suggestion.	we rephrased knowledge gaps, but it has to stay very short here	Government of New Zealand	Ministry for the Environment	New Zealand
83869	7	4	7	14	Demand-side solutions are missing in this paragraph on knowledge gaps and policies. Most of the research and policies tend to focus mostly on the supply-side and technologies for mitigation. (Creutzig et al. 2018) https://doi.org/10.1038/s41558-018-0121-1	we rephrased knowledge gaps, but it has to stay very short here	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
1339	7	5	7	6	"...improved forest management techniques" I would change it "...improved sustainable forest and agriculture management techniques"	we rephrased knowledge gaps, but it has to stay very short here	Carolina Boix-Fayos	CEBAS-CSIC	Spain
21131	7	5	7	9	The knowledge gaps are also social and cultural concerning the adoption and the implementation of mitigation measures. This should be also pointed out.	we rephrased knowledge gaps, but it has to stay very short here	Government of France	Ministère de la Transition écologique et solidaire	France
45945	7	8	7	8	After "IPCC WGII", please provide a reference to IPCC SRCCL 2019, IPBES assessment of land degradation and restoration (2018): https://ipbes.net/sites/default/files/spm_3bi_ldr_digital.pdf, and the IPBES global assessment (2019): https://ipbes.net/sites/default/files/2020-02/ipbes_global_assessment_report_summary_for_policymakers_en.pdf.	we rephrased knowledge gaps, but it has to stay very short here	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
1395	7	11	7	14	Such response options should also contribute to adaptation to climate change, especially for the most vulnerable countries.	we rephrased knowledge gaps, but it has to stay very short here	Julien Demenois	Cirad	France
21133	7	11	7	14	Such response options should also contribute to adaptation to climate change, especially for the most vulnerable countries.	we rephrased knowledge gaps, but it has to stay very short here	Government of France	Ministère de la Transition écologique et solidaire	France
21135	7	11	7	11	It might not be sufficiently clear what cross-sector trade-offs refers to. More specifically, it is not clear whether it refers to trade-offs and co-benefits between AFOLU mitigation options and biodiveristy, food security and land degradation (as highlighted by the SRCCL). After "cross-sector trade-offs", I therefore suggest adding "... and co-benefits, including with biodiversity, land quality and food security". This is mentioned in the sentence after on country level policy options, but it is important to underscore the importance of accounting for these trade-offs and co-benefits also in models, in order that models give apt signals to policy regarding the suitability of mitigation options.	we rephrased knowledge gaps, but it has to stay very short here	Government of France	Ministère de la Transition écologique et solidaire	France
71783	7	11	7	14	I think this statement needs to be turned around to make proper sense (at least in most poor countries): mitigation can be the co-benefit of good, climate-resilient land management to address multiple SDGs, such as food security and nutrition, biodiversity, ecosystem services, etc.	see earlier responses	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
61311	7	28	7	32	Although many aspects of land degradation result from land use change, it would be appropriate to add land degradation explicitly. I.e. the lead line should read "AFOLU emission fluxes are driven by land use change, LAND DEGRADATION, and agriculture. In many cases a change in the intensity of the land use, rather than the nature of the land use per say, is the driver of emissions.	see earlier responses	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
30743	7	41	7	43	It is desirable to explain the rationale for "the AFOLU sector cannot provide more than approximately a third of the global mitigation needed for a 1.5 or 2 C pathway". In addition, it would be better to put explanations why the AFOLU cannot act as a cheap 'greenwashing' opportunity, even though its mitigation potential and relatively low cost.	see earlier responses	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
1101	8	1	11	35	To improve readability and understanding, I suggest that many of the very long sentences in section 7.1 be divided into multiple shorter ones.	see earlier responses	Reid Miner	Private Consultant	United States of America
28739	8	1	145	17	I have read this chapter, It made an integral and extense analysis about the topic in discussion. I haven't found mistakes, but I think It is a bit large. I scarcerly could read a chapter. I really don't know who are the objetive readers, but I think It is necesary to evaluate the reduction of the number of pages.	thank you, we will try to reduce size	Leonor Vera	Instituto Oceanográfico de la Armada	Ecuador
21137	8	2	8	3	It is problematic to focus only on population growth as the main driver of pressure on land ressources : land grabbing and low-income peasant exclusion are as important as population growth to explain this pressure.	accpet, we will name affluence as well.	Government of France	Ministère de la Transition écologique et solidaire	France
83871	8	2	8	2	Not only increased population, but also (and of higher importance) increased affluence. (Wiedmann et al., 2020) https://doi.org/10.1038/s41467-020-16941-y	accpet, we will name affluence as well.	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
8815	8	7	8	7	Just a note on the way the SRCCL has been referenced - not consistent throughout the chapter. Here it is Shukla et al 2019 in other places IPCC 2019a.	accept	Eamon Haughey	Galway-Mayo Institute of Technology	Ireland
19719	8	7	8	7	land degradation and soil erosion	reject, we need to keep sentence also legible , and not too long	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
81269	8	7			The SRCCL should be cited as IPCC 2019 (see citation guidance)	accept, we will synchronise	Andy Reisinger	Ministry for the Environment	New Zealand
54329	8	9	8	16	Agree that this is undisputable, but it would also be good to acknowledge that the IAM literature is moving beyond a focus on horror scenarios of removing 20 Gt CO2 per year with BECCS (which is mentioned only later, but would be helpful to have already here).	accept, we include now a more ciritical look on IAMs, also by IAMs themselves	Sabine Fuss	MCC Berlin	Germany
55947	8	9	8	32	The text here is vague about what report it is summarizing. It is all in past tense, but not clear upfront about whether it is talking about SRCCL or this report or what. On line 33, the text refers to SRCCL but not from lines 9-32. Make this clearer.	accept, we now clarly refer to SRCCL and SR1.5	Government of United States of America	U.S. Department of State	United States of America
1103	8	12	8	36	Check the units in this paragraph as it appears that in several cases the units should be "per year" instead of simply Gt.	accept	Reid Miner	Private Consultant	United States of America
76709	8	14	8	14	Replace "greenhouse gas (GHG) emission reductions, as well as removals" with "greenhouse gas (GHG) emission reductions, as well as increasing CO2 removals". The report should avoid giving the impression that "removals" automatically constitute mitigation, in particular because the bulk of removals are non-anthropogenic.	accept, done	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76711	8	22	8	23	"and-related measures, including bioenergy, estimated as capable of contributing between 20 and 60% of the total cumulative abetment to 2030": It would be important to clarify how much would be from the sector (AFOLU proper) and how much from the energy sector and how double-counting (with energy) is avoided. The report clarifies that for BECCS, only the carbon stock effect (but not energy substitution) is considered under AFOLU. As BECCS is unlikely t play a significant role before 2030, the abatement of "related measures" is likely to fall outside the sector.	reject, this is only intro. later we go in detail	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76563	8	24	8	24	"abetment" to replaced with "abatement"	accept	Julius Daka	Zambia Institute of Environmental Management	Zambia
1105	8	26	8	26	insert the word "IPCC" before "GWP100" and then remove "...and multiple IPCC..." as it is unnecessary and could create confusion.	accept, there is a metrics box in the report	Reid Miner	Private Consultant	United States of America
17217	8	29	8	47	Approximately 95% of the food we eat comes from the ground, and every year up to 50,000 square kilometres of soil is lost worldwide. In Europe, due to the expansion of communication routes and cities, eleven hectares of land are sealed every hour. However, it takes a century to generate only two centimeters of soil.	thank you,but reject. later we go in detail	carlos ramirez	AFA-ANDALUCIA	Spain
19721	8	29	8	29	soil organic carbon (soc)	accept, added	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
66037	8	31	8	31	Change to: "...having the greatest..."	accept	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
56255	8	32	8	32	"Limited research prevented conclusive estimation of mitigation potential from demand-side measures." This seems to be an outdated sentence, as their is a strong and growing body of scientific evidence on this regard, some of it presented later in the chapter.	accepted, elaborated the senetnce	Reyes Tirado	Greenpeace and University of Exeter	Spain
21139	8	33	8	36	Another important factor to take into account are the local and national capacities for public regulation of land-use change.	reject, this is intro, we cannot go in detail	Government of France	Ministère de la Transition écologique et solidaire	France
66039	8	38	8	38	Change to: "...AFOLU, but..."	accept, edits improved	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
27767	8	39	8	39	Delete "can only be" and replace it with "is". It is also important to highlight the viability of AFOLU for emission reductions to attract means of implementation, while every available option should be accounted for mitigation.	accept, edits improved	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
19723	8	43	8	43	soil erosion	reject, this is intro, we cannot go in detail	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
74745	8	43	8	44	It being recommended to uses new cultivation methods with higher productivity per in each Unit Area such as the vertical cultivation to produce the more agricultural production, Expand precision agriculture to monitors and increases the efficiency of agricultural products and uses methods to improve the soil quality for the future cultivation in poor soil with acceptable water resources.	noted, but we now give an extended description of various manners of agricutlure with all pros an cons	Mahnaz Ahmadi Namin	Meteorology Organization of IRAN	Iran

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
51633	8	47	9	1	It should also be mentioned that not only existing carbon stocks are at serious risk from extreme events, but also the potential to sequester carbon is at risk. The potential to sequest more carbon, however, is one of the key assumption for the mitigation potential estimates given in this chapter, and reduced capacity to sequester carbon could change the whole chapter. The very important discussion on 'tipping points' and their effects on cc mitigation is almost completely missing. Compare, for example, https://www.nature.com/articles/d41586-020-00508-4 and K.A. Duffy el al., "How close are we to the temperature tipping point of the terrestrial biosphere?," Science Advances (2020). https://advances.sciencemag.org/content/7/3/eaay1052	accept, we added ' new stocks' as well.	Florin Vladu	UNFCCC Secretariat	Germany
63679	8	47	8	47	Not only wildfires but also other natural disturbances such as hurricanes, insect outbreaks, etc.	accept, changed to disturbances	Government of Canada	Environment and Climate Change Canada	Canada
14801	9	1	9	1	add "change" after 'land cover' (i.e. "land cover change"). Also, it would seem as though the phrase "through biophysical effects" should not be in brackets since otherwise this statement could encompass other effects on regional and global climate. To say there is no confidence in the effects of land cover change on global climate is inconsistent with previous IPCC conclusions about the influence of albedo-related land cover changes on radiative forcing and climate.	accept, edits improved	Elizabeth Bush	Environment and Climate Change Canada	Canada
18339	9	3	9	4	Since AR5, the share of AFOLU to anthropogenic GHG emissions had remained largely unchanged (23% - medium confidence).>it is not clear what the 23% and the confidence interval refer to, assume it is the confidence level that 23% has remained unchanged, but could make this clearer	accept, improved sentence	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
76713	9	5	9	6	"land to have very likely provided a net removal of CO2 between 2007 and 2016": It shoudl be clarified whether "land" here includes (or perhaps dominated by) "natural response", which this report does not consider part of AFOLU (cf Table 7.1)	accept, improved sentence	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
66041	9	7	9	7	Change to: "…land-cover change…"	accept, edits improved	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
74747	9	7	9	7	The monitoring, managing and designing the remote sensing based on the frequency and intension of extreme weather and climate events, impacting ecosystems, the food security, wildfire regimes, and land processes, with existing carbon stocks within soils, and the biomass at the serious risk and The impact of the land cover on the regional climate (through biophysical effects) will be generalized in all countries to adopt, mitigate and reduce the effect of them.	accept, edits improved	Mahnaz Ahmadi Namin	Meteorology Organization of IRAN	Iran
1397	9	11	9	13	That would necessary to give some examples : e.g. soil carbon management (SRCCL)	reject, no space for details in intro and it may give biased impression	Julien Demenois	Cirad	France
21141	9	11	9	13	We recommend to give some examples : e.g. soil carbon management (SRCCL)	reject, no space for details in intro and it may give biased impression	Government of France	Ministère de la Transition écologique et solidaire	France
56257	9	12	9	12	typo "adaption" should be "adaptation".	noted and it will be corrected	Reyes Tirado	Greenpeace and University of Exeter	Spain
1107	9	14	9	14	change "fluxes is unclear" to "fluxes are unclear"	noted and it will be corrected	Reid Miner	Private Consultant	United States of America
49883	9	14	9	14	sentence not correct	noted and it will be corrected	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
66043	9	14	9	14	Change to: "…fluxes are unclear…"	noted and it will be corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
1109	9	15	9	15	change "while' to "and"	both correct	Reid Miner	Private Consultant	United States of America
55949	9	15	9	15	"necessary" should be "necessarily"	noted and it will be corrected	Government of United States of America	U.S. Department of State	United States of America
1111	9	16	9	20	divide this long sentence into two shorter sentences	noted and it will be corrected	Reid Miner	Private Consultant	United States of America
3837	9	17			drivers instead of driers?	noted and it will be corrected	Rosa M Poch	ITPS and UdL	Spain
8769	9	17	17	9	Spelling error: "driers" should be "drivers"	noted and it will be corrected	Billy Jones	Lund University	Sweden
10675	9	17	9	17	"economic driers"? Perhaps a "v" is missing	noted and it will be corrected	Philippe Waldteufel	CNRS	France
51635	9	17	9	17	driers' should probably read 'drivers'	noted and it will be corrected	Florin Vladu	UNFCCC Secretariat	Germany
55951	9	17	9	17	"driers" should be "drivers"	noted and it will be corrected	Government of United States of America	U.S. Department of State	United States of America
56259	9	17	9	17	typo "driers" should be "drivers"	noted and it will be corrected	Reyes Tirado	Greenpeace and University of Exeter	Spain
66045	9	17	9	17	Change to: "…economic drivers, insufficient…"	noted and it will be corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
12675	9	21	9	21	"nonetheless"	noted and it will be corrected	Donald Falk	University of Arizona	United States of America
55953	9	21	9	21	"None the less" should be one word if authors must use it. Really not necessary to the text.	noted and it will be corrected	Government of United States of America	U.S. Department of State	United States of America
66047	9	21	9	21	Change to: "Nonetheless, the…"	noted and it will be corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
51637	9	23	9	23	The correct term for NDCs is "Nationally Determined Contributions"	noted and it will be corrected	Florin Vladu	UNFCCC Secretariat	Germany
51639	9	24	9	25	Please check accuracy. NDCs are diverse, and the message that AFOLU may be the only sector with CDR being possible seems misleading. Most countries rely on additoinal CDR technologies to be developed and scaled-up very soon, as the limited area of land available is unlikely to be able to fulfil large-scale CDR functions.In any case, a broad reference to 'the NDCs' does certainly not justify this statement.	partly accepted. specified better	Florin Vladu	UNFCCC Secretariat	Germany
19725	9	25	9	25	soil organic carbon (soc)	reject partly. added 'organic'	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
1113	9	29	9	31	to the list of options before the words "…were suggested…" add "increasing agricultural productivity" as it was also highlighted in the SRCCL report (e.g., See Panel A in the Executive Summary of that report)	reject, no space for details in intro and it may give biased impression	Reid Miner	Private Consultant	United States of America
81717	9	30	9	31	Suggest changing this sentence to read "Changing agricultural management, reducing food loss and waste and a shifting diets to reduce overconsumption and in some instances reduce consumption of animal sourced foods " noting that overconsumption is an overarching issue and overconsumption of animal products is a subset of that	accept, done	Government of New Zealand	Ministry for the Environment	New Zealand
66049	9	31	9	31	Change to: "…more plant-based diets…"	noted and it will be corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
1399	9	33	9	35	That would necessary to specify that tackling climate change include also adaptation to climate change which is a key issue in developping countries, especially in Africa.	accept, done	Julien Demenois	Cirad	France
21143	9	33	9	35	It seems necessary to specify that tackling climate change includes also adaptation to climate change which is a key issue in developping countries, especially in Africa.	accept, done	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
45947	9	35	9	35	After Shukla et al. 2019, it is suggested to include the following references: 1. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages. https://ipbes.net/sites/default/files/2020-02/ipbes_global_assessment_report_summary_for_policymakers_en.pdf 2. IPBES (2018): Summary for policymakers of the assessment report on land degradation and restoration of the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services. R. Scholes, L. Montanarella, A. Brainich, N. Barger, B. ten Brink, M. Cantele, B. Erasmus, J. Fisher, T. Gardner, T. G. Holland, F. Kohler, J. S. Kotiaho, G. Von Maltitz, G. Nangendo, R. Pandit, J. Parrotta, M. D. Potts, S. Prince, M. Sankaran and L. Willemen (eds.). IPBES secretariat, Bonn, Germany. 44 pages. https://ipbes.net/sites/default/files/spm_3bi_ldr_digital.pdf, 3. M.J. Sanz, J. de Vente, J.-L. Chotte, M. Bernoux, G. Kust, I. Ruiz, M. Almagro, J.-A. Alloza, R. Vallejo, V. Castillo, A. Hebel, and M. Akhtar-Schuster. 2017. Sustainable Land Management contribution to successful land-based climate change adaptation and mitigation. A Report of the Science-Policy Interface. United Nations Convention to Combat Desertification (UNCCD), Bonn, Germany. https://knowledge.unccd.int/sites/default/files/2018-09/UNCCD_Report_SLM_web_v2.pdf 'Sustainable land management contribution to successful land-based climate change adaptation and mitigation (2017): https://knowledge.unccd.int/sites/default/files/2018-09/UNCCD_Report_SLM_web_v2.pdf	accept, included IPBES	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
76715	9	36	9	36	"7.1.2 Boundaries, scope and changing context of the current report": This section should provide much more clarity on scope, in particular whether or to what extent the residual sink is considered part of AFOLU and how the sectoral boundaries (e.g., with respect to other sectors like energy or waste) are considered. It is also unclear whether "changing context of the current report" refers to changes compared to past reports or forward-looking changes within the current report.	accept, partly revised	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
29667	9	37	9	39	The chapter should not be restricted only to GHG-fluxes, and could benefit by including other (biogeophysical) forcings/perturbations resulting from AFOLU. Actually, it already does, as i.e. in chapter 7.2.4. However, this could be expanded, since it is relevant for development of successful responses.	reject, the biogeophysical is dealt with	Government of Norway	Norwegian Environment Agency	Norway
66235	9	37	11	35	Would you mind to make it more concise. The figure 7.1 is good to be there, but please empahasize also what is the difference between this chapter with others?	agree and it will be done	Marissa Malahayati	National Institute for Environmental Studies	Japan
66237	9	37	11	10	It is like a lack introduction to jump to the Figure 7.2. You first explain about the relation between this chapter with another chapter, then suddenly you talk about land management. Why? It will make sense if you said "This chapter will more emphasize on the land management....." or something like that.	agree and it will be done	Marissa Malahayati	National Institute for Environmental Studies	Japan
10677	9	38	9	39	Why does not the AFOLU chapter consider times beyond 2050, when most of the report goes up to 2100? Does that imply that available literature itelf is limited to the 2050 time horizon?	reject, we stick to 2050 , it is already uncertain enough in afolu	Philippe Waldteufel	CNRS	France
66051	9	38	9	38	Change to: "...at timescales of..."	noted and it will be corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
1115	9	39	3	39	change "has" to "have"	noted and it will be corrected	Reid Miner	Private Consultant	United States of America
66053	10	1	10	1	Change to: "Ch. 3 & 4: Long-term and near-term mitigation..."	noted and it will be corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
76717	10	1	10	6	Figure 7.1: It would be essential to add links to WG I. In particular, the GHG balances (and athropogenic fractions thereof) across chapters should be consistent and there should be clarity on the role of the residual sink / natural response, as it is a major factor in the global carbon budget, but not considered to be part of the scope of this chapter.	accept, we refer to WGI now. e.g. spmfig1. that denotes larger sinks	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76719	10	1	10	10	Figure 7.2 is lacking essential carbon flows, fluxes, and pools. It would be useful to use graphics that allow the reader to conceptualise major factors and the mitigation measures mentioned in the report. For example: - There is no indication of agricultural products moving out of land, neither for food, nor as raw material/energy, although these are bigger than the flows of wood products (which are there). - Livestock seem to have no carbon inputs/outputs, although much of agriculture is dedicated to feed them and manure is a major imput of C to soil. - CCS is not represented, neither for the fossil sector nor for BECCS, although it is a major part of the scenarios presented, and the chapter considers them part of AFOLU - No effort is made to separate atmospheric uptake/accummulation between anthropogenic and natural causes, although the latter is bigger and is not considered part of AFOLU - Emissions due to forest harvest are missing. Only C flow out of forest is in respiration, HWP and deforestation. - NPP is mentioned, but unclear what it refers to or how it relates to NEP or harvest (in agriculture or forest). - The only carbon input to soil seems (forest?) litter. The only output indicated is soil respiration. The soil-related mitigation options in the chapter would be difficult to place. - why is "soil respiration" separate from the "soil carbon budget"? What is the latter, if it does not include respiration? - lateral flows of carbon, such as erosion or dissolved CO2/organic matter in rivers to the oceans are not recognised, although they can be a major factor of continental C balances (e.g., in the Amazon basin) and a major source of Carbon to acquatic ecosystems (thus essential for understanding "blue carbon").	accept and will be done	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76721	10	1	10	10	Figure 7.2 the graphical representation of pools and fluxes should be consistent. For example: - Arrows indicating uptake originate in the atmosphere pool, but arrows idicating emissions do not reach it. - It would be useful to label arrows and pools with quantities, perhaps also making the thickness of arrows proportionate to fluxes. - It is unclear what the yellow and green dotted bubbles are supposed to indicate and why they are drawn like that (e.g, why the green one does not include soil and why the yellow on includes the harvested wood pool) - Competition between wood products and other products/energy is indicated, but not the competition of agricultural products with the same sectors or competition between forests and agriculture (food is missing altogether).	accept and will be done	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
1117	10	7	10	10	The figures is missing soil and plant fluxes of N2O and CH4	accept and will be done	Reid Miner	Private Consultant	United States of America
4441	10	7	10	10	Fig. 7.2.. Add a component of 'Agriculture Land'_type of modified Land cover	accept and will be done	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
11767	10	7	10	10	Figure 7.2 The length, size and, in some cases, colour of the arrows do not appear to be related to what they should represent! Photosynthesis should be much more prominent. We also question having the same brown color for CO2 released from fossil sources and biofuels.	accept and will be done	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
19727	10	7	10	7	Biosphere (between atmosfera and pedosphera) in schema	accept and will be done	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
29631	10	7	10	8	Please consider including afforestation and forest management to balance deforestation. In addition, please move the text "CO2 uptake" away from the atmosphere and rotate and connect it to the appropriate arrow.	accept and will be done	Government of Norway	Norwegian Environment Agency	Norway
49885	10	7	10	9	I think one should replace competition with "substition" , or at least mention both (between ff-energy and products and biomass energy and products). Also, I would suggest to move the cow to the "open field", and not leave it under the tree (to avoid intepretation of wild animal emissions). As roots are not shown, the box "soil carbon budget" is not correct. Roots do not belong to the SOC but to biomass. Why is the arrow labelled "wood products", there is also agric. products that provide bioenergy or goods.	accept and will be done	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
50835	10	7	10	8	Illustration of CH4 uptake by soils and CH4 emissions from wetlands& rice cultivation should be presented in Figure 7.2	accept and will be done	Wen Zhang	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
55955	10	7	10	7	Above the oil/gas derrick there should be a CH4 emissions arrow.	accept and will be done	Government of United States of America	U.S. Department of State	United States of America
55957	10	7	10	10	There is no clear representation of carbon stored in wood products or in wood products in landfills here. If that is not included in this chapter, then that should be made clear here or in the chapter text. So far, it has not been mentioned.	accept and will be done	Government of United States of America	U.S. Department of State	United States of America
56193	10	7	10	10	there is only litter on the figure. The "litter" word should be changed as "Dead Organic Matter"(litter, dead wood) in my opinion. The "Deforestation" word should be also changed as "Deforestation, Degradation" in the figure.	accept and will be done	Eray Özdemir	General Directorate of Forestry	Turkey

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61379	10	7	10	10	we may added illustration for emissions with fertiliser using in the figre 7.2.	accept and will be done	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
70181	10	7	10	10	I advise to include N2O an CH4 in the flux of gases from soil to atmposphere	accept and will be done	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain
72621	10	7	10	10	The figure and caption are not entirely consistent. For example, fossil fuel emissions are clearly in the figure, but not noted in the caption. And "food and fibre" are stated in the caption, but are the only two things not labelled in the figure.	accept and will be done	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
83873	10	7	10	10	Figure 7.2 N2O fluxes from soils and manure management are missing	accept and will be done	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
19729	10	8	10	8	Pedosphare soil organic carbon and soil respiration	accept and will be done	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
31313	10	8			Delete "Summarised representaion of" from caption. Animals (and humans) respire CO2 too - not shown. Locking up C in timber used for buildings etc is not clearly depicted. Is lost under "other wood products" and confused with bioenergy that oxidises in the short term. Some wood products such as paper mostly have short term oxidation whereas wooden buildings etc would lock up the C for many years.	accept and will be done	Ralph Sims	Massey University	New Zealand
41659	10	8	10	10	Figure 7.2 and text associated with it: - Since the figure deals with land management then 1) young plantation increases CO2 release comapred to mature or old forest and 2) not only deforestation but also site preparation for AFORESTATION increases CO2 into the atmposphere from soil disturbances and residues left on site. So maybe add one upward arrow indicating CO2 release with the name: "forest practices"	accept and will be done	jean-christophe domec	Bordeaux Sciences Agro	France
45949	10	8	10	10	Though figure 7.2 illustrates the interplay between land and atmosphere in an accessible way, it might be structured more around land and ecosystems in general. The role of forests is displayed prominently in the figure, but it would be valuable to have a more balanced representation of all ecosystems with major roles in the carbon cycle (savannahs, wetlands, grassland etc.), especially regarding peatlands.	accept and will be done	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
61101	10	8	10	10	Figure 7.2: Please add CH4 and N2O in Combustion / Oxidation of Bioenergy Other wood Products as well.	accept and will be done	LOKESH CHANDRA DUBE	TERI School of Advanced Studies	India
79803	10	8	10	10	The box presents correctly soil respiration, but the legend is ... and land - atmospheric .... Also, soil organisms are an important part in the gas fluxes, they should be listed in the figure, not just being implicit as soil respiration.	accept and will be done	Lucia Helena ANJOS	UFRRJ	Brazil
81271	10	8			Please consider using a less Europe- (or temperate zone) centric picture of an animal; replace "competition" with "substitution"; and add icons that demonstrate the offtake of animal products (which implies offtake of C and N).	reject, not relevant	Andy Reisinger	Ministry for the Environment	New Zealand
1401	10	9	10	10	Some harmonization would be necessary to make a clear difference between process (eg soil respiration) and budget (soil carbon budget). Using the same color might be misleading. The term photisynthesis should be added for the arrow related to CO2 uptake. Arrow should be added for input of exogenous organic matter in agriculture.	accept and will be done	Julien Demenois	Cirad	France
8521	10	9	10	10	Full stop needed at the end of figure title.	accept and will be done	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
11239	10	9	10	9	something that is missing in this figure is that generally the burning residues are amended on soils.	accept and will be done	Bertrand Guenet	CNRS	France
12677	10	9	10	9	Figure 7.2 is a valuable overview, but has an error and is lacking a crucial component in the middle panel illustrating "combustion and oxidation". First of all, combustion and oxidation are the same thing where ecosystems are concerned, so it is factually incorrect to list them as if they were separate (the same error is repeated on the righ-hand panel). Second, the text inside that panel says "bioenergy/other wood products" but fails to mention wildfires, which are a major source of emissions (both natural fires but also fires set intentionally as part of land use, e.g. recent major human-set fires in the Amazon). At a minimum please add the word "wildfires" inside this figure to acknowledge these important sources.	accept and will be done	Donald Falk	University of Arizona	United States of America
19731	10	9	10	9	land and soil management (but strictly is soil management at this level)	partly accept, small refinements made	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
19733	10	10	10	10	food,wood and fiber	partly accept, small refinements made	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
20247	10	10	10	10	food,wood and fiber	accept and will be done	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
55959	10	10	10	10	Need to state that the length or thickness of the arrows do not indicate level of flux.	accept and will be done	Government of United States of America	U.S. Department of State	United States of America
21145	10		10		A down arrow for depositing faeces on the soil is missing in Figure 7.2	accept and will be done	Government of France	Ministère de la Transition écologique et solidaire	France
21147	10		10		Fig 7,2 : Some harmonization would be necessary to make a clear difference between process (eg soil respiration) and budget (soil carbon budget). Using the same color might be misleading. The term photisynthesis should be added for the arrow related to CO2 uptake. An arrow should be added for input of exogenous organic matter in agriculture.	accept and will be done	Government of France	Ministère de la Transition écologique et solidaire	France
21149	10		10		The focus in on energy and wood, while it may also include the competition between fibers and fossil fuel-derive textile or food crops versus bioenergy crops (BECCS). It may also represent the roots, so as to be consistent with the autotrophic respiration. We recommend to replace soil budget by soil organic carbon protection/decomposition to be consistent with the boxes representing processes on the diagram.	accept and will be done	Government of France	Ministère de la Transition écologique et solidaire	France
19735	11	1	11	1	land and soil management (but strictly is soil management at this level); sustaintable soil management	reject, overall it is land management	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
77665	11	1	11	35	• In addition to recognising the complexity of interactions between land management and GHG fluxes it is important to also recognise the complexities of interaction between land management and the condition (also referred to as ecosystem integrity) of natural and agricultural ecosystems that influence both the stability/longevity of carbon storage and risk of premature release of GHG to the atmosphere. There should be a broader discussion in this section of the benefits of encouraging the development of comprehensive stock and flow information systems as proposed by the UNSEA-EA and articulated by Keith et al in 'Evaluating Nature based Solutions for Climate Mitigation and Conservation requires comprehensive carbon accounting (2021) Science of the Total Environment 769(202114434114. The benefits of developing a comprehensive information base are many but in particular enable far greater transparency of the costs and benefits of different mitigation actions and the benefits of management actions that improves the integrity and stability of natural and agricultural ecosystems. A more comprehensive information a system would also benefit modelling and comparability •	reject, too much detail for intro	Virginia Young	Australian Rainforest Conservation Society	Australia
3839	11	3			Add soil diversity to the list of factors.	reject, too much detail for intro	Rosa M Poch	ITPS and UdL	Spain
80653	11	7	11	16	Bioenergy substitution for fossil fuels is not an effective mitigation strategy because burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels. Furthermore, bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.").	reject, see also other responses. we deal with bioenergy in its section and in bioeconomy box, as well as in ch 12. NGOs do not want bioenergy, but lietrature portrays it as part of solution	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America

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80797	11	7	11	16	Bioenergy substitution for fossil fuels is not an effective mitigation strategy because burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels. Furthermore, bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.").	reject, see also other responses. we deal with bioenergy in its section and in bioeconomy box, as well as in ch 12. NGOs do not want bioenergy, but lietrature portrays it as part of solution	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
1119	11	8	11	8	after "biomass production for bioenergy" add a parenthetical saying "(other than substitution effects which are considered in other chapters)". This will help avoid confusion as it is stated earlier in this chapter that bioenergy is not considered in this chapter.	noted	Reid Miner	Private Consultant	United States of America
66055	11	8	11	8	Change to: "…ecosystems, (2) agriculture, (3)…" & "…bioenergy, and (4)…"	noted	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
3841	11	11	11	16	This sentence is too long, with too many subordinates and probably incorrect (I'm not english native speaker).	noted and it will be improved	Rosa M Poch	ITPS and UdL	Spain
21151	11	11	11	11	is there, in complement to the 2017 paper a more recent assessment taking into account revised NDCs since 2017?	reject. There is the Grassi et al 2021 which is a reconciliation of various methods, but does not have new NDCs in it	Government of France	Ministère de la Transition écologique et solidaire	France
55961	11	11	11	16	This is only one of several terrible run-on sentences and is not at all clear what is intended. Change to: "The AR5 and the SRCCL indicate a large land-based mitigation potential that is undermined by current land management practices. Land capacity, a finite resource, will be challenged to support the wider critical functions and service humanity will need."	sentence change noted and it will be improved	Government of United States of America	U.S. Department of State	United States of America
19737	11	14	11	14	land and soil	reject, 'land' is all land management incl soil	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21153	11	16	11	17	Is this extremely important statement based on scientific references? Are there figures on the transfer of pressure from other sectors to the AFOLU sector?	partly accept. slightly revised	Government of France	Ministère de la Transition écologique et solidaire	France
55963	11	16	11	17	Need to reference this statement with a citation or confidence level. Better yet, delete it as this could be perceived as personal judgment.	reject, , literature sometimes perceives land measurs as greenwashing. this is relevant remark here in intro	Government of United States of America	U.S. Department of State	United States of America
51641	11	17	11	17	It is interesting somewhat inconsistent that the chapter has such a strong focus on offsetting, while also claiming here: "AFOLU simply cannot compensate for mitigation shortfalls in other sectors." It may be required to check the position on offsetting potential of the AFOLU sector for other sectors, and then present the outcome consistently.	partly accept, taken up in improved exe summ	Florin Vladu	UNFCCC Secretariat	Germany
73099	11	18			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	noted and it will precised	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73101	11	19			There are two studies conducted by 'IPBES in 2019' (see line 2 and line 5 in page 174).	noted and it will precised	Raehyun KIM	National Institute of Forest Science	Republic of Korea
79805	11	19	11	19	I suggest to include in the citation from ITPS, the recent publication on soil erosion - FAO, 2019. Outcome document of the Global Symposium on Soil Erosion. Rome. The conclusions of the document are tied to soil / land degradation and increase of poverty as well as impact of climate change.	reject, does not add a lot to intro	Lucia Helena ANJOS	UFRRJ	Brazil
19739	11	20	11	20	land and soil	reject, 'land' is all land management incl soil	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
11769	11	37	15	16	As said also in the summary; The modeling is not complete and is under development, yet the conclusions have weighed the potential for improvement with regard to the need for increased food production for a growing population with a changed diet where people who receive increasing income switch from rice diet to a more animal-based diet. This leads to greater land requirements for food production and demands for improved efficiency and forms of cultivation that increase the earth's long-term production capacity, create biodiversity and reduce the need for fossil fuels. The modeling is done with boundaries that for Agriculture mean that an important carbon sink is omitted and means an unnecessary disqualification of N-fertilizer use. In several places in the report, it is considered that the "synthetic N-fertilizer application" has negative effects. This is true if one only takes into account the emissions of greenhouse gases that are released into the soil, and does not take into account the harvest increase that takes place in crops and at the same time the improved root development. This leads to a reduced need for land and increased organic C content in the soil that stores C. The net effect of this is positive and should be credited to agriculture's share of greenhouse gases. This carbon sink in the soil, which means increased carbon content, is not included in the calculations. If I, as farmer, were to apply the same method in my accounting and not include all income, I would be convicted of tax offenses. In the report, no value for what a mulch build-up in the soil would entail.	noted	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
19741	11	39	11	39	land/soil	Reject - the term "land" includes soil and ground cover/biomass as used in IPCC termionology	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
71785	11	37	30	21	In 7.2, It would be good to also briefly explain why emissions rose or fell in certain regions. By adding a few macro-drivers the results could be better contextualized	Accept with modification, information on drivers is in drivers section 7.3	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
85805	11	39	11	39	Suggest it may be useful to make separate statements here for CH4 versus CO2: "The land is an important source and sink of CO2 and CH4.." This is true for CO2, but for CH4 the major sink (~94% of total removal) is reaction with hydroxyl radicals in the atmosphere.	Accept with modification, the land is a sink for CH4 but agree it is not an important sink, removed the word "important"	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
73103	11	43			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
18341	11	45	11	47	Estimates of AFOLU flux and climate impacts remain subject to large uncertainties due to the difficulties in attribution, the different methodologies applied, and large uncertainties in the underpinning data (high confidence).>saying there is high confidence in there being large uncertainties is not needed I think?	Accept	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
76723	12	4	12	10	It is uncelar whether CO2 from agriculture (mostly soils) would be part of (i) "LULUCF" or (ii) "Agriculture". The earlier convention (and thus the use of the term "LULUCF") would strongly suggest the former, but the remark that net CO2 would come "predominantly" from LULUCF would suggest that agricultural soils would be considered in agriculture. Unfortunately, Table 7.1 also fails to clarify this. What is the point in saying that they "can be separated", if the separation is not done? Perhaps this separation is not important, but then the whole paragraph should be deleted.	Accept with modification: It is explained in footnote 2 of the table that modelled estiamtes do not seprate lulucf and agicultsure., However the paragraph text has been changed to make it clear that its the GHGIs that separate them in this way . we disagree with deleting the paragraph as there has abeen confusion in the past re . how LULUCF and agriculture in the inventories relate to FOLU and A as used in previous IPCC reports. `However we agree the sepration in the table is not necessary,sowe have adjusted both text and table	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
66057	12	6	12	6	Change to: "…Land-Use Change…"	Accept	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
76725	12	8	12	10	Do not capitalise "Agriculture". If it is supposed to be a reference to the sector as understood in the 1996 GL, then this notation shoudl be clearly explained and consistently applied throughout the chapter. In any event, it is confusing to see the simultaneous use of the previous and current sectoral divisions (AFOLU vs LULUCF+agriculture).	Accept.Changed to make to clear this was the convention from 1996 GL and also removed the sepration into A and LULUCF from the table	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
1121	12	12	12	14	Specify that the numbers in the table are annual	Accept	Reid Miner	Private Consultant	United States of America
1403	12	12	12	13	Many cells of the table are left blank which does not help to catch the information. Redesigning the table would be necessary. What about the values for CH4 and N2O from non AFOLU sector which account respectively for 56 % and 18 % of the total ?	Accept,table redesgined and numbers filled in	Julien Demenois	Cirad	France
11771	12	12	12	14	Table 7.1. Not being able to further separate the lump sum of CO2-emissions from FOLU indicates a great insecurity in the model and that it needs to be further investigated. Since 1990 the total emissions have increased 15,6 pc land use changes being the most important. At the same time the globally fed population has increased with at least 2 billion.	Accept with modification. This is not a fault of themodels,it is that the modelsincude both acricultural and forestry processes together, they are not set up to seprate these as they were not designed with IPCC guidelines in mind. hwoever the table also now does not seprate LULUCF and A for any of the gases. I am not sure as to the second point how this is relevant. drivers are discussed in a later section	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
29925	12	12	13	6	This table from the IPCC SRCCL has gotten a lot of attention from relevant ministries and agencies in Norway. However, the term "natural" in column G has caused some confusion, since "natural" has different definitions, and also includes "indirect emissison from human activity", depending on the method. Please consider if it is right to call this "natural respons" as it seems to be connected to both indirect and natural respons.	accept with modification. This was discussed a lot at the SRCCl plenary, and this was decided to be the most appropriate term as it is consitent with what the models consider to be natural. We go on to explain this in more detail in the text below.	Government of Norway	Norwegian Environment Agency	Norway

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
72625	12	12	12	28	What are the uncertainties for CH4 and N2O? The footnote states that they are available, but they are not reported here. They are also not summed in the net-land flux atmosphere column	Accept, added	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
76727	12	12	13	6	Table 7.1: Title refers to "enthropogenic emissions" from AFOLU, but the table includes "natural response", which is framed as non-anthropogenic and is often excluded even from the scope of AFOLU as a sector. Given that this "natural" flux is about the same magnitude as the anthropogenic fluxes combined, it would be essential to consistently clarify this relationship in the table, including title, table headings and footnote 5, as well as the text.	Accept,title and footnote 5 ameded, see sub section below for clear explanation of this and why it is incuded.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76729	12	12	13	6	Table 7.1: For CO2, it would be be important to provide a split between columns A nd B. It would also be important to give an indication of how these and column G would change if the proposal outlined in Cross-Chapter Box 5 were followed.	Accept with modification: As explained in footnote 2, this is notpossible from the models. We have removed columns a and b in response to other comments and not sjut show AFOLU combined. as box 5 is an adjustment, the reduction in the new column A would be the same as the increase in new column E, but the total net (new column F) woudl remain unchanged. we will make this clear in the box. . The suggestions to show the adjustment is really helpful, we have included it as a footnote so as not to further confuse the table	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76731	12	12	13	6	Table 7.1: For CH4 and N2O, it would be useful to indicate what emission sources are included under "LULUCF", i.e. whether it is only biomass burning or also things like CH4 from reservoirs and wetlands.	Accept with modification, table adjusted to remove split in response to other comments	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81273	12	12			This table is strikingly different from the one in the SRCCL in that it suggests that no separation can be made between CO2 emissions associated with agriculture, and other FOLU (also stated explicitly in footnote 2). This is in sharp contrast to what was done in the SRCCL. It's fine if the authors feel that actually, that was perhaps a bit too rash and we have to make clear that one cannot simply read the number out of FAOSTAT - but then they should do an assessment and provide an estimated range. Leaving the cells blank entirely and saying "this can't be done" strikes me as a significant cop-out and as a disservice to highly policy relevant information needs - namely, what is the overall contribution of agriculture to emissions, rather than always wrapping it up in the much more abstract term AFOLU.	Accept with modification. Some of the models now include agcirulutral management, but do not separate out CO2 from agricultural or other processes. To use the FAO number could potnetially be double counting. In the text we discuss the FAO sepration.	Andy Reisinger	Ministry for the Environment	New Zealand
3843	12	13	12	14	Figures in table 7.1 are too small, hardly readable. See also next comment for table contents.	Accept, table reformatted	Rosa M Poch	ITPS and UdL	Spain
8463	12	13		14	CO2 and 2 confusing	Accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
8523	12	13	12	14	write LULUCF in one line. Adjust colum.	Accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10229	12	13	12	14	CO2 and 2 confusing	Accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
29649	12	13	12	14	In footnote 2, page 12, line 17-18, CO2 fluxes are defined as "Net anthropogenic flux of CO2 due to land cover change such as deforestation and afforestation, and land management including wood harvest and regrowth, peatland draining and burning, cropland and grassland management." Please clarify whether regrowth in this context is included as a sink under column G.v	Accept, changed placement of footnote so its clear it refers only to anthopogenic AFOLU	Government of Norway	Norwegian Environment Agency	Norway
55965	12	13	12	14	In Table 7.1, the row 'Mt CO2' is blank and unnecessary. For the 'CO2' row, the math in columns E,F, and column C+G seems to be slightly off. Perhaps there is rounding error, but this should then be acknowledged in a footnote. Why is there no uncertainty for CH4 and N2O?	Accept	Government of United States of America	U.S. Department of State	United States of America
66239	12	13	12	28	This table is very messy. First, please change the superscript for notes to a,b, c, … or symbols instead of 1,2,3 as it is mixing together with the chemical equation and make confusing. And also please fix the table to be more neat.	Accept	Marissa Malahayati	National Institute for Environmental Studies	Japan
66241	12	13	12	28	it is also very possible to make the notes so much more concise. Something like the data range, can be explained on the paragaraph as you also have several same footnotes or notes just to explain about it.	Reject: others have asked for more notes and explanations, this is a compromise of what is necessary tounderstand the table.	Marissa Malahayati	National Institute for Environmental Studies	Japan
73105	12	23			The source of 'FAOSTAT (2019)' cannot be found in the Reference list.	Accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21155	12		12		Many cells of the table 7,1 are left blank which does not help to catch the information. Redesigning the table would be necessary. What about the values for CH4 and N2O from non AFOLU sector which account respectively for 56 % and 18 % of the total ?	Accept	Government of France	Ministère de la Transition écologique et solidaire	France
21157	12		12		Please, optimise the format of table 7,1	accept	Government of France	Ministère de la Transition écologique et solidaire	France
21159	12		12		The 42.7 total does not correspond to the sum of the numbers in the 5th. column of Table 7.1	accept	Government of France	Ministère de la Transition écologique et solidaire	France
49819	12				On page 14, line 23, the value in the text is -12.5+or-3.3. Here in the table, it is +or-3.2. This needs to be corrected to be consistent, whether 3.3 or 3.2.	accept	Arthur Lee	Chevron Corporation	United States of America
49821	12				On page 14, line 26, the value in the text is -7.0+or-4.0. Here in the table, it is -6.9. This needs to be corrected to be consistent, whether -7.0 or -6.9	accept	Arthur Lee	Chevron Corporation	United States of America
29633	13	1	13	2	Is this a natural responce only? Where is the responce of antropogenic afforestation and forestmanagement accounted? Figure 7.3 clearly show a sink associated with antropogenic land use in Europe	Accept with modification, yes this is the natural response, the anthopogenic part is in the third column	Government of Norway	Norwegian Environment Agency	Norway
72633	13	1	13	4	Here the natural sink is defined as indirect anthropogenic effects.	accept, this is true as per the approach of the modellers to include this as non-anthopogenic. TheNGHGIs also treat this as non-anthopogenic where it occurs on non-managed lands.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
50837	13	3	13	4	"Friedlingstein et al., under review", revision needed	accept	Wen Zhang	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
81683	13	3	3		Suggest place Dynamic Global Vegetation Model in an acronym.	Reject: Some readers may be unfamilair with the acronym, and it is helpful in table notes to explain acroonyms	Government of New Zealand	Ministry for the Environment	New Zealand
83875	13	3	13	4	Already published https://doi.org/10.5194/essd-12-3269-2020	accept	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
4443	13	8	13	9	Fig. 7.3 a check %	accept	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
11773	13	8	13	9	Figure 7.3. It should be transparent how the CO2 equivalents for CH4 are estimated. The GWP100 is under debate and other alternatives are presented. F.i. GWP* https://www.nature.com/articles/s41612-019-0086-4 The difference between CH4 as a flow gas and CO2 as a stock gas is ignored in these comparisons.	accept	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
31613	13	8	18	8	This comment refers to the trends of GHG emissions reported per region in the document, specifically the way of reporting and accounting for emissions from Africa. The estimates in the figures and in the show relatively higher total emissions from Africa than other regions. This is a representation bias since Africa is also the biggest landmass represented. For instance, four regional groups represent Asia, two for America which are in size comparable to Africa's landmass. It would be fair to have at least four groups (North, Eat and central, West and South). A quick look at net emissions from these regional groups compare with the low estimates reported in the text. Beyond Geographical differences, this grouping allows to reduce variability, hence increase accuracy of the reported data because of the agroecologic similarities between countries within each group. This is in line with the statement in page 15 (line36-38) and Grassi et al., 2018 about the low confidence in the estimates generated from the continent among other developing countries.	Thank you for your comment. Regional classification has been finalised and agreed as part of the approval process.	Olivier Kashongwe	Leibniz Institute for Agricultural Engineering and Bioeconomy	Germany
31615	13	8	29	1	This comment refers to Figures 7.3b, 7.6, and 7.9. regarding the representation of Africa Continent as a single unit, while it is composed of regional groups that identify ist diversity in agroecological conditions. This will allow to present more accurate estimations and inform appropriate targetted policies and interventions. An alternative could be to present figures with Africa's regional groups and/or relative emission conributions for each of the represented regions. FAOSTAT database provides already disaggregated dataset	Thank you for your comment. Regional classification has been finalised and agreed as part of the approval process.	Olivier Kashongwe	Leibniz Institute for Agricultural Engineering and Bioeconomy	Germany
66243	13	8	13	27	the caption for figure 7.3 is too long, but there is not enough paragraph to explain this figure. I suggest to move some parts of this caption to the text.	Accept with modification, figure and caption needs to stand alone, as per usualy IPCC style, and is within figure caption word limit, however have tried reduced text.	Marissa Malahayati	National Institute for Environmental Studies	Japan
66245	13	8	13	27	Figure 7.3 b seems fit better in another section which talking about AFOLU emission for regional and sub-regional	Reject,thisis thesection where we draw together all three GHG globally and regionally, the sub sections below are separatd by gas and also present global and regional numbers	Marissa Malahayati	National Institute for Environmental Studies	Japan
70183	13	8	13	9	Manure management also generate CO2 in aerobic conditions	Accept , this is discused int eh table note and in more detail in section 7,3	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76733	13	8	14	2	Table 7.3: For "biomass burning", it would be important to note that it includes only burning in the field, but not biomass for energy (which is how "biomass burning" is mostly encountered in teh mitigation context).	biomass burning mentioned in fig 7.3	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
60171	13	10	13	10	Clarification in Figure 7.3 caption needed: "anthropogenic net greehouse gas flux"	Accept	Government of Hungary	Ministry of Innovation and Technology - Climate Policy Department	Hungary
8465	13	17			replace : with ;	accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10231	13	17	13	17	replace : with ;	accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
66059	13	24	13	24	Change to: "…For CO2, the…"	accept	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
66061	13	25	13	25	Change to: "…Inventories, which…"	accept	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
21161	13		13		Table 7.1 : this concept of natural response would benefit from being further introduced ahead of the table, maybe wihtin the text? As it relies on results from 17 DGVM, it could indeed justify more details.	Accept with modification, it will be taken up during the publication process	Government of France	Ministère de la Transition écologique et solidaire	France
21163	13		13		Figure 7,3 : Please remind 'anthropogenic' in axis titles as in Table 7.1 so as the reader clearly makes the difference between human activies-derived and natural response. Please, make a note to explain why the average value of AFOLU emissions in Table 1 is 12.9 Gt / yr over 2009-2018, while yhe maximum is only 12.6Gt/yr in 2018 in Figure 7.3 a. (it seems the same three bookkepping models were used for both illustrations). For figure b, please add 'anthropogenic' before GHG emissions and removals	Accept with modification, "anthopogenic" has been added to the title rather than the sub headings for the panels,but also AFOLU is by definition anthopogenic. Table 1 and fig 7.3 have been updated and numbers are now consistent.	Government of France	Ministère de la Transition écologique et solidaire	France
11775	14	4	14	5	The AFOLU sector is an emission source, accounting for 23% of global anthropogenic Greenhous Gas (GHG) emissions. In Chapter 12 (below)	Unclear, I am not sure waht the problem is here as we say 23%	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
55967	14	4	14	5	The error of 2.9 is not indicated in Table 7.1. Where does it come from?	accept, numbers updated	Government of United States of America	U.S. Department of State	United States of America
76735	14	4	14	4	Insert "anthropogenic" before GHG.	accept	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76737	14	7	14	7	Clarify what "anthropogenic removals of CH4" includes. It should be consistently addressed throughout. CH4 removals are mentioned occasionally in the chapter, but its magnitude, nature and relevance to mitigation remains unclear.	acccept, improved	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76739	14	8	14	9	"Global emissions of CO2 are predominantly due to LULUCF": Please clarify. It presumably refers to "Global AFOLU emissions of CO2". However, assigning them to "LULUCF" is confusing, as (1) AFOLU (as an inventory sector) replaced LULUCF (thus they do not co-exist) and (2) virtually all CO2 emissions from AFOLU come from the ex-LULUCF sector (which also included agricultural soils). It is also unclear what part of the sentence "low confidence" refers to. It would be better to delete reference to LULUCF altogether.	Accept, text modified	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
55969	14	10	14	10	This figure 6.1 GtCO2e/y needs a reference.	accept.reference given in table to which this number is related.	Government of United States of America	U.S. Department of State	United States of America
21165	14	14	14	19	This paragraph should also comment part a of figure 7.3, namely which activities are the largest sources of AFOLU emissions. LUC vs enteric fermentation vs ...	Accept with modification, breif text added in paragraph above	Government of France	Ministère de la Transition écologique et solidaire	France
76741	14	16	14	16	Replace "AFOLU is the only sector to include sinks" with "AFOLU is currently the only sector to include sinks". The scope of the Chapter includes sinks in other sectors (e.g., DAC).	Accept, modified as suggested with text now earlier in section	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76743	14	16	14	16	Delete "Europe". Europe is part of Eurasia	Reject, these are the regional names as used across IPCC AR6	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76745	14	16	14	16	This discussion of sinks could be a good place to elaborate on methane sinks, which have been mentioned before, but their role and relevance never clarified.	accept, improved sentence	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
55971	14	17	14	19	Needs a citation, chapter, or chapter subsection.	accept	Government of United States of America	U.S. Department of State	United States of America
3845	14	20	14	27	(Also table 7.1.) The data drawn from Friedlingstein et al. under review can be misleading and let people think that CO2 increase is positive and will compensate the emissions from AFOLU. I could not access the manuscript, so I doubt that this increase is realistic because besides CO2 increase other factors for biomass production will prevent this potential to be reached, as lack of water, increased erosion and soil degradation, loss of coastal land, among many others. So I advise to remove the column from the table and to modify the interpretation of the results from Friedlingstein et al. accordingly. This is referred further in page 16, L15-32, where all the uncertainties are listed. So, more reasons to remove the column of potential sinks in table 7.1. because you are crediting more that publication under review than other references.	Accept with modification.re. the first sentence it is uncelar what the reviewer mean by people thinking the CO2 increase is positive. this natural sink has been included in each previous IPCC report and in WG1 and to give a fuller picture of the carbon budget. A;so this table was asked for in the SRCCL plenary to help make things more clear to policy makers, Its layout was developed with policy makers and authors. The natural sink is corroboporated in inventory numbers and atmopsheric inversions as described in the text. It is imortant in understanding the overall role of land and the value in particular of protecting forests and peatlands. This has been clarified with improved clarity in the table headings and text.	Rosa M Poch	ITPS and UdL	Spain
8289	14	20	14	23	does the word 'natural' just reflect plants ability to photsynthesis and/or indicate the absence of any form of management by humans? I think the former based on the the use of managed and unmanaged on page 20, line 14	accept: yes it is the former, text below calrifies this.	Ceris Jones	National farmers union/ world farmers organisation	United Kingdom (of Great Britain and Northern Ireland)
29635	14	20	14	23	Figure 7.3 shows that it is almost only Europe that has a land-use sink. It need to be clarified if this sink is regarded as a natural sink and further where in Table 7.1. this is included.	Accept: fig 7.3 is only the anthopogenic flux and therefore eaulivelt to the third column. This is made clear in the title of fig 7.3 and the text. Many countries have anthopogenic sinks as well as sources due to AFOLU, these contribute to the AFOLU net.	Government of Norway	Norwegian Environment Agency	Norway
72631	14	20	14	23	I guess the natural land sink has been referred to the indirect effect of anthropogenic activity for some time (note the 2010 IPCC), but this may not be technically correct. This assumes that the land carbon flux would be in perfect neutral equilibrium without humans on the planet, which is a convenient modeling paradigm, but not something that we can know for sure, and discounts any non-anthropegenic drift in the system, or asymmetric inter-annual variability. My concern is that this can be confusing to identify this a both an indirect anthropogenic effect and a natural land sink in the same breath, as is done here. This can also be confusing with regard to references to anthropogenic emissions and removals, as such references are not clear about direct vs indirect anthropgenic effects (e.g., page 14 lines 4-7).	Acceptwith modification: Whilst we agree the terminology is confusing, this terminology has been discussed in length and not managed to be improved upon in the ltierature as assessed by the authors. Every effort is taken to explain it in the text in some detail, including the different perspectives from different approaches as to what is anthopogenic or not. The models do include interannual variability and response of land to natural processes, and any drift as far as it is represented in the real world climate data that is used to drive the models. These points are better clarified with modifications to the table headings, footnotes and text	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
76747	14	20	14	27	"To present a fuller understanding of the role of land as a natural sink for CO2 emissions": A fuller understanding would require more consistent terminology. This paragraph seems to equate "natural sink" with "indirect anthropogenic effects", which is earlier (e.g., in Table 7.1) is referred to as "natural response [to anthropogenic environmental change]". At the same time, there is no recognition of truly natural sinks, which would exist in the absence of anthroppogenic impacts, e.g. the carbon sink of natural wetlands.	Acceptwith modification: Whilst we agree the terminology is confusing, this terminology has been discussed in length and not managed to be improved upon in the ltierature as assessed by the authors. Every effort is taken to explain it in the text in some detail, including the different perspectives from different approaches as to what is anthopogenic or not. The models do include interannual variability and response of land to natural processes, and any drift as far as it is represented in the real world climate data that is used to drive the models. These points are better clarified with modifications to the table headings, footnotes and text	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
49823	14	23	14	23	Table 7.1 shows a different uncertainty range -12.5+or-3.2. The text here shows +or-3.3 GtCO2 yr-1.	Accept	Arthur Lee	Chevron Corporation	United States of America
55973	14	23	14	23	Shouldn't this (-12.5+/- 3.3) be identical to Table 7.1?	Accept	Government of United States of America	U.S. Department of State	United States of America
63043	14	24	14	27	The onfidence level (medium confidence) is from an article (friedlingstein et al. Under review). Please clarify whether the confidence level is medium.	Accept, the medium confidence is not just based on freidlingstein but also the fact tht other methods corroborate a sink.	Changke WANG	National Climate Center, China Meteorological Administration	China

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
72629	14	24	14	27	Again, the total emissions are selectively downplayed in favor of showing a net CO2 sink, when the land is relatively neutral when including the other GHG emissions. The reporting needs to be consistent, and if CO2 only wants to be shown, the totals have to be shown also.	Accept with modification. the total emissions are not downplayed but are clearly show in the table and discussed in more detail in the text, when you say the land is relatively neutral when including the other emissions, do you mean emission from non-land sector here? that is not the role of this chapter, but emissiosn from all sectors are also shown in table 1. therefore I am not clear what is wanted here. if it is referring to the need to include the other non-CO2 GHG emissions in the non-land sector, then this has been done as it is noted it would be in the table notes, we were just awaiting final numbers. Thre is not an equvalent literature for land based CH4 sinks, and there are no land based N2O sinks.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
1123	14	26	14	26	The table above shows the global sink at 6.9, not 7.0 GtCO2 yr-1	Accept	Reid Miner	Private Consultant	United States of America
49825	14	26	14	26	Table 7.1 shows a different value of -6.9+or-4.0. The text here shows -7.0+or-4.0 GtCO2 yr-1.	Accept	Arthur Lee	Chevron Corporation	United States of America
8467	14	27			Remove all those citation which are not published. E.g. (Friedlingstein et al. under review).. So many more. Higlighted in PDF file.	Accept with modification, studies have now been published	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10233	14	27	14	27	Remove all those citation which are not published. E.g. (Friedlingstein et al. under review).. So many more. Higlighted in PDF file.	Accept with modification, studies have now been published	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73107	14	27			The year of the publication cannot be found in the in-text citation of 'Friedlingstein et al'.	accept and amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
63681	14	29	27	20	This section dealing with the global models estimates and GHG national inventories is important. However, the text is very detailed and full of jargon and it is difficult to understand the recommendations that are made. Perhaps this text and figures could be condensed and more to the point. It should frame the issue clearly,l29 show some results and clearly express solutions and how this could affect both global models and national inventories. This could possibly be done in a more synthetic way.	Accept	Government of Canada	Environment and Climate Change Canada	Canada
72635	14	29	14	29	Here the natural sink is defined as non-anthropogenic land sink	Accept, section on natural sink moved from here to above so title simplified	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
66247	14	30	14	33	Figure 7.4. the legend is unclear, something is missing (?). The caption, again, needs to be more concise and moved to the text. Give a reason and clear explanation about why this figure needs to be there? It still very lack of explanation there	Accept with modification, figure captions need to stand alone and this is withinin IPCC guidelines, but caption has been modified and more explanation added into text as to relevance and reasons for difference.	Marissa Malahayati	National Institute for Environmental Studies	Japan
8105	14	31	15	16	Figure 7.4: Please revise the figure and the associated text. The purple shading mentioned in the text to the figure is missing.	accept and amended	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
81275	14	31			Figure 7.4: it would be helpful if the authors explicitly referred to WGI results here and made clear if their figures are identical or different (and if the latter, why).	accept	Andy Reisinger	Ministry for the Environment	New Zealand
1405	14	32	14	33	The key message of this figure is hard to catch especially because of the non continuous temporal coverage for FAO net flux and NGHGInet flux. To tackle this issue, probably just move the figure to the next page after line 31 for instance.	accept, data updated and is more continuous and text links to relevance including cross chapter box on global stocktake	Julien Demenois	Cirad	France
21167	14		14		Fig 7.4 what are these min and max which are not visible on the figure?	accept and amended	Government of France	Ministère de la Transition écologique et solidaire	France
21169	14		14		Fig 7,4 : The key message of this figure is hard to catch especially because of the non continuous temporal coverage for FAO net flux and NGHGInet flux. To tackle this issue, probably just move the figure to the next page after line 31 for instance.	Accept	Government of France	Ministère de la Transition écologique et solidaire	France
30745	15	1	15	16	Please check the consistency between Figure 7.4 and its caption. For instance, we can find neither purple shading nor pink line in the figure.	accept and amended	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
55975	15	1	15	1	The shading referenced in the text is missing in Figure 7.4.	accept and amended	Government of United States of America	U.S. Department of State	United States of America
8107	15	2	15	5	Figure 7.4: Please revise the associated text. Degradation is not necessarily connected to management and not restricted to forests, so the text should read "... including wood harvest, land degradation, shifting ...".	accept and amended	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
73109	15	9			The year of the publication cannot be found in the in-text citation of 'Friedlingstein et al'.	accept and amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8469	15	10			(http://www.fao.org/faostat/ - downloaded: November 2020) change as accessed on exact date 2020.	accept and amended	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10235	15	10	15	10	(http://www.fao.org/faostat/ - downloaded: November 2020) change as accessed on exact date 2020.	accept and amended	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73111	15	10			The source of 'FAOSTAT' cannot be found in the Reference list.	accept and amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
11241	15	16	15	32	Other changes in biophysics effects like albedo, heat fluxes due to land management are not take into account too in most of the DGVMs see for instance Luyssaert, S., Marie, G., Valade, A., Chen, Y., Njakou Djomo, S., Ryder, J., Otto, J., Naudts, K., Lansø, A. S., Ghattas, J. and McGrath, M. J.: Trade-offs in using European forests to meet climate objectives, Nature, 562(7726), 259–262, doi:10.1038/s41586-018-0577-1, 2018. Naudts, K., Chen, Y., McGrath, M. J., Ryder, J., Valade, A., Otto, J. and Luyssaert, S.: Europe's forest management did not Mitigate Climate Warming, Science (80-.)., 351(6273), 597–601, doi:10.1126/science.aac9976, 2016.	Accept with modifiation, this is true but there is a separate section on biophysical effects later, this section is on CO2 flux	Bertrand Guenet	CNRS	France
66063	15	16	15	16	Change to: "...2020), which include land-use change and flux..."	accept and amended	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
73113	15	18			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	accept and amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77667	15	18	16	14	The discussion in this section points to the benefits of developing a new information framework that would help state parties see (and understand the significance) of important differences in the condition of land, forest and other ecosystem carbon stocks and their vulnerability to increasing risks from pests, disease, drought and fire. The UNSEA-EA has developed an ecosystem accounting framework that would enable state parties to develop stock accounts to reflect differences in ecosystem condition. The benefits of this approach for guiding future management and establishing priorities within Nature Based Solutions is elaborated by Keith et al in 'Evaluating Nature Based Solutions for Climate Mitigation and conservation requires comprehensive carbon accounting' (2021) Science of the Total Environment 769 (2021) 14434114.	noted, . It is not for a setion on CO2 histirical fluxes to comment on need for good carbon accounting as part of NBS	Virginia Young	Australian Rainforest Conservation Society	Australia
21171	15	20	15	20	This article froùm Fridglinstein et al., also referred to as "under review" at several instances in the text, can be fully cited: https://essd.copernicus.org/articles/12/3269/2020/essd-12-3269-2020-discussion.html	accept and amended	Government of France	Ministère de la Transition écologique et solidaire	France
73115	15	20			The work of 'Friedlingstein et al.' is under submission.	accept and amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
19743	15	26	15	26	soil and vegetation organic carbon	Reject: not needed as specify vegetation and soils, and may be confused with term "organic soils" which refer to peatlands and wetland soils to distinguish from mineral soils which also store carbon	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
66065	15	26	15	26	Change to: "...following land-use change..."	accept and amended	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
11243	15	33	15	39	peat drainage to turn peat into cropland are also large CO2 emmitters. Might be worth to mention it see for instance H. E. Taft, P. A. Cross, G. Edwards-Jones, E. R. Moorhouse, D. L. Jones, Greenhouse gas emissions from intensively managed peat soils in an arable production system. Agric. Ecosyst. Environ. 237, 162–172 (2017).	Accept with modification, it is already mentioned several times in the text, although all the text on this has now been pulled into one paragraph. It is also mentio ned inr elation to what is included int he different estiamtes, but we have updated figure and table captions to make it clear where peatland emissions are included with each estiamte and where the data comes from	Bertrand Guenet	CNRS	France
66067	15	33	15	33	Change to: "...1960s, individual..."	accept and amended	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28801	15	37	15	42	It would seem a paragrapgh depictig alternative solutions would be of great help here. Additionally mention of these limitations in the knowledge gaps is required.	Acccept with modification, the next section and cross chapter box go in to this in great detail with a solution to reonciling differences. This is not really a knoweldge gap as much work has been done on reasons for differences, as assesssed in the next section. Text modiefied to make flow more clear and avoid overlap with later section	naikoa aguilar-amuchastegui	WWF-US	United States of America
49887	15	37	15	42	It is important also to note that bookkeeping models do not aim at depicting GHG fluxes, but to isolate the land-use effect (related to key land-use activities or impact such as timber harvest or forest area change), disregarding (factoring out) the natural growht dynamics (caused by e.g. environmental drivers). Thus, they cannot straightforwardly be used to assess emissions actual fluxes. 10.1111/gcb.12233 Relates also to pg16, ln 15ff	Accept with modification, they do aim to depict fluxes, but as reviewer says just those fluxes due to direct human activity, as now clearly stated in the text, they do not aim to estaimte the full net land-atmostphere flux but this was not implied in the first place. text modified to ensure this is clear	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
49827	15	40	15	40	What is 'driving data'? Are we talking about roads that are cut through primary forests, and the data for driving vehichles through these forests?	accept, change to "input" data	Arthur Lee	Chevron Corporation	United States of America
61387	15	43	15	43	“dependant” should be “dependent”	Accept	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
73117	15	45			Please distinguish which work it is between 'IPCC (2019a)' and 'IPCC (2019b)'.	Accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
29637	15	46	16	1	Is there a chance for underestimation of the antropogenic sink as well as overestimation?	Accept,text amended with onput from FAO	Government of Norway	Norwegian Environment Agency	Norway
76749	16	1	16	1	"leading to possible overestimation of anthropogenic fluxes": It is unclear why fluxes would be overestimated, an why not underestimated. Also unclear what "fluxes" are being referred to (all fluxes?) and what it would mean for the net result.	Accept,text amended with onput from FAO	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
30747	16	2	16	3	The recent update of FAOSTAT emission estimation for land provides a more credible estimation of net CO2 removals from forestland, whereas the old estimations could hardly be referred to as the values were too different from other calculations. It would be more informative not only to explain that it included "biomass only" but also to describe the method applied (ex. using Tier 1 gain-loss method with default IPCC parameters)	Accept with modification, New FAO numbers now all updated and used. Methods not explained here in detail as this is done in SRCCL ,but text improved, update and key points of relevance to compare with other data sets building on SRCCL	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
73119	16	6			Cited 'FAO (2015)' cannot be found in the References.	Accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73121	16	9			Cited '(Hurt et al., 2020)' cannot be found in the References.	accept and amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73123	16	10			There are only one work by 'Goldewijk et al. (2017)' in the References.	Accept, there is also only one in the main text	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73125	16	10	16	11	Cited 'FAO (2015)' cannot be found in the References.	Accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76751	16	20	16	32	This section is crucially important and should be highlighted in the executive summary. It would be important to elaborate more on the implications, in particular on the representation (or lack thereof) of "forest management including wood harvest" in the models.	Accept, has been added. to ES, and there is a whole section of text referring to this later on, but we have linked the text better now	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73127	16	24			Please distinguish which work it is between 'Erb et al. (2018a)' and 'Erb et al. (2018b)'.	Accept with modification, only one erb et al 2018	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73129	16	25	16	26	Please distinguish which work it is between 'Erb et al. (2018a)' and 'Erb et al. (2018b)'.	Accept with modification, only one erb et al 2018	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76753	16	25	16	28	There shoudl be an expalnation of the main differences between "bookkeeping models" and DGVMs. There is a brief (too brief) explanation to the former, but nothing is said about the latter. As both of them are models that track vegetation carbon and surely both are "digital", it would be important to explain how they are constructed and what they do (and do not) represent.	acept with modification, a detailed explanation fo the models is included in the SRCCL, as now referenced clearly, this text aims to build on the SRCCL with what is new, hence the focus is on the new results and not the detailed methods. The focus here is more on why the models differ from the inventories and FAO then from eachother.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
12679	16	26	16	26	Instead of limiting this item to "fire suppression", it would be much more meaningful to refer to "fire management", which would then include some very important recent literature on the carbon consequences of these practices, such as (1) Hurteau, M. D., M. T. Stoddard, and P. Z. Fulé. 2010. The carbon costs of mitigating high-severity wildfire in southwestern ponderosa pine. Global Change Biology 17:1516-1521; (2) Loehman, R. A., Reinhardt, E., & Riley, K. L. (2014). Wildland fire emissions, carbon, and climate: seeing the forest and the trees–A cross-scale assessment of wildfire and carbon dynamics in fire-prone, forested ecosystems. Forest Ecology and Management, 317, 9-19; (3) Johnson, D., Murphy, J. D., Walker, R. F., Glass, D. W., & Miller, W. W. (2007). Wildfire effects on forest carbon and nutrient budgets. ecological engineering, 31(3), 183-192.	Accept with modification, changed wording and included the second reference on the list.	Donald Falk	University of Arizona	United States of America
6051	16	27	16	27	"erosion and transport of soil carbon and accumulation in river bed sediments or open ocean"	accept	Remigio Paradelo	Universidade de Santiago de Compostela	Spain
19745	16	27	16	27	soil organic carbon (soc)	accept with modification, added organic but avoided acronym	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
63683	16	29	29	30	The statement “observations from leaf to global scale suggest higher than expected CO2 fertilisation (Haverd et al. 2020)” must be nuanced against the recent literature indicating a lower than expected CO2 fertilisation effect on productivity and growth. Notably Wang et al. (2021, doi:10.1126/science.abb7772), using multiple long-term satellite- and ground-based datasets, showed that the global CO2 fertilisation effect has declined across most terrestrial regions of the globe from 1982 to 2015. The same finding was also found with the study of a global network of tree-ring records (Adams et al. (2020, doi.org/10.1038/s41558-020-0747-7). Furthermore, Jiang et al. (2020, doi.org/10.1038/s41586-020-2128-9) using data from ecosystem-scale Free-Air CO2 Enrichment experiment in a mature forest, showed that increases in carbon uptake through gross primary production did not lead to increased carbon sequestration at the ecosystem level. Instead, the majority of the extra carbon was emitted back into the atmosphere via several respiratory fluxes. Additionally, studies from tree-ring analyses also report a lack of aboveground tree growth under increased CO2 (e.g. Girardin et al. 2016, doi.org/10.1073/pnas.1610156113; Giguère-Croteau et al. 2019, doi.org/10.1073/pnas.1816686116). It is a possibility that commonly assumed CO2 effects on water use efficiency be over-estimated (Marchand et al. 2020, doi.org/10.1111/gcb.15166; Brienen et al. 2017, doi.org/10.1038/s41467-017-00225-z). Assumptions made by vegetation models about the main processes influencing impacts of CO2 fertilisation strongly impact the modelled trends in effects. So far, the declining trend in CO2 fertilisation has not been adequately accounted for in carbon cycle models, and CO2 fertilisation has limitations for long-term mitigation of climate change as future warming might be underestimated (Wang et al. 2021, doi:10.1126/science.abb7772).	agree, need to read papers and modify text and then may be just double check text with colin/pierre	Government of Canada	Environment and Climate Change Canada	Canada
73131	16	31			Please distinguish which work it is between 'Erb et al. (2018a)' and 'Erb et al. (2018b)'.	reject. there is only one Erb et al 2018	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73133	16	31			The work 'Henttonen et al. (2019)' cannot be found in the References.	Accept and amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73135	16	34			The source of 'GFED4S' cannot be found in the References.	now includes reference: van der Werf et al 2017	Raehyun KIM	National Institute of Forest Science	Republic of Korea
28803	16	35	16	35	Change 1960-2019 from to "from 1960-2019"	Accept	naikoa aguilar-amuchastegui	WWF-US	United States of America
66069	16	35	16	36	Change to: "…from croplands…"	Accept and amended	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
49829	16	38	16	38	as used by	Accept	Arthur Lee	Chevron Corporation	United States of America
55977	16	38	16	39	Note that CO2 emissions from biomass burning are generally treated as carbon neutral in NGHGIs (IPCC, 2006, 2019b) if the vegetation regrows and if from annual agricultural crops.	accept, text added	Government of United States of America	U.S. Department of State	United States of America
66071	16	38	16	38	Change to: "…(used by Houghton…"	accept	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
73137	16	38			The work 'Houghton and Nasikas (2017)' cannot be found in the References (likely to be a typo from 'Nassikas').	accept and amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73139	16	42			Please distinguish which work it is between 'Erb et al. (2018a)' and 'Erb et al. (2018b)'.	accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1125	17	1	17	1	Change title to "Global gross AFOLU CO2 fluxes" to make it clear that other GHGs are not considered	accept and amended	Reid Miner	Private Consultant	United States of America
29639	17	1	17	2	It is difficult to distinguish the different line types in the figure and in the legend. Please consider to change the line types and increase the size of the legend to make it easier for the reader to distinguish them.	accept and amended	Government of Norway	Norwegian Environment Agency	Norway

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
66249	17	1	17	18	Figure 7.5. the font for the legend needs to be bigger; the caption too long	Accept with modification. Font has been made bigger. The figure caption is within the 250 words limit (IPCC guidelines)	Marissa Malahayati	National Institute for Environmental Studies	Japan
72637	17	1	17	2	The figure legends are not clear enough to distinguish between lines.	accept and amended	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
83877	17	1	17	1	It is difficult to distinghish between dotted lines	accept and amended	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
4299	17	2	18	6	For completeness and better presenting the current status of the science, the figure should be updated including a fourth graph from "Earth Observations" based on the recent Harris et al., 2021, NCC study. The study provides an independent global estimate of forest carbon emissions and removals for managed/non-intact and unmanaged forests for the period 2000-2019 to should contrasted with the other data sources. The related text describing the figure (p. 17, l. 19 to p.18, l. 6) needs to be updated accordingly.	accept and amended	Martin Herold	Wageningen University	Netherlands
53725	17	2	17	2	The legend in Figure 7.5 is hard to read.	accept and amended	ZHENG XINZHU	China University of Petroleum (Beijing)	China
10679	17	3	17	3	Indications provided within the charts concerning the curve symbols do not allow to identify clearly the curves. This is particularly ackward for the FAO plot.	accept	Philippe Waldteufel	CNRS	France
8471	17	5			H&N – Houghton and Nassikas 2017; Remove H&N see PDF file.	accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10237	17	5	17	5	H&N – Houghton and Nassikas 2017; Remove H&N see PDF file.	accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73141	17	10			The source of 'FAOSTAT' cannot be found in the Reference list.	accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
19747	17	19	17	19	soil organic carbon (soc)	accept	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
9911	17	20		21	Reference is made to the statement says: 'The Russian Federation, USA, China, Indonesia and India, all had large sinks and an increasing sink rate (Tubiello et al., submitted)'. Suggestion. Check for the latest status of the submitted paper	accept: Tubiello reference has been added to list	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
29669	17	26	17	28	The sentence compares gross and net emissions. It should probably be stated somewhere that both gross and net are relevant in a mitigation perspective. Net emissions demonstrate the overall status and progress. However, gross figures are relevant for individual efforts, as such individual efforts can only impact the gross amount, and net amounts are always the sum of such individual efforts. (Alternatively, this statement could be given in chapter 7.4.1.1 (p 42, line 11-12)	accept	Government of Norway	Norwegian Environment Agency	Norway
73143	17	29			Please clarify the publication year after 'Hansis et al.' (likely to be '2015').	accept and amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76755	17	30	17	31	For NGHGIs it could be useful to also mention that CO2 emissions mostly represent direct emissions from from ongoing (current) activities whilst removals are resulting mostly from past actions (legacy of past management) and indirect impacts of environmental change (CO2 and N fertilisation)	Accepted. Taken into account	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
11777	17	31	17	31	The statement that the fluxes are close to 0 has not data – no reference – and cannot be put forward in this way. The statement is wrong. As comes later in the report, grasslands mitigate a large amount of carbon	Accept with modification, added reference, but disagree with the statement on grasslands, the NGHGI reported fluxes in grasslands are included in this number	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
72639	17	36	17	37	Here is an example of where "removals" is problematic: "...emissions and removals from 'forest land'...". Removals from forest land? This sounds like emissions.	Reject: "emissiosn and removals". is widely used terminology by IPCC and UNFCCC to denote emisions to the atmopshere and removals (sinks) from the atmopshere as defined in IPCC glossary.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
21173	17		17		Fig 7.5 : please enlarge the legend of the different boxes	accept and amended	Government of France	Ministère de la Transition écologique et solidaire	France
55979	18	1	18	6	These sentences do not refer to which approach (bookkeeping, DGVM, or NGHGI) these statements are based on. Per the last sentence, it seems NGHGI, as it is the only one that shows a small net sink, but this is not stated or explicit. Refer to the specific study, or it could be interpreted as an outcome from the three, which is not accurate.	Accept: parabgraph is about FAOSTAT so refers to that, but text amended to clarify	Government of United States of America	U.S. Department of State	United States of America
63685	18	2	18	6	line 3 should read: "-3.4 GtCO2 yr-1" line 5 seems to include an error in one of the figures: "Emissions from peatland soils also decreased from 1.4 GtCO2 yr-1 in 1990 to 1999, to 1.4 GtCO2 yr-1 in 2010-2019."	accept	Government of Canada	Environment and Climate Change Canada	Canada
72641	18	2	18	4	I think this should be -3.4. And again this states "forest land removals", which sounds like carbon is removed from forest land, but this is referring to land uptake.	accept with modification, Number changed. however re. removals: "emissiosn and removals". is widely used terminology by IPCC and UNFCCC to denote emisions to the atmopshere and remivals (sinks) from the atmopshere as deined in IPCC glossary.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
49831	18	3	18	3	Decide on whether to use a negative sign consistently. 3.4 GtCO2 yr-1 to -2.6 GtCO2 yr-1 (around 20% decrease) are not consistent in sign.	Accept	Arthur Lee	Chevron Corporation	United States of America
8291	18	5	18	6	not sure this sentence makes sense? "emissions from peatland soils also decreased from 1.4 GtCO2 yr-1 in 1990 to 1999, to 1.4 GtCO2 yr-1 in 2010-2019"	Accept and amended	Ceris Jones	National farmers union/ world farmers organisation	United Kingdom (of Great Britain and Northern Ireland)
45951	18	5	18	6	This sentence is not understandable: "Emissions from peatland soils also decreased from 1.4 GtCO2 yr-1 in 1990 to 1999, to 1.4 GtCO2 yr-1 in 2010-2019". Please add the right numbers or reformulate.	Accept and amended	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
47623	18	5	18	6	Please, verify this information and/or the value [... decreased from 1.4 to 1.4 ...], and add reference(s)	Accept and amended	Andriamihaja RANAIVOSON	Directorate General of Meteorology	Madagascar
49833	18	5	18	5	Emissions from peatland soils could not have decreased from 1.4 GtCO2 yr-1 to (again) 1.4 GtCO2 yr-1. Is there a rounding error problem here?	Accept and amended	Arthur Lee	Chevron Corporation	United States of America
1127	18	7	18	22	Suggest using the same scale for the vertical axes for all of the regions	accept and amended	Reid Miner	Private Consultant	United States of America
76757	18	7	20	7	The regional grouping should be harmonised with other parts of the report. It is confusing to read "Europe" as separate from "Eurasia".	Reject - these are the IPCC 10 regions disagregation as consistent with other chapters where 10 regions are used (not europe and eurasia may be combined in chapters using fewer regions)	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
8819	18	8	18	9	Figure 7.6. The number of trendlines shown in the sub-panels of this figure make interpretation very challenging. Would it be possible to reduce the number of trendlines – or combine them? Or alternatively, show the full range of trendlines for a single example region in a Panel B and only a sub-set on the main figure? This is not a critique of the importance of the content of the figure.	Accept. We now only present net changes	Eamon Haughey	Galway-Mayo Institute of Technology	Ireland
31041	18	8	18	8	Please ensure that the Northern Territories of Japan, namely Etorofu island, Kunashiri island, Shikotan island and the Habomai islands (See the map here: http://www.mofa.go.jp/territory/index.html), are shown as part of Japan (described in the color of Japan), not as part of Russia in the Figure 7.6. The Northern Territories have remained occupied by Russia without any legal grounds up until the present day. The map not only may cause misunderstanding among the international community but may also give a chance to Russia to take advantage of the map to assert its occupation, which does not have any legal grounds, as a fait accompli. For the reasons above, it is neccessary to modify the display of the Northern Territories on the map in the above mentioned Figure in an appropriate manner.	Accept with modification, The coloured map has been removed from the figure. We have included a reference to IPCC offical region guidelines	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
66251	18	8	18	22	Could you merge/ combine Figure 7.6 with 7.3b. The informations are quite similar. Or choose one that relevant the most.	Reject. Fig 7.2 is for all GHG and it is less easy to see the trends for Co2, but also, it is an important point that 7,3 only shows one data set, here we show how trends and magnitude differs between data sets as there is a big difference in some, so less consensus as to trends. text amended to highlight this point more clearly.	Marissa Malahayati	National Institute for Environmental Studies	Japan
70185	18	8	19	3	Figure 7.6 is very complex, so much information, the legend is huge (15 lines), I wonder if it were posibble a simpler one	Accept. We now only present net changes. THe legend has also been reduced in text	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76759	18	8	19	3	Figure 7.6: Explain the difference between "Europe" and "Eurasia" (and preferably change the labels).	Accept with modification, We have included a reference to IPCC offical region guidelines	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
1407	18	10	18	11	That would be necessary to use the same scale in Y to make the comparisons between regions easier.	Accept	Julien Demenois	Cirad	France
11779	18	10	18	12	In Figure 7.6, add net figures for Europe.	Accept, this was already there, but gross lines removed to make figure easier to read	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
73145	18	16			The source of 'FAOSTAT' cannot be found in the Reference list.	accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
19749	18	17	18	17	organic soil (peatland?) or hihg organic soil content?	accept, peatland soils, amended	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21175	18		18		Fig 7.6 : That would be necessary to use the same scale in Y to make the comparisons between regions easier.	Accept.	Government of France	Ministère de la Transition écologique et solidaire	France
29929	19	5	19	10	Please consider including these regional differences in the SPM. It is important to highlight the large differences across regions, in our opinion. Please also consider including a sentence about deforestation also being a challenge in Europe, as this is not very well known.	passed on to SPM team and make sure it is considered in exec summary for this chapter, However not clear what is meant by the european deforestation comment	Government of Norway	Norwegian Environment Agency	Norway
72643	19	8	19	8	These sinks are actually for all forests,not just managed forests (at least for FAO, see page 16 line 1), and NGHGI "forest" definition includes forest that is not managed for biomass extraction or control (see page 22 lines 1-5). The bookkeeping results are not there yet to see if this is true for most biomass-managed forest also	Accept with modification, this is already commented on in the text re. FAO and NGHGI sinks not necesarily all being due to direct anthopogenic acitivity, not sure what is meant here about bookeeping models not being there yet, its mainly different approach to what is anthopogenic. . also graph simplified to just show net fluxes and text amended to merge and improve explanations and reduce redundancy	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
76761	19	8	19	8	Explain what is meant by "gross sink". Is it GPP or net sink excluding LUC emissions? Or sink excluding forest harvest?	Accept, text modified to be clear what each gross flux is referring to	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76763	19	8	19	8	"forest regrowth and sinks in managed forests": clarify the relation of the two. If "forest regrowth" is part of the "sinks in managed forests", then it should read "other sinks in managed forests". It could be useful to clarify what those other sinks in managed forests would be.	accept	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
51643	19	11	19	11	Please check whether the referenced publication can really be considered to be estimated "by FAO". The publication disclaimer reads: "The views expressed in this paper are the author's only and cannot be taken to represent FAO's position on the subject."	accept , the emissiosn data is published on the FAOSTAT website. but also text modified.	Florin Vladu	UNFCCC Secretariat	Germany
21177	19	18	19	18	We are not sure what Eurasia (https://en.wikipedia.org/wiki/Eurasia) stands for here (and elsewhere), considering that Europe and Eastern Asia are also listed.	Accept with modification. We have included a reference to IPCC offical region guidelines for reference	Government of France	Ministère de la Transition écologique et solidaire	France
73147	19	22			The work of Tubiello et al.' is under submission.	Accept and updated	Raehyun KIM	National Institute of Forest Science	Republic of Korea
6053	19	24	19	25	"mostly in South East Asia (0.6 GtCO2 yr-1) and Africa (0.4 GtCO2 yr-1), followed by North America (0.2 GtCO2 yr-1) and Eurasia (0.1 GtCO2 yr-1)"	Accepted	Remigio Paradelo	Universidade de Santiago de Compostela	Spain
66073	19	27	19	27	Change to: "…South-East Asia…"	Accept	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
76765	19	28	19	31	Please explain how remote-sensing technology is used to estimate gross CO2 removals from intact forests. References would be most useful.	Accept. This text has been clarified	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
4293	19	29	19	37	In light of the recent Harris et al., 2021, NCC study, make sure to update this section that remote sensing approaches, in combination with ground provide global data on forest-related carbon emissions and removals at high spatial detail.	accept and amended	Martin Herold	Wageningen University	Netherlands
50839	19	30	19	31	"During 2000-2017 net estimated net emissions". Should be "During 2000-2017 the estimated net emissions"	accept and amended	Wen Zhang	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
51645	19	30	19	31	"net estimated net emissions" should probably read "estimated net emissions"	accept and amended	Florin Vladu	UNFCCC Secretariat	Germany
76767	19	30	19	30	Delete "net" (repeated).	accept and amended	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76769	19	30	19	30	"net emissions varied from 0.84 GtCO2 yr-1 to 10.34 GtCO2 yr-1 (Table 7.2)." 10.34 only occurs in the table as a gross value. 0.84 appears as net, but it is not the lowest estimate.	Accept, this has been changed and the table removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
45953	19	34	19	37	The value presented in this sentence are standing in stark contrast to the values presented on page 18, line 5f. It would be helpful to explain the reasons for the different scales with which peat soil emissions are reported in different studies.	Accept with modification, EO estiamtes of peat flux now deleted as not comparable	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
73149	19	35			The work 'Busch and Engelmann (2017)' cannot be found in the References.	Accept. THis has since been added	Raehyun KIM	National Institute of Forest Science	Republic of Korea
4295	19	38	19	38	Important to add a paragraph on the findings of the global Harris et al., 2021, NCC study - summarizing the global numbers and new findings and remaining limitations for such a remote sensing driven approach	accept	Martin Herold	Wageningen University	Netherlands
41661	19	38	19	48	You have to be more carefull about remote sensong methods to estimate carbon stock and fluxes. Those techniques have a large variance and you should be using the conditionnal tense (line 38 ="can potentially capture" or "could capture", unless the studies listed have been verified or calibrated by groundtruthing measurements . For example, it it not the case for teh refernce Wigneron et al. 2020....	Accept, text amended to highlight variance among studies and some of reasons why	jean-christophe domec	Bordeaux Sciences Agro	France
73151	19	40	19	41	The work 'Fan et al. (2011)' cannot be found in the References.	Accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61389	19	44	19	45	"Newer satellite products ... make ..." should be "Newer satellite products ... make..."	Accept with modification, text changed	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
51647	19	46	19	46	The term "climate mitigation solution" doesn't fit well. Will this solve climate mitigation? Suggest to use more accurate wording, e.g. "contribute to climate change mitigation". Grammar also needs to be check, to "play a key role" "to the Paris Agreement" doesn't make much sense.	Accept with modification, text changed	Florin Vladu	UNFCCC Secretariat	Germany
8473	19	47			(PRODES, no date; Date in citation is imporant or delete refernce	Accept with modification, text changed	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10239	19	47	19	47	(PRODES, no date; Date in citation is imporant or delete refernce	Accept with modification, text changed	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73153	19	47			Please clarify the refence of 'PRODES' in the Refences.	Accept with modification, text changed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
79807	19	47	20	3	Recent large scale fires in the Pantanal region of Brazil are noteworthy in terms of events with potential to increase the gross emitions. Also, interesting data is presented by the paper: Wang, Y., Ziv, G., Adami, M. et al. Upturn in secondary forest clearing buffers primary forest loss in the Brazilian Amazon. Nat Sustain 3, 290–295 (2020).https://doi.org/10.1038/s41893-019-0470-4	Accept with modification, first point less relevant to the point being made here, but second refernce has been added.	Lucia Helena ANJOS	UFRRJ	Brazil
73155	19	48	20	1	Please distinguish which work it is among the ones conducted by Smith et al. in 2020.	Accept	Raehyun KIM	National Institute of Forest Science	Republic of Korea
18343	20	1	20	3	reduction of regrowth rates of secondary forests 8% to 55% is quite a wide range - could more info be provided on the regions experiencing higher/lower ends of this range?	Accept with modification, text changed	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
51649	20	1	20	1	"Repeated deforestation" is a strange concept to use, given that deforestation implies a land-use change, usually at least medium-term. The meaning should be described more accurately, which seems to be more temporary unstockings due to overharvesting or other degrading processes.	accept and modified "repeated deforestation cycles"	Florin Vladu	UNFCCC Secretariat	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76771	20	1	20	1	What is meant by "repeated deforestations"? Is it shifting cultivation? What time period would the data cover (to be able to substantiate multiple changes in land use)?	accept and modified "repeated deforestation cycles",timescale is variable depending on site	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
11781	20	2	20	10	As Tian et al. (2020) demonstrate there are substantial emissions of nitrous oxide from natural terrestrial systems. Per area unit they appear to be almost on par with those from the agriculture system (including grasslands). Therefore, it is misleading that all nitrous oxide emissions from agriculture lands are classified as antropogenic. It should rather be emission over and above “natural” emissions from the same kind of land not used for agriculture purposes. This would also include emissions from manure in extensively grazed lands (where livestock gets no feed and which is not fertilized) where there is no logic in that nitrous oxide emissions from manure from a sheep is considered antropogenic, but the manure from a deer grazing the same land is called natural. The same reasoning could also be used for methane emissions from ruminants on extensive grazing.	Wrong page number.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
79809	20	3	20	3	Seasonality of gross primary production is also a component relevant, as showed by Delgado, R.C., Pereira, M.G., Teodoro, P.E., dos Santos, G.L., de Carvalho, D.C., Magistrali, Irí.C., Vilanova, R.S., Seasonality of gross primary production in the Atlantic Forest of Brazil, Global Ecology and Conservation (2018), doi: 10.1016/j.gecco.2018.e00392.	Reject, while this is true, the paper in questions is specifically considering the anthopogenic drivers in relation tot his number, it also considers climatic drivers, but in this section the focus is on how the staellite data can help with attributing to anthopoigenic drivers versus seasonal drivers. We therefore dont feel we need to mention seasonality here	Lucia Helena ANJOS	UFRRJ	Brazil
1129	20	5	20	7	what to the asterisks in this table mean?	Accept with modification, table now removed so comment redundant	Reid Miner	Private Consultant	United States of America
4297	20	5	20	5	The table is a nice summary and includes both tropical and global studies and also the one of Pan et al., which is not a remote sensing study. The table could be kept in to showcase the variability of approaches for the tropical domain. But in general, it could also be turned into a small paragraph is ne some of the studies are rather dated now in what is a quickly evolving field. In case the table is kept please add Harris et al., NCC study	Accept with modification, table now removed so comment redundant	Martin Herold	Wageningen University	Netherlands
55981	20	5	20	7	Authors are missing a huge opportunity in the table on satellite data. It should be compared with many of the other techniques for assessing the various continents and discussed with the future of satellites in land use/land use cover imagery. Imagery may be the future of any reasonable assessments in remote regions in interpreting relations between NDVI and specific land pattern spectra as well as data from SMAP. There is a lot of literature already available in remote sensing. This topic should be included in the gaps in knowledge section for future ARs to address. Instead there is a mere paragraph on page 19. If authors are not going to spend more time on the possibilities associated with remote sensing here, recommend deleting both this table and the paragraph on page 19.	Accept with modification, we have removed the table and modified the text making it clear where and how satellite data can help e.g. with MRV and attribution of fluxes, will suggest to add to gsps, but it is not really a knoweldge gap when there is more and more data becoming available and more and more papers, the gap here is understanding why and how it relates to other types of estaimtes, one of the satellite data results (new harris) hhas been included in the figures in comparison with other estiamtes and reasons for differences discussed.	Government of United States of America	U.S. Department of State	United States of America
9913	20	6			Reference is made to the table 7.2 Satellite based estimates of the net flux in tropical forests. Positive value represents emissions; negative value represents removals. Suggestion. Numbers reported in the table should have the same precision level.	Accept with modification, table now removed so comment redundant	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
51651	20	6	20	6	What do the stars mean in the last row of table 7.2? Needs an explanation.	Accept with modification, table now removed so comment redundant	Florin Vladu	UNFCCC Secretariat	Germany
73157	20	6			The work 'Busch and Engelmann (2017)' cannot be found in the References.	Accept and ammended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73159	20	6			Please distinguish which work it is between 'Liu al. (2015a)' and 'Liu et al. (2015b)'.	Accept with modification, table now removed so comment redundant	Raehyun KIM	National Institute of Forest Science	Republic of Korea
3847	20	8	21	7	See my previous comment on potential C sink due to CO2 fertilisation. Apparently it does not take into account the limitation of the other factors for biomass production (nutrients, water, adequate soil physical properties), so either remove (it is redundant from previous paragraphs), or shorten and note these limitations.	Reject. The models do take into acount water and nutrient limitation etc. . noting this text has been combined with earlier text to reduce dupication	Rosa M Poch	ITPS and UdL	Spain
4445	20	8	20	8	Pt. 7.2.2.4 .. Consider changes in Forestarea / Agriculture area_give Dynamic modified results	Unclear, However changes in forest and agricultural area count as anthopogenic and are dealt with in the section above. Also note this section now moved and merged with earlier text	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
72645	20	8	21	7	Here the "natural" land sink is defined as non-anthropogenic, but qualified as "indirect anthropogenic effects". Which is it? This ambiguity is confusing. Pick one, prefereably the non-anthropogenic sink, as it reduced confusion. It is good to acknowledge indirect contibutions of environmental change to this sink, but that can be done once on the initial definition. See comments above.	Accept with modification. the terminology used here is now described more above text and also in the section below.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
83879	20	8	21	7	Under business as usual scenarios, Duffy et al. (2021) found a near halving of the land sink strength by 2040 due to temperature increase and the decline of photosynthesis at higher temperature, while respiration rates increase. https://doi.org/10.1126/sciadv.aay1052	Accept with modification, we thank the reviewer for the reference but this section is about historic trends. WGi and II deal with the future trends, we have added a reference at the end of the paragreaph to box 5.1 in WG1 that discusses this in more detail.	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
83881	20	8	21	7	There is also a positive feedback between temperature increases an soil organic matter decomposition that will alter the land-atmosphere flux of CO2 (see for example Cheng et al., 2017 https://doi.org/10.1038/ismej.2017.48)	Reject, we agree with the reviewer and appreicate the reference, but in this chapter we do not have the space to discuss mutiple feedbacks, this was done in more detail in the SRCCL	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
55983	20	9	20	11	Confusing language. Suggest editing to: "In addition to anthropogenic AFOLU fluxes, natural sink services are provided by lands, but may be impacted by future AFOLU activity or climate change."	Accept with modification, some of this wording used as text from here now combined with earlier text.	Government of United States of America	U.S. Department of State	United States of America
61359	20	9	20	11	The land carbon sink shows strong uncertainties under high global warming scenarios so this sentence shoud be qualified. This is fully addressed in the Box5.1 of the WGI	Accept with modification. This is true the sink may weaken and the net effect may even reverse, but there will still be natural sink processes, so the concept is correct. howeverplease refer to the useful box in relation to how this sink may be affected in the future.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
76565	20	11	20	14	The sentence which starts "It is predminantly due to the natural response ..... " is incomplete.	Accept with modification, some of this wording used as text from here now combined with earlier text.	Julius Daka	Zambia Institute of Environmental Management	Zambia
61371	20	14	20	16	The locations or types of “unmanaged and managed lands" needs to be clarified.	Accept with modification, It is global, Now clarified in amended and merged text.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
61373	20	14	20	16	The 12.5 GtCO2 yr-1 sink is from land management? Is it included the feedbacks from atmospheric response under land management?	Accept with modification, Now clarified in amended and merged text.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
76567	20	14	20	16	The sentence which starts "DGVM models ....." does not connect well with the preceding sentence.	Accept with modification, Now clarified in amended and merged text.	Julius Daka	Zambia Institute of Environmental Management	Zambia
61375	20	21	20	22	are there some specific results about the net land-atmosphere flux CO2 for the forest?	Reject: the results are for all land cover types, although forest land fluxes predominate. We do not have the model results for forest land only.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
76773	20	21	20	22	"Data from forest inventories around the world corroborate a modelled land sink" seems to contradict the statement in the executive summary that "overall total global forest growing stock reported to be stable". It would be useful to explain the apparent discrepancy.	Accept with modification. This text has now been amended and merged with earlier text. But for the reviewer, this sink is due to increased CO2 uptake in extant forests, not to a change in forest area. ` Also there are of course regional differences.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
29931	20	25	21	1	We believe that there is an error in the first part of this sentence. Please consider looking carefully at it. We believe the correct sentence would be "When combining the anthropogenic AFOLU net source with the non-anthropogenic AFOLU net sink,..."	Reject, if it is non-anthopogenic it is be definition, not AFOLU.however this setnence no long appears in current form due to merging with other text	Government of Norway	Norwegian Environment Agency	Norway
55985	20	25	20	26	"anthropogenic AFOLU net source vs non-AFOLU net sink" is confusing. It would be more accurate to use something like 'natural' or 'natural lands response' net sink. Non-AFOLU does not link explicitly with non-anthropogenic.	Accept with modification. AFOLU is anthropogenic and is meant to cover all direct anthropogenic activities .however text has been changed and merged with earlier text in a way that picks up on this point.	Government of United States of America	U.S. Department of State	United States of America
1131	20	26	20	26	This should be 6.9 instead of 7.0, according the to values in the table above.	Accept	Reid Miner	Private Consultant	United States of America
60173	20	26	20	26	Check exact value for total net land-atmosphere flux (cf. page 4 line 14)	Accept	Government of Hungary	Ministry of Innovation and Technology - Climate Policy Department	Hungary
4301	20	38	21	3	In line with the previous comments, I find this part too long for what it provides in terms of information. If room is needed, I would suggest to shorten and this way create some room to add some text on the new global study by Harris et al	accept	Martin Herold	Wageningen University	Netherlands
9907	20				Table 7.2 line 4 row 2 and line 7 row 4 What is meant by 3.75 (4.78) . is it (3.75 or 4.78) or (3.75 + 4.78) ?	Accept with modifiation, table now removed so comment redundant	Government of Indonesia	Ministry of Environment and Forestry	Indonesia

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
55987	21	1	24	1	Without further information, this approach seems inappropriate. If the IAMs do not include the 'missing' land and related emissions as supposedly identified by the DGVMs and NGHGIs, then the projections from the IAMs do not include/consider those lands within the modeling framework (as stated, it is a post processing adjustment). Therefore, when considering mitigations options and costs within the IAMs during simulation, the IAMs do not consider these lands, which could feasibly affect the final simulations' outcomes. Simply adding this realtively large chunk of land post-processing rather than taking the time to incorporate the 'missing lands' into the models seems a hasty shortcut.	Noted. The approach proposed assumes that the IAMs' original flux captures the impact of the more intensive management activities (direct effects) that occur on a subset of the NGHGIs' managed area, whereas the DGVMs' flux captures the indirect effects on all the NGHGIs' managed area. Since mitigation options and costs are based on future direct effects (on any area), these can be assumed to be reasonably captured. We understand that the adjustment proposed may be simplistic, but it is based on the functional understanding of the difference and where this difference is (i.e. is not a constant offset). In the absence of the correction, the assessment of collective climate progress vs IAMs' pathways would be less accurate.	Government of United States of America	U.S. Department of State	United States of America
55989	21	1	24	1	The issue on page 21 is between NGHGIs and models, whereas the issue on page 22 is between bookkeeping models and NGHGIs. There are more issues here than an adjustment can and should address. It seems that this new proposed method can be useful as an interim way for modelers and policymakers to view global stocktake, etc., but these adjusted results should always be accompanied by the original outcomes so users can see initial magnitude of modeled outcomes.	Agreed. The original IAMs' results (ch 3) remain untouched. Here and in ch. 3 it is just mentioned that the adjustment proposed would help in ensuring a greater comparability between countries' reports and IAMs' mitigation pathways, helping to assess collective progress towards Paris' targets	Government of United States of America	U.S. Department of State	United States of America
55991	21	1	24	1	Per the IAM outcome adjustment, authors should make it clear that this is an interim approach to be used as a check, neither to be adopted writ large nor for perpetutity.	Noted. In this report we just note that a major gap exist between what countries and global models reports for LULUCF, due to a double counting of the forest sink. If ignored, this gap could jeorardize the assessment of collective climate progress. While Ch 3 presents the original IAM results, we also note that the proposed adjustment would be a possible pragmatic short-term fix to the problem (interim until a better solution is found), which would avoid double counting and thus support a more accurate assessment of collective progress. If the adjustment will be adopted or not during the Global Stocktake, is a policy decision.	Government of United States of America	U.S. Department of State	United States of America
55993	21	1	24	18	It seems inappropriate to include this 'alignment' methodology in this important IPCC report based on a method that has not yet (1) been published in peer literature and (2) been vetted by the broader scientific community post publication. And it is not clear why this section is being included in this report.	Noted. The methodology has been now published and receive widespread attention by both the scientific community and the media. No substantial methodological criticism emerged (but of course much debate is on the policy implications). This section is included here because if the gap between what countries and global models reports for LULUCF is ignored, it could jeorardize the assessment of collective climate progress. Thus, we identify a serious problem and we propose an pragmatic solution. It's then up to policy to decide how to handle this information.	Government of United States of America	U.S. Department of State	United States of America
76775	21	1	21	3	"Worldwide atmospheric measurements of CO2 corroborate that the entire land surface (land-atmosphere flux) is a net sink due to a combination of all natural and anthropogenic processes (high confidence).": If this sentence refers to the inversion models mentioned in the subsequent sentences, then it could be deleted, as it does not add value. If it refers to other measurements, then more detail and/or a reference would be needed.	accept with modification, it is relevant as it corroborates the model results and adds additional lines of evidence giving more confidence in the result. however text modified and references given	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
61313	21	8	25	28	My experience on the NGHGI methodology for fluxes in natural vegetation is that the methodology used is unlikely to provide meaningful results (even the direction of change can be incorrect) due to lack of data to substantiate key assumptions. The tier 1 and 2 methodologies for especially tropical grasslands and savanna systems need to be reviewed.	Noted.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
76777	21	8	25	20	The discussion in 7.2.2.5 is useful, but it is unclear why it is in WGIII and not in the WG I report, as it seems to relate to our understading of GHG fluxes (the global GHG balance).	Thanks. Actually, the findings explained in this section do not change our scientific understanding of the global C balance. C fluxes do not change, but rather we highlight that a different 'labelling' of these fluxes occur by countries vs. global models. This would led to a erroneous double counting of the forest sink when collective progress is assesses vs. IAMs' pathways.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21179	21	14	21	14	The Special Report on Climate Change and Land in 2019 also identified the soil organic carbon dynamics as a simplified component of the global C models. In particular deep soil carbon dynamics and impact of enhanced tree productivity, which in turn may induce priming in soil.	Noted. It's certainly true that soil C is not well represented in global models, and often not adequately included in NGHGIs. However, we feel this important topic is outside the scope of this section.	Government of France	Ministère de la Transition écologique et solidaire	France
55995	21	25	21	25	Why define DGVA now? It's been used for pages. Define acronym at first use.	Accepted. Changed as suggested	Government of United States of America	U.S. Department of State	United States of America
76779	21	25	21	26	"developed different approaches - valid in their own specific contexts - to identify anthropogenic CO2 fluxes": Consider replacing "identify" with "interpret". "Identify" suggests establishing (approaximating) the "true" value of a variable (that may be abstract, but conceptually clear). The approaches mentioned here estimate (approximate) the values of different concepts, i.e. different interpretations of "anthropogenic". As they are called "valid" in their contexts, it seems to be about different interpretations of what "anthropogenic" shoudl be, not just different methods of identifying the same thing.	Accepted. Changed as suggested	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73161	21	27			Please clarify the refence of 'IPCC SRCCL' in the Refences.	Accepted. Changed as suggested	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76781	21	32	21	33	Add "age legacy effects" to the list under "indirect effects". IPCC 2013 identifies "indirect effects" as "The effects on emissions by sources and removals by sinks caused by climate change, raised CO2 concentrations, age legacy, and atmospheric nitrogen deposition. If age legacy is not included, then it should be expalined why, as the sources referenced are older (2006 and 2010).	Noted, thanks. While indeed the glossary of the IPCC KP 2013 Supplement includes age legacy among the indirect effects, the context of this definition (implementing Decision 2/CMP.6 of the Kyoto protocol, which required Parties to consider in their FMRL submissions factoring out in accordance with paragraph 1(h) (i) and 1(h) (ii) of Decision 16/CMP.1) is different from the context assessed here, which is supporting a more accurate comparison of country GHG report vs IAMs' pathways under the Paris Agreement. Contrary to the Kyoto protocol, the Paris Agreement does not requires Parties to factor out indirect effects. While we considered to include this explanation, due to restriction in text length it was not possible.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76783	21	33	21	34	"Natural effects" should include natural sinks, not only responses to variability. Notably, the carbon sink of natural wetlands (mires) and the lateral transport of carbon (especially by rivers) to stable reservoirs (ocean sediments) should be recognised, as they are not driven primarily by human influence, neither by natural variability.	Noted, and thanks for the comment. As note in this IPCC expert meeting report https://www.ipcc-nggip.iges.or.jp/public/mtdocs/pdfiles/0905_MLP_Report.pdf. Precise separation of direct, indirect and natural effects is difficult. According to that report, natural effects in managed lands are mainly referred to variability. We fully agree that more discussion would be useful on the issues identified, but overall we feel it is a bit outside the scope of this section.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
14743	21	34	21	34	I would suggest adding "insect outbreaks" to this short list	Accepted. Changed as suggested	Pierre Bernier	Natural Resources Canada	Canada
8117	21	42	22	5	One important difference between NGHGIs and models is that in NGHGI removals must not be reported in every instant. Under specific circumstances it suffices to proof that a pool is not a source. This is part of the "conservative approach" to accounting. Please revise the text accordingly.	Noted. The provision on "pool is not a source", part of the "conservative approach" to accounting, applies to the Kyoto protocol. The context of the section is the Paris Agreement, where no such provision exists.	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
73163	21	43			Please distinguish which work it is among the ones conducted by IPCC in 2019.	Accepted. Now clarified	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73165	22	2			Please distinguish which work it is among the ones conducted by IPCC in 2019.	Accepted. Now clarified	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8109	22	3	22	5	Please check and correct when necessary: is it the models that include only intensely managed lands, or is it the driver data that include only areas showing intense land cover change?	Noted. We prefer keeping current text, because irrespective of the driver data global models are currently not able to capture low-intensity managed (e.g. thinning, selective logging etc)	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
4447	22	6	22	6	Add standardisation / Normalisation of different scale Data	Noted. We prefer keeping the current text (Reconciliation of the differences between global models and countries)	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
55997	22	7	22	9	The Global Stocktake is to take stock of the implementation of the Paris Agreement to assess the collective progress towards achieving the purpose of the Agreement and its long-term goals. The outcome of the global stocktake shall inform Parties in updating their NDCs. The word "country" should be replaced by "collective".	Accepted. Changed as suggested	Government of United States of America	U.S. Department of State	United States of America
8113	22	13	23	21	Please check and revise this part of the text. It relies solely on one paper cited here (Grassi et al. 2020), but this could not be found in literature databases. Please check and correct the citation. If the paper has not been published, either use other sources or, if not possible, delete this part of the text.	Accepted. Now updated to Grassi et al. 2021. https://www.nature.com/articles/s41558-021-01033-6	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
66253	22	22	23	21	The first paragraph in this subsection didn't explain clearly about Figure 7.7. It is only mention Figure 7.7b then for what Figure 7.7a? Looking this Figure seems didn't make the reader more understand about the flux matter. Also, again and again, the caption for Figure 7.7 is too long.	Accepted. Caption shortened and improved.	Marissa Malahayati	National Institute for Environmental Studies	Japan
8111	22	23	23	21	Figure 7.7: Please check and revise figure and / or text, as appropriate. DGVMs also capture regrowth, which is included in direct human-induced effects on managed lands. Thus, in panel b, parts of the upper-left cell in the 2x2-matrix in the middle (DGVMs) is "grey" and combining the left and the middle sub-panels would lead to "double-counting". Please describe this approach in greater detail and clarify this issue.	Noted, thanks. We feel than changing the figure would make reading more complex. However, to address the comment, at the end of the caption we added "DGVMs can also simulate direct effects, but it is not considered here"	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
8115	22	23	23	21	Figure 7.7: The paper Grassi et al. (2020) could not be found. Please check citation and if the paper has not been published by now, use other sources and revise or delete this figure, as appropriate.	Accepted. Now updated to Grassi et al. 2021 https://www.nature.com/articles/s41558-021-01033-6	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
55999	22	24	23	26	The Figure 7.7 caption is critical to understanding the approach. Most of the material in the caption should be in the text.	Accepted. Caption shortened and improved, and partially moved in the text	Government of United States of America	U.S. Department of State	United States of America
66075	22	25	22	25	Change to: "…South-East Asia…"	This comment does not apply to this section	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
66077	23	4	23	4	Change to: "…consider all fluxes anthropogenic occurring…"	Noted, thanks. While the comment is right with regard to the original justification for the managed land (i.e. that"all anthropogenic fluxes occurr in managed land" https://www.ipcc-nggip.iges.or.jp/public/mtdocs/pdfiles/0905_MLP_Report.pdf), in practice the use of the managed land PROXY leads to the sentence in the text, i.e. "NGHGIs consider anthropogenic all fluxes occurring in areas defined as 'managed'". The proposed sentence is not incorrect, but in the context of the paragraph we think the current sentence is more appropriate.	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
81277	23	7	23	21	This detailed explanation does not belong in a figure caption but in text	Accepted. Caption moved.	Andy Reisinger	Ministry for the Environment	New Zealand
66079	23	9	23	9	Change to: "…IPCC SRCCL)."	Corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
73167	23	9			Please clarify the refence of 'IPCC SR 1.5C, IPCC SR CCL' in the Refences.	Corrected	Raehyun KIM	National Institute of Forest Science	Republic of Korea
66081	23	10	23	10	Change to: "…of the 'Land Sink' flux…"	Corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
75525	23	10	23	10	Spelling	Corrected	Government of Ireland	Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division	Ireland
28805	23	14	23	21	Perhaps worth make it explicit and state that the solution remains imperfect as we woek with incomplete activities in bookkeeping models, as well as incomplete geospatial reference data for GHGis	Note, and agreed. We added in the text that our methods is "interim and pragmatic" method to translate and adjust the output of global models has been proposed	naikoa aguilar-amuchastegui	WWF-US	United States of America
66103	23	14	23	17	The publication, "Grassi, et al. 2020. Critical adjustment of land mitigation pathways for assessing countries' climate progress" (in press), was not available to me online and therefore was not reviewed for these comments so I am not aware of the specifics of how "managed" forests were determined by Grassi et al. 2020. However, I think I should make this point anyway. Following Potapov et al. 2017, it would likely be important that the buffers used to distinguish managed/unmanaged lands surrounding infrastructure observable in Landsat imagery are representative for the forest being sampled. These buffer assumptions would affect the estimate and may be quite different in different sampled forested lands for many reasons. Also, managed land, as defined by the country, is not necessarily related to infrastructure observable in Landsat imagery and may be based on land use rather than distance to settlement (for example). This is an issue that Grassi and his coauthors are keenly aware of and have likely taken the necessary steps to control for it to the extent possible in the publication and the development of the methodology published here.	Noted. Now Grassi et al. 2021 is published https://www.nature.com/articles/s41558-021-01033-6. We thanks for the valuable comments on Potapov. However, due to text length restriction, we deleted the detailed on intact/non-intact forests (and the ref to Potapov), referring to Grassi et al. 2021 for details	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
66083	23	17	23	17	Change to: "…sum of 'Land Use' flux…"	Corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
73169	23	17			The work 'Potatov et al. (2017)' cannot be found in the References (considered as a typo from 'Potapov').	Due to text length restriction, we deleted the detailed on intact/non-intact forests (and the ref to Potapov), referring to Grassi et al. 2021 for details	Raehyun KIM	National Institute of Forest Science	Republic of Korea
66085	23	18	23	18	Change to: "…the 'Land Sink' flux…"	Corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
66087	23	19	23	19	Change to: "…model CO2 flux…"	Corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
1133	23	20	23	20	change "case" to "cases"	Corrected	Reid Miner	Private Consultant	United States of America
66089	23	20	23	20	Change to: "…in some cases be an…"	Corrected	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
54331	23	22	25	19	This is a useful box.	Thanks!	Sabine Fuss	MCC Berlin	Germany
8121	23	23	25	19	Cross-Chapter Box 5: This box relies mostly on a single paper (Grassi et al . 2020) that could not be found in any literature database or on the homepage of the journal it is allegedly published in. Please check and correct citation, and if the paper has not been published, either substantiate this text here by other sources or delete this box. Even if the paper has been published, some additional references here would be welcome.	Noted. Now Grassi et al. 2021 is published https://www.nature.com/articles/s41558-021-01033-6 Unfotunately, there is no other paper specifically discussing this issue	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
71787	23	23	25	19	Comments on Cross-Chapter Box 5: This box is extremely helpful. However, its wording should be revised to avoid appearance of being policy prescriptive. 'Shall' words, such as 'require', should be used sparingly and should only refer to scientific requirements: i.e. the Box should not suggest what the UNFCCC process requires. Also, Table 3.2 requires a footnote explaining the degree to which this issue is considered (or not) - similar to SR1.5 Table 2.4. Is the knowledge robust enought to produce an adjusted version of this table for comparison? If not, this could be considered for future UNEP Emissions Gap reports.	Thanks. We change the text a bit to make it less policy prescriptive , e.g. 'Requires' changed in "implies"	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
75527	23	23	25	19	Whilst aligning the Global models with NGHGIs is essential the Cross Chapter Box 5 is too prescriptive and should consider the options that remain in determining the aligned pathways.	Text changed to be less prescriptive	Government of Ireland	Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division	Ireland
81279	23	34			Please don't use "likely" here, as it is not a quantitative probabilistic assessment	Accepted	Andy Reisinger	Ministry for the Environment	New Zealand
71789	23	35	23	37	Best to specify that aggregate country data will be needed in the context of the global stocktake (since its mission is to take stock of collective (not national) progress).	Accepted	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
8119	23	38	24	2	Please revise text. The paper cited here (Grassi et al. 2020) could not be found to be published, and this chapter does not contain figures 7.32a-d.	Accepted. Now changed to Fig 1	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
76785	23	38	23	40	"reallocating part of the land sink from the 'non-anthropogenic' to the 'anthropogenic' component helps to reconcile the ~5 GtCO2 yr-1 difference between anthropogenic land CO2 estimates": Without prejudice to the pragmatism and scientific justification of the proposed approach, in the context of this report, the apparent increase in "athropogenic" sink resulting from such a reallocation can appear as an increase in mitigation, without additional action. It would be useful for the box to address not only the benefits of resolving the mismatch between the different approaches, but also the potential drawbacks of changing the representation of the sector in the pathways, e.g. in the context of comparing past and future estimates and address.	Accepted, thanks. We added "The resulting apparent increase in anthropogenic sink reflects simply of reallocation of a CO2 flux previously labelled as natural, and thus does not reflect a mitigation action."	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
66091	23	41	23	41	Change to: "…at both the global and…"	Text changed	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
30749	23	43	24	19	It is necessary to replace "Figure. 7.32x" by "Cross-Chapter Box, Figure 1".	Changed	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
66093	23	43	23	44	Renumber Figure "7.32a", "Fig. 7.32b", and "Figure 7.32c" to existing figures	Changed	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
8535	23	44	23	45	Use uniform wording e.g. Fig, or Figure in whole document, remove dot from figure.	Accepted.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
66095	24	4	24	4	Change to: "…NGHGI-comparable…"	Accepted.	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
72647	24	9	24	13	Here is another example of flipping between "narual" and "indirect" that is confusing because it isn't clear that these two lines are referring to the same thing.	Text has been changed and partly deleted.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
79907	24	10	24	20	Role and need to advance on removal and sinks towards net zero (2050) is not sufficiently discussed. Despite ambition efforts for reducing emissions, offsetting (compensation) from forest for example still required to net zero.	Probably this comment does not refer to this specific sub-section	Carlos Ruiz Garvia	UNFCCC	Panama
30751	24	19	24	19	Please correct "panel j" to "panel f".	Changed	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
66097	24	19	24	19	Relabel "(panel j)" to existing figure	Changed	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
81281	24	21	24	23	This sentence is both prescriptive and too weak at the same time. Prescriptive because "appropriate" implies a judgement of how countries ought to account for their emissions, but also too weak because it will result not just in a perceived increase in the required mitigation effort, but in a real increase.	Changed, deleting "appropriate" and "perceived" and also direct references to "increase mitigation efforts". We now just refer to the fact that the adjustment "would have an impact on the NGHGI-comparable remaining GHG budget"	Andy Reisinger	Ministry for the Environment	New Zealand
50833	24	24	25	15	Missing in this section is the issue of how to evaluate the use of bioenergy in lightof sustainability criteria. The issue is discussed in chapter 7.4.4 and illustrated in box 7.10, unfortunately not in a way that would allow to present useful recommendations to policy makers on this politically very sensitive issue. Chapter 7 should attempt to draw policy recommendations from the literature on what is sustainable/ unsustainable use and develop a methodological recommenstions to evaluate specific cases. When that is included in ch7, the SPM should include a paragraph on it.	Probably this comment does not refer to this sub-section	Bert Metz	European Climate Foundation	Netherlands
73171	24	31			The work 'Rogelj et al. (2011)' cannot be found in the References.	Now added	Raehyun KIM	National Institute of Forest Science	Republic of Korea
51653	24	36	24	38	The technical and scientific explanations appear sound. However, it should be considered whether it's actually within the scope of the mandate for AR6 to make explicit recommendations for approaches to be used for the GST.	Accept, this is within scope as it was within the AR6 scoping document to consider the implication of differences between modelled and NGHGI AFOLU flux. However we have modified the wording to make it clear this is not a recomendation, but is a genuine scientific consideration with a potential approach explained but not "proposed"	Florin Vladu	UNFCCC Secretariat	Germany
81283	24	37			"will" -> "would"; otherwise this is prescriptive	changed	Andy Reisinger	Ministry for the Environment	New Zealand
79909	24	40	34	47	Impacts on Forest Fires (particularly tropical) in 2019 are not sufficiently covered in this chapter. The combination of climatic factors and risks could be further elaborated. For example the temperature of the fires in some areas in lowland Bolivia (above 300 oC phosphorus in soils is permanently lost with no recovery potential).	Probably this comment does not refer to this sub-section	Carlos Ruiz Garvia	UNFCCC	Panama
85807	25	1	25	19	Suggest it would be useful to plot both "adjusted" IAM-based pathways and NGHGI-based pathways on the same sets of axes (for at least one SSP) so that readers can see that even after adjustment there are differences between the two sets of pathways.	Not sure if the comment is well understood . Adjusted IAM-based pathways are the same of NGHGI-comparable pathways. Not sure what "NGHGI-based pathways" refer to	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
66099	25	16	25	16	Relabel "h," to existing figure	changed	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
73173	25	24			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Noted. Thank you – the reference list will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73175	25	27			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Noted. Thank you – the reference list will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73177	26	3			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Noted. Thank you – the reference list will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21181	26	4	26	4	Please, insert "done" (or similar) after "must be".	Noted. The sentence was changed in response to another comment	Government of France	Ministère de la Transition écologique et solidaire	France
49855	26	4	26	5	must be done with caution	Noted. The sentence was changed in response to another comment.	Arthur Lee	Chevron Corporation	United States of America
53367	26	4	26	4	Change "must be with" to "must be considered with"	Accepted – 'considered' has been added.	Donald Smith	McGill University	Canada
73179	26	5	26	6	The work 'Ndung'u et al (2018) cannot be found in the References.	Noted. All references will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
11783	26	9	27	17	As for the ruminants, the negative effects of their ruminants are described, but no account is taken of the fact that they use their digestive system to convert indigestible plant fiber into essential proteins for us. In addition, they also create the biodiversity that is included in the environmental goals. This should also be taken into account when calculating possible improvement potential and dietary changes. Conclusion: possibilities in shifting diets from animal based food is overestimated because of growing population and when people getting better economy in developing countries ask for more meat instead of rice.	Noted. The reviewer makes valid points but their relevance to Section 7.2.3, which concerns historic and current emission trends, is unclear and therefore, no changes to the text have been made.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
71791	26	10	26	13	Also provide the total global CH4 emissions as a comparison	Accepted. Global total CH4 emissions have been added.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73181	26	11			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Noted. Thank you – the reference list will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76787	26	14	26	14	Please explain the "combustion of organic soils" and perhaps replace it with "peat fires" (if appropriate).	Accepted. The FAO description has been checked and the text modified.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73183	26	15			Please distinguish which source it is among the ones by 'FAO' in 2019.	Accepted. The citation has been updated.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
72649	26	16	26	16	What about biomass burning of crop fields? It seems that biomass burning is attributed only to forest land, and that agricultural land focuses on soil. This is particularly unclear in figure 7.8. And does "rice cultivation" include burning of rice fields, or is this burning separated out as biomass emissions (e.g., figure 7.9)?	Noted. Point 1: Biomass burning is referred to under two categories, (1) with regards to FOLU which concerns forest land, and (2) under agricultural emissions which refers to biomass burning specifically on agricultural land (e.g. crop residues). The two are strictly dealt with separately in FAOSTAT to prevent double counting. Differentiation is clarified in Fig 7.8. Point 2: 'rice cultivation' does not include burning rice crop residues (this is included in 'agricultural burning biomass'). Following consideration, no specific changes to the text were deemed necessary.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
83883	26	16	26	17	Dissagregate between ruminants and rice. Livestock -> 66% of agricultural emissions (EDGAR 4.3.2 database, May 2018; USEPA 2012; Tubiello et al. 2014; Janssens-Maenhout et al. 2017b). Rice emissions -> for about 24% of agricultural emissions. % of share recently updated in Crippa et al., 2021 (https://doi.org/10.1038/s43016-021-00225-9)	Rejected. As the SRCCL did not outline precise proportional shares of these two sources, other than graphically in Fig. 2.9, and considering a strict word limit here, it was decided not to add these data. It is hoped shares are sufficiently indicated in Fig. 7.8.	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
53369	26	17	26	17	Change "Latest" to "The latest".	Accepted. Relevant sentences have been changed.	Donald Smith	McGill University	Canada
73185	26	17			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Noted. Thank you – the references will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
53371	26	19	26	19	"and that enteric fermentation and rice cultivation remain the main sources" is redundant	Noted. It is preferred that these lines are unchanged in order to confirm that these sources remain dominant	Donald Smith	McGill University	Canada
71793	26	23	26	25	Also provide the total global N2O emissions as a comparison	Accepted. The share of AFOLU N2O of total emissions has been added.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
18345	26	31	26	31	For clarity - does 'fertiliser application on croplands' include managed organic material addition (e.g. slurries and manures) or just mineral fertilisers? The uninitiated reader will likely assume the latter.	Accepted. Reference to manure has been added.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
73187	26	32			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Noted. Thank you – the reference list will be checked	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73189	26	32			There is no work by 'Tian' ALONE in 2020 in the References.	Accepted. The reference has been corrected	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8295	26	34	26	34	Aggregation of CH4 and N2O to CO2 equivalence'. I see reference here to GWP100 IPCC AR6 values and unfortuantely I did not request permission to see annex B, however I am slightly confused by the absence of any mention of GWP* (https://iopscience.iop.org/article/10.1088/1748-9326/ab6d7e). it may be in another chapter or WG report.	Noted. GWP* is discussed elsewhere in AR6. In line with IPCC policy, aggregation of GHGs uses GWP and updated IPCC values for CH4 and N2O.	Ceris Jones	National farmers union/ world farmers organisation	United Kingdom (of Great Britain and Northern Ireland)
30753	27	1	27	1	To avoid confusion for the readers, please use the same color for CH4 and N2O emissions from biomass combustion as shown in Figure 7.9.	Rejected. As the graphs represent two different gases, it was deemed appropriated to maintain different colours. Additionally, colour palettes will be further modified by the editing team to ensure consistency before final publication.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
60175	27	24	28	1	Decreasing emmissions from enteric fermentation found in Latin America may contradict information on Figure 7.9	Noted. The findings of the SRCCL were checked and indeed reductions in livestock emissions (not just Enteric F.) were outlined in L. America, which contradicts latest FAOSTAT data. The sentence highlighted by the reviewer has duly been deleted to prevent confusion	Government of Hungary	Ministry of Innovation and Technology - Climate Policy Department	Hungary

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
73191	28	2			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Noted. Thank you – the reference list will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
49835	28	5	28	5	principal, not principle	Accepted. Thank you – this has been changed.	Arthur Lee	Chevron Corporation	United States of America
53373	28	12	26	12	Change "Latest" to "The latest".	Accepted. Relevant sentences have been modified.	Donald Smith	McGill University	Canada
3849	28	20			grazing land N2O hotspots? Not clear, please rephrase from line 19.	Accepted. The sentence has been adjusted.	Rosa M Poch	ITPS and UdL	Spain
73193	28	20			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Noted. Thank you – the reference list will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8821	29	1	29	7	Figure 7.9. This is very useful figure, however there is one aspect which is perhaps misleading. That is the large difference in areas of land and (utilised agricultural land) between these regions. Just for example total area of land for Africa is around three times larger than Europe. Would it be possible to account for emissions per area in some way? Or if that is not appropriate to note the large variation in area?	Rejected. Following discussion, it was decided not to include reference to agricultural land area, as Ag. systems differ enormously (for many reasons) in different regions and so comparison of emissions per unit area is not useful (i.e. it is not comparing like with like). The main aim of Fig 7.9 is to show trends in absolute AFOLU emissions per region and the proportional share of different components.	Eamon Haughey	Galway-Mayo Institute of Technology	Ireland
56001	29	1	29	8	Figure 7.9 elements need to be enlarged: axes, scales, any text on figure.	Accepted. It is hoped that modifications have satisfied concerns, however figures may be redrawn by the editing team in preparation of the final draft.	Government of United States of America	U.S. Department of State	United States of America
11245	29	2	29	2	I am not sure this kind of graph to compare regions is easy to understand. I suggest to present also the units per ha-1 to take into account that the surface considered is different.	Rejected. Following consideration, it was decided not to include reference to land area. Due to the huge variation in land type (e.g. desert, mountains etc) between and within regions, comparison of emissions per ha-1 was deemed not useful.	Bertrand Guenet	CNRS	France
28807	29	9	30	21	We are missing impact to hydro balance and precipitation as highlighted for the amazon https://advances.sciencemag.org/content/4/2/eaat2340.full	Accepted. The contribution of changes in land condition to climate tippings points was added.	naikoa aguilar-amuchastegui	WWF-US	United States of America
51327	29	9	30	21	Anthropogenic desertification and land degradation in tropical ecosystems due to open mining (coal, tin, gold, nickel, etc.) are more dangerous than natural desertification in sub-tropical or temperate ecosystems (Agus et al., 2020). This phenomenon is caused by rapid progress, heavy metal toxicity, dissolution by high rainfall, and expansion of pollution. However, site engineering with organic materials and biological technology as well as support of temperature, rainfall, humidity, sunlight, and cycles that are consistently high throughout the year (Agus, 2018), so the recovery of tropical ecosystems can occur faster (Agus et al., 2019; 2020). It is because natural net primary production in tropical ecosystems can reach 750 gC/m2/yr, about ten times that of temperate ecosystems (Freezailah, 1998; Agus et al., 2004).	Rejected. out of scope. The comment refers to ecosystem resilience. The cited studies do not deal with biophysical variables and/or feedbacks.	Cahyono Agus	Universitas Gadjah Mada Yogyakarta Indonesia	Indonesia
11785	29	10	29	15	Here it is stated that there is robust evidence and high confidence in the importance of biophysical effects on climate – and that is high confidence that these can have effect long distance – but then there is very low confidence in such. The whole paragraph is contradictory. The references for the statements in this paragraph are some old – and others very specific. It seems strange not to refer to comprehensive references here like Bonan's Ecological Climatology: Concepts and applications (2016) and more recent papers on the subject. Bonan, G. 2016. Ecological Climatology: Concepts and Applications (3.eds). Cambridge University Press. 436 p.	Accepted comment 1. The last paragraph has been rewritten to calrify this apparent contradiction. There is robust evidence and high confidence for some of the biophysical effects. The understanding of the net effect, including, all major processes across spatial scales remains fragmented. Accepted comment 2. The Betts reference was deleted. Rejected comment 3. The other reference were not especially old. The references are indeed specific. This specificity contributes to the difficulties in formulating general conclusions.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
21183	29	13	29	14	Here and in other paragaphs grouped citations are presented without any rules (chronological, alphabetical, etc.)	Accepted. Ordered group references by ascending publication date	Government of France	Ministère de la Transition écologique et solidaire	France
21185	29	13	29	14	We suggest to add: "Corbeels et al. 2019 showed that SOC storage rates under fallows and multistrata systems are higher than 4‰ yr−1." Corbeels, M., Cardinael, R., Naudin, K., Guibert, H., Torquebiau, E., 2019. The 4 per 1000 goal and soil carbon storage under agroforestry and conservation agriculture systems in sub-Saharan Africa. Soil and Tillage Research 188, 16–26. https://doi.org/10.1016/j.still.2018.02.015§	Rejected. This comment is about soil carbon, whereas the section is about biophysical processes.	Government of France	Ministère de la Transition écologique et solidaire	France
29661	29	16	29	19	Please consider to add language explaining that the climate is altered not only by alterations in the compostition of the atmosphere, but also by changes in the earths surface.	Rejected. The effect of the land condition on the local and non-local climate is explicitly mentioned in the sentence above. The purpose of this paragraph is to stress the importance of biophyiscal processes in addition to biogeochemical processes when assessing the net climate impact of land cover changes and land management changes.	Government of Norway	Norwegian Environment Agency	Norway
72651	29	16	29	19	The radiative transfer effects not associated with GHGs are not clearly included here. They may possible fit into the thermal gradients and advection category, but that doesn't really capture the loss of energy absorbed by the earth due to albedo increases, which may or may not be major factor in creating horizontal transport, but does affect the broader scale energy balance.	Rejected. The sentence deals with non-local climate changes. Changes in surface albedo and subsequent changes in the Earth's energy budget are a local change.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
73195	30	1			The work 'Alkame and Cescatti (2016)' cannot be found in the References.	Accepted. "Alkame"was replaced by "Alkama"	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73197	30	2			The work 'Strandberg and Kjellstrom (2018)' cannot be found in the References.	Accepted. "2018"was replaced by "2019"	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73199	30	3			The work 'Mueller et al. (2015)' cannot be found in the References.	Accepted. "2015"was replaced by "2016"	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73201	30	4	30	5	The work 'Haberlie et al. (2014)' cannot be found in the References.	Accepted. "2014"was replaced by "2015"	Raehyun KIM	National Institute of Forest Science	Republic of Korea
11787	30	5	30	11	The first sentence in this paragraph is strange – land conditions to mitigate GHG-induced climate change as this section is on Biophysical forces – not GHG. Further, the last sentence in this paragraph (i.e. "low agreement on th impact of .. tillage .. grazing") - stated without citations in wrong. Grazing keeps the land open and snow covered in the winter and lighter in the summer (grass vs. trees) - tillage leaves the land open and dark - heating the land. This paragraph is recommended to be rewritten.	Accepted comment 1. The sentence was deleted. Rejected comment 2. The comments on the effects of grazing and tillage seem to solely refer to the effects of albedo. The reference to snow limits this comment to climate regions with a substatial snow season. The net biophysical effect cannot be simply derived from the albedo as it should include changes in turbulent fluxes, short-lived forcers, regional thermal and pressure gradients, etc ...	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
73203	30	7			The work 'Mueller et al. (2015)' cannot be found in the References.	Accepted. "2015"was replaced by "2016"	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73205	30	7	30	8	The work 'Alther et al. (2015)' cannot be found in the References.	Accepted. "Alther"was replaced by "Alter"	Raehyun KIM	National Institute of Forest Science	Republic of Korea
49889	30	9	30	21	This conclusion sounds a bit bold and oversimplified: "because components are missing, one cannot say anything". Well, then we would not able to say something about the land-sink either, isn't it? This passage should more carefully sort what can be said and what not. E.g. the Naudts and Luyssaert papers qouted make the point that the biophysical impact can be as large or larger than the biogeochemical one - at the very large scale (continental) - the assessment now needs to explicitly take such statements explore under which contexts does the finding hold or how does it need to be contexualized. Otherswise, the passage is not very helpful -and it does not do justice to the existing research efforts.	Accepted. The last paragraph has been rewritten to better calrify why this section lacks general recommendations.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
327	30	12	30	21	Why in the text the definition "short-lived tracers" is used twice instead of short-lived climate forcers as reported in the title of the paragraph and thjat is the term generally adopted by IPCC throughout AR6? Also, the statement "...and the effects of pollution such as atmospheric deposition, acidification, and ozone." is ill posed in terminology and not true in principle. In fact, there are alot of studies in this field (a quick reference could be Chapter 6 of WGI AR6).	Accepted. "Short-lived tracers" has been replaced by "short-lived forcers".	Sandro Fuzzi	ISAC CNR	Italy
11789	30	12	30	21	Here again it seems that bold statements are made with very little effort to find new studies and references. The three citations used here are either very old (Betts 2000) or very specific. With the statement ": Studies of biophysical effects have increased since AR5 and confirmed the importance of accounting for biophysical effects including albedo (Betts 2000) ..." . AR5 Synthesis Report is from 2014. Citing a publication from 2000 after saying studies have increased since 2014 is not acceptable. There is comprehensive later work, like Bonan 2016 and Bonan 2019. Bonan, G. 2016. Ecological Climatology: Concepts and Applications (3.eds). Cambridge University Press. 436 p. Bonan, G. 2019. Climate Change and Terrestrial Ecosystem Modeling. Cambridge University Press. 692 p.	Accepted the first comment. The first sentence of the paragraph was rewritten and the references were removed or moved. This paragraph is intended as an updated summary of section 2.5 of SRCCL where more or less the same processes are covered in no less than 18 pages. Given the stringent word limitation, the references are indeed incomplete. The effort was on summarizing 2.5, adding new findings (i.e., Meier et al 2021 and Cohen et al 2019), and stressing the potential importance of land management (changes) in addition to land cover changes. Rejected the suggestion to cite Bonan 2016/2018. This is a text book and not original research.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
14741	30	12	30	21	I would remove the mention of albedo in this paragraph. Measurements of albedo acquired from satellite-based sensors provide a direct measure of solar irradiance reflected back to space and therefore not entering into the earth's climate system. Of all the radiative forcing factors, this is the only one for which we can obtain a direct measurement in w/m2. Studies on the radiative forcing from a change in land albedo have been done at local to global scales over the past two decades. Values of albedo for various land covers are well documented. None of this applies to turbulent fluxes, to transpiration or to BVOC.	Accepted. The first sentences of the paragraph were rewritten to better stress the unique position of albedo within the biophysical processes.	Pierre Bernier	Natural Resources Canada	Canada
14747	30	12	30	13	Betts (2000) predates AR5. I would suggest using a more recent global study on albedo, for example Leonardi et al (2015) https://doi.org/10.1111/gcb.12681	Accepted. Betts et al 2000 were removed. Leonardi et al 2015 were cited instead.	Pierre Bernier	Natural Resources Canada	Canada
29663	30	12	30	18	Albedo is given rather broad mention in tables 7.6 and table 7.7 when considering "best practices" in forestry and agriculture. From this perspective it would be benefitial if 7.2.4 provide as much insight as possible into the relevance of albedo and other biogeophysical for the design of response options. All assessments are probably incomplete, however it would also be benefitial if it is possible to indicate to what extent albedo is relevant for choices between responce option.	Accepted. The last paragraph has been rewritten to better calrify why this section lacks general recommendations. An explicit statement was made on the relationship between albedo and the net climate effects.	Government of Norway	Norwegian Environment Agency	Norway

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76789	30	12	30	13	"confirmed the importance of accounting for biophysical effects including albedo": Suggest deleting "accounting for". It does not add much value, but in the context of WGIII it may suggest the importance of taking it into account for mitigation, such as in SRM. However, the conclusion of the section suggests that it would be premature to do that, as uncertainties remain large.	Accepted. "accounting for" was deleted to avoid confusion.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
28809	30	14	30	21	However, Yet the general findings should be reported, and not dismissed as thise are relevant for implementation at the local level. It's a matter of scale of application rather than of the qualities of the data.	Accepted. The last paragraph has been rewritten to better calrify why this section lacks general recommendations. It is now explicitly mentione that local and non-local effects could differ in sign. Both would need to be assessed to avoid unintented and unwanted climate effects.	naikoa aguilar-amuchastegui	WWF-US	United States of America
76791	30	14	30	14	"short-lived tracers": it should probably read "forcers" or "trace gases" (or both?).	Accepted. "Short-lived tracers" has been replaced by "short-lived forcers".	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
45955	30	24	30	28	This para. refers to the IPBES Global Assessment. Therefore, please change to IPBES 2019 as cited in the chapters list of references.	Accepted, citation will be changed	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
73207	30	24			The work 'IPBES (2018)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73209	30	24			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73211	30	25			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73213	30	27			The work 'IPBES (2018)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61377	30	28	30	30	can we add an example for "indierct driver"?	Examples are provided in the subsequent subsection	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
73215	30	28			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
10681	30	31	30	35	What is meant by "in recent decades"? On figure 7.3, I do not see a decline over 1990-2010; rather overall stability of GHG emissions between 1990 and (around) 2002, and later on an unambiguous increase until 2018.	Accepted, text will be revised.	Philippe Waldteufel	CNRS	France
56003	30	31	30	35	The first sentences summarize AR5 results from 1990-2010, saying there is overall decline in AFOLU emissions. But the last sentence says that 'in recent decades' AFOLU emissions have resumed growth, which conflicts with first sentence. Does the last sentence mean to indicate the most recent decade 2010-2020? And what specifically does 'resumed growth' mean? Increasing? Clarify.	Accepted, text will be revised.	Government of United States of America	U.S. Department of State	United States of America
76569	30	31	30	35	For the sake of clarity, the paragraph should be revised as follows: "AR5 reported a decline in average annual aggregated AFOLU emissions between 1990-2010. However, there was a marked decline of FOLU emissions over this period mainly due to a slowdown in deforestation rates, while emissions from agriculture increased (Section 7.2). In recent decades, AFOLU emissions have resumed growth (Figure 7.3)".	Accepted, text will be revised.	Julius Daka	Zambia Institute of Environmental Management	Zambia
60177	30	32	30	32	Missing word: "Forestry and Other Land Uses"	In this case, we are not including Agriculture.	Government of Hungary	Ministry of Innovation and Technology - Climate Policy Department	Hungary
81685	30	32	32		No need to define FOLU here as it has been defined earlier at page 26 line 14. First mention is page 12 line 7.	Accepted.	Government of New Zealand	Ministry for the Environment	New Zealand
8123	31	1	31	3	Figure 7.10: Please explain the "not consistent" category. Why are some drivers denoted "less deforestation", although they are in the "not consistent" range?	The figure will be redrawn by the design team and the legend was improved.	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
50841	31	1	31	1	For better illustration, I recommend the drivers in the Figure 7.10 be presented by different fonts or colors according to their categories.	The figure will be redrawn by the design team and the legend was improved.	Wen Zhang	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
56005	31	1	31	7	Explain the 'not consistent' grey shading in the Busch graphic embedded in Figure 7.10.	The figure will be redrawn by the design team and the legend was improved.	Government of United States of America	U.S. Department of State	United States of America
66255	31	1	31	1	Figure 7.10 the figure is unclear	The figure will be redrawn by the design team and the legend was improved.	Marissa Malahayati	National Institute for Environmental Studies	Japan
71795	31	1	31	4	Why is rural income support a positive driver for deforestation? Does it mean that the deforestation income is the income support? Or that lack of income support policies drive deforestation?	The figure is from a meta-analysis that considered TISI Web of Knowledge, Proquest, EBSCO E-Journals Database, and Google Scholar for articles containing combinations of terms related to our subject (e.g. DEFOR*; LAND USE), concept (e.g. CAUS*; DETERMIN*) and methods (e.g. ECONOMETRIC*; REGRESS*). We, unfortunately, can not expand on the discussion of each driver assigned in the figure.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
14803	31	2	31	2	Figure 7.10. Add information to the figure caption on how to correctly interpret the 'not consistent' grey bars in Figure 7.10. Intuitively, "not consistent" results would indicate both more and less deforestation for the same driver, and yet the figure does not show grey bars on either side of the middle line.	The figure will be redrawn by the design team and the legend was improved.	Elizabeth Bush	Environment and Climate Change Canada	Canada
63687	31	2	31	2	Results in this Figure seems to be specific to tropical regions; to be validated, if so, it needs to be specified.	The figure is from a meta-analysis that considered also studies outside the tropics if attending the following criteria of search: TISI Web of Knowledge, Proquest, EBSCO E-Journals Database, and Google Scholar for articles containing combinations of terms related to our subject (e.g. DEFOR*; LAND USE), concept (e.g. CAUS*; DETERMIN*) and methods (e.g. ECONOMETRIC*; REGRESS*)	Government of Canada	Environment and Climate Change Canada	Canada
61381	31	5	31	6	we may add some description for land degradation in this section.	Definition is the glossary.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
76793	31	5	35	42	A global land-use change matrix (and/or matrices) would be useful, if data are available. Even if not, many of the changes would be better presented in a tabular format.	Noted, but in face of space limitation we could not expand the figures and tables.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
49891	31	7	31	21	IN such a passage a short passage on onther tree-bearing ecosystems, or "other wooded lands", such as Savannas, is required to enhance clarity (and to overcome an old "notion" that simply disregards these ecosystems which span quite a large area, globally. According to Erb et al. approx. 20 Mkm², half the global forest area)	Noted, text will be revised to improve clarity.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
73217	31	8			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73219	31	13			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
79811	31	13	31	13	Agricultural intensification and change of land management toward conservation agriculture (CA) should be highlighted. For instance, the paper from Polidoro et al. - Potential impact of plans and policies based on the principles of CA on the control of soil erosion in Brazil. Land Degradtion and Development. 2021. https://doi.org/10.1002/ldr.3876, presents a forecast of the CA area increase of 34.4 and 25.4 Mha for zero-tillage and integrated systems crop-forest-pasture, respectively, in Brazil.	These practices are discussed in the section about Mitigation options.	Lucia Helena ANJOS	UFRRJ	Brazil
73221	31	14			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73223	31	15			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
43325	31	18	31	20	It should be precised that the rate of decline in net forest loss (forest gain) is unfortunately and actually due to the converion of native/old forests (with large C stock and low or stable CH4 emissions) to fast growing monospecies plantations (high CO2 emissions due to perturbation at plantation and harvest). So forest gain increase does not translate into less GHGs emissions.	Noted, the section is presenting trends related to land cover. Further discussion on mitigation potentials is presented in subsequent sections.	jean-christophe domec	Bordeaux Sciences Agro	France
73225	31	18			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
9543	31	22			7.3.1.1. Conversion of natural ecosystem to agriculture: I would say intensive agricultural systems	Rejected. The authors understand the reviewers point but believe that conversion facilitates both intensive and extensive agriculture.	Blanca Casares Guillén	EfecTo TP	Spain
12681	31	22	31	22	correct title to "ecosystems" [plural]	Accepted. The title has been changed.	Donald Falk	University of Arizona	United States of America
45957	31	22	32	32	It would seem appropriate to include the specific developments in ecosystems other than mangroves in section 7.3.1.1 as well, as they are relevant for the AFOLU sector, e.g. peatlands, other wetlands and savannahs.	Accepted. The paragraph concerning mangroves has been incorporated into the discussion on other ecosystems.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
61315	31	22	32	32	This speaks to natural areas and agriculture. It is not clear where semi-natural rangeland areas used for livestock production fit into this. I assume they are not fully incorporated into pasture. This needs to be cross checked and made clear.	Noted. FAO data is principally used here. The category 'agriculture' includes natural grasslands used for grazing, feed or agricultural purposes. Reference is now made to what is included.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
11791	31	23	32	20	Here land use change is identified as an important driver of emissions and that the trend has been intensification with less grazing land and more arable land use for crops for livestock feed. This important change is not put in context in the whole report and in most cases grassland, savannah, cropland, meadow and pasture is put under the same roof (i.e. table 7.5). There is no division made between permanent grassland and annual (arable) land and natural and managed (seeded-perennial) grassland – i.e. permanent meadow and pasture, cropland and pasture. There is a fundamental difference between natural grasslands and managed grasslands, both in soil stability, soil depth, root depth and species composition and biodiversity. There is no difference made between grassland, cropland, meadow, pasture, savannah. The fact that arable agricultural land (crops) on old grassland soil (i.e. USA) has lost much SOC is well known (i.e. Thaler et al. 2021) and shows clearly that these cannot be put in the same category. In the whole report – there has to be made a clear difference between cropland and grassland on one side and what kind of grassland – natural, permanent, seeded or cultivated. The carbon cycle is very different in these – and how these are acting in relation to climate. Natural grasslands and permanent pastures have, in general, high biodiversity, plants with deep root systems and accumulate SOC. Croplands and annual transitional pastures have, in general, low biodiversity, plants with shallow root system and more aboveground tissue. Further, these are usually seeded on regular basis and plowed, tilled or harrowed, leaving the soil open for SOC oxidation and carbon emissions. Thaler, E. A., Larsen, I. J. & Q. Yu. 2021. The extent of soil loss across the US Corn Belt. Proceedings of the National Academy of Sciences, 118 (8) e1922375118.	The reviewer(s) make(s) valid points. With consideration, it is felt that discussion on grasslands and croplands, and associated management, is sufficiently separated (considering the type of report this is). For example, discussion on soil C sequestration as a mitigation measure (7.4.3.1) clearly differentiates between cropland and grassland. In terms of grasslands, the difference between systems and types are indirectly alluded to, for example discussion on savannahs and natural grasslands is provided in 7.4.2.4, while managed grasslands are covered in 7.4.3.1. In depth discussion on the subtle differences between grassland systems and management may be challenging due to the high-level nature of this report. Regarding Section 7.3.1.1, no specific changes have been made.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
1435	31		31		figure 7.10 has low quality	The figure will be redrawn by the design team.	Hamideh Dalaei	climatologist at Islamic Republic of IRAN Meteorological Organisation	Iran
3193	31		31		figure 7.10 has low quality. It should be noted that there are low quality figures in the IPCC Chapters as usual.	The figure will be redrawn by the design team.	Hamideh Dalaei	climatologist at Islamic Republic of IRAN Meteorological Organisation	Iran
27769	31		31		Figure 7.10 shows that greater poverty will be contributing to less deforesestation, but this is not the case for all countries and in a number of developing countries greater poverty exacerbates deforestation and adverse impacts on ecosystems.	The figure will be redrawn by the design team.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
43431	31		31		figure 7.10 has low quality. It should be noted that there are low quality figures in the IPCC Chapters as usual.	The figure will be redrawn by the design team.	sadegh zeyaeyan	Head of national center for forecasting and weather hazards management of Islamic Republic of Iran Meteorological Organization (IRIMO)	Iran
50337	31		31		figure 7.10 has low quality. It should be noted that there are low quality figures in the IPCC Chapters as usual.	The figure will be redrawn by the design team.	Government of Iran	Islamic Republic of Iran Meteorological Organization (IRIMO)	Iran
9603	32	1	32	23	In my view it is not appropriate to base this discussion more or less exclusively on FAO numbers, in particular where they concern grassland use for mowing and grazing. It has long been recognized that FAO data on grassland use and grazing suffer from inconsistencies and lacking data harmonization. Land use categories such as "permanent meadow and pasture" do not properly reflect the true extent and density of livestock grazing, in particular where competition between different land uses is at stake (e.g., Erb et al., 2007, J Land Use Sci doi 10.1080/17474230701622981; Haberl 2015, Ecol Econ, doi 10.1016/j.ecolecon.2014.10.002, Erb et al., 2017, Global Change Biol, doi 10.1111/gcb.13443). In my view such an assessment makes critical errors when neglecting new research on extent and intensity of grazing, e.g. Fetzel et al., 2018, Global Biogeochemical Cycles, doi 10.1002/2016GB005601, Fetzel et al., 2017, Global Change Biol, doi 10.1111/gcb.13591, see also the introductory chapter of the SRCCL)	Noted. It was agreed that FAO data would provide the basis for the discussion. The references outlined by the reviewer were examined, and potential uncertainty in the extent of grazing is noted (citing one of the suggested references).	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
18347	32	1	32	2	Potentially confusing - clarify decrease from 2000 to 2010?	Accepted. The sentence has been modified.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
18349	32	1	32	13	Worth noting that animals fed higher quality (generally high starch) diets will have lower per capita emissions than fully grazed counterparts (since a higher propotion of energy intake is metabolised, and DMI is the dominant driver of methane emissions). The land conversion emissions are a one off event with declining impact (negative exponential emissions profile) whereas the productivity gains are persistent. The above argument applies to existing livestock systems - additional livestock established on newly created agricultural land represent a significant additional burden.	Rejected. The reviewers' point is noted, but it assumes that production remains at a constant level. If greater production arises from a similar land area, 'per capita' emissions will go up despite potential increases in feed quality.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
73227	32	1			Please distinguish which source it is among the ones from 'Smith et al.' in 2019.	Noted. The reference will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76795	32	1	32	5	Rather than just mentioning the changes in the total area of agriculture, it would be important to note how it is shifting. E.g., 7.3.1.2 notes that urban areas took over approximately 4.5% of global land area since 1975 (7.6% being a 2.5-fold increase). Presumably, much of this came at the expense of agricultural land, often prime cropland. At the same time, agriculture continued to expand into forests.	Noted. Urbanisation is now mentioned.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
56007	32	2	32	4	Make it clear that it is a 'reduction (-2%) in total' GLOBAL AGRICULTURE LAND area.	Accepted. The word 'global' has been added.	Government of United States of America	U.S. Department of State	United States of America
73229	32	6			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	Noted. The reference has been checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73231	32	11			Please distinguish which source it is among the ones from 'FAO' in 2019.	Accepted. The reference has been checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
4449	32	22	33	17	Add reference: Bharat, A (2017), Is an unbuilt area of land available for development,https://www.acccrn.net/sites/default/files/publication/attach/is_an_unbuilt_area_of_land_available_for_development.pdf	The authors thank the reviewer for the suggested reference. Due to word count restrictions, the reference has not been included.	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
81687	32	22	22		Smallholder structure prevalence could be better defined. Perhaps 'ubiquity of smallholder farmers'.	This mentioned section has been removed during final edits	Government of New Zealand	Ministry for the Environment	New Zealand
3851	32	24	32	32	These areas are the most prone to disappear due to rising sea levels, it would be important to mention this threat here, or refer to other parts of the report where this threat is analysed.	Impacts of climate change are within the scope of WGII report. Here the focus in on land area lost due to conversion to other uses.	Rosa M Poch	ITPS and UdL	Spain
73233	32	24			The work 'Neogi (2020a)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73235	32	25			The work 'Neogi (2020b)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73237	32	26			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
18351	32	30	32	31	Could supplement with case study/further expansion on primary drivers?	Thanks, references were revised.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
73239	32	30			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73241	32	31	32	32	The work 'Bhattarai and Giri (2011)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1759	32	33	32	48	This article is relevent to this section. Please review it. Arfanuzzaman, M. and Dahiya, B. 2019. Sustainable Urbanization in Southeast Asia and Beyond: Challenges of Population Growth, Land Use Change and Environmental Health, Journal of Growth and Change, vol. 50 (2), doi:10.1111/grow.12297, John Wiley & Sons	Noted, thank you for the reference.	Md Arfan Uzzaman	FAO	Bangladesh
9605	32	33	33	17	In my view this assessment is based on a much too small fraction of the extant literature. There are huge literatures on the role of infrastructure and settlement development as drivers of loss of productive land and land-use change in general, as well as the growing human domination of the terrestrial biosphere. For example, only recently a study that quantified human-made mass in buildings, infrastructures and machinery found that these human-created structures now weigh approximately as much as all plants on land (Elhacham et al., 2020, nature, doi 10.1038/s41586-020-3010-5), and has grown 23-fold in the last century (Krausmann et al. 2017, PNAS 114, pp 1880-1885). This text also ignores the large body of literature developed by IPCC-AR5 CLA Karen Seto and her group on urbanisation, as well as that of IPCC-AR6 CLA Felix Creutzig and his group, e.g. Bren D'Amour et al., 2016, PNAS, 10.1073/pnas.1606036114). Industrial Ecologists have been busy mapping settlements and infrastructures now for the last 1-2 decades, see e.g. Inostroza, 2014, Ecol. Indic. 2014, 42, 10-19, Liu et al. 2020, Nat. Sustainability doi 10.1038/s41893-020-0521-x, Takahashi et al. 2010, Resour., Conserv. Recycl 55, 196-200, and with increasing resolution (down to 10m) at national scales (Haberl et al., 2021, Env Sci Tech, doi 10.1021/acs.est.0c05642)	Thank you for the references. Unfortunately, we have space limitations for this section that focus on the impacts on land use. More detailed information about the infrastructure and urban settlements is provided in other sectoral chapters of the assessment.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
60179	32	35	32	36	Check number (7.6%) refering to global share of built-up land area	Noted, number will be checked.	Government of Hungary	Ministry of Innovation and Technology - Climate Policy Department	Hungary
73243	32	36			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73245	32	38			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
81689	32	39	42		Could add 'and policies which encourage density in urban form'.	Accepted.	Government of New Zealand	Ministry for the Environment	New Zealand
76797	32	40	32	42	It is difficult to conceptualise how the significant urban expansion can "enhance sustainability". Surely, natural areas can be expanded/protected to some extent in cities, but this is despite the expansion, not because of it. It may be better to highlight the overall loss of productive land (and the even faster loss of per capite land area).	Accepted, text will be revised to improve clarity	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73247	32	42			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
49837	32	46	32	46	other drivers, not other drives	Thanks, word was corrected.	Arthur Lee	Chevron Corporation	United States of America
56009	32	46	32	46	Change 'drives' to 'drivers'	Thanks, word was corrected.	Government of United States of America	U.S. Department of State	United States of America
81691	32	46	46		Suggest change drives to drivers.	Thanks, word was corrected.	Government of New Zealand	Ministry for the Environment	New Zealand
21187	32	48	32	48	This urban expansion can accelerate with socio-institutional instability, like observed in Egypt over the last decade. Radwan TM, Blackburn GA, Whyatt JD, Atkinson PM. Dramatic Loss of Agricultural Land Due to Urban Expansion Threatens Food Security in the Nile Delta, Egypt. Remote Sensing. 2019; 11(3):332. https://doi.org/10.3390/rs11030332	Noted. Unfortunately, we have space limitations for this section that focus on the impacts on land use. More detailed information about the infrastructure and urban settlements is provided in other sectoral chapters of the assessment.	Government of France	Ministère de la Transition écologique et solidaire	France
3853	33	1	33	2	In relation to my previous comment, it would be useful to indicate how much of the new urbanisation referred in the previous paragraphs is along coastal areas, which increases the impact of future sea level rise.	Impacts of climate change are within the scope of WGII report. Here the focus in on land area lost due to conversion to other uses.	Rosa M Poch	ITPS and UdL	Spain
81693	33	1	2		This section on mangroves feels out of place. Suggest moving to 7.3.1.1 (p.32).	Rejected, thanks, but the proposed change will not impact the message.	Government of New Zealand	Ministry for the Environment	New Zealand
73249	33	2			The work 'Hirales-Cota (2010)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
9919	33	4		17	Development of roads does not only affect land use change in terms of deforestation but also bring subsequent impacts on further development intensity due to increasing economic activities and sometimes it may also result in disasters since unintended development mostly irrespective to spatial plan or disaster risk mitigation. Additionally, more roads tend to result in more distances between center of activities, between homes and jobs, promoting car dependence (as discussed in chapter 8).	Thanks, cross-reference with Chapter 8 will be inserted.	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
63689	33	10	33	14	And also the introduction of invasive species	Accepted.	Government of Canada	Environment and Climate Change Canada	Canada
60181	33	17	33	17	Use of other term (e.g. "forest resource utilisation" or equivalent) suggested instead of "forest exploitation"	Rejected, the term is widely use.	Government of Hungary	Ministry of Innovation and Technology - Climate Policy Department	Hungary
63691	33	19	33	19	Related to Box 7.1., it would also be interesting to add reforestation of roads as a mitigation measures for 1) increase forest cover (and consequenlty inveasing C sink potential) and 2) deacrease the effects mentioned at lines 11-15 of page 7-33.	Noted, we will try to find suitable examples, although mitigation options are subject in the subsequent section.	Government of Canada	Environment and Climate Change Canada	Canada
81285	33	19			I struggle with this box as it doesn't clearly separate proximate from ultimate causes. I.e. it's not clear whether the box is concerned with land taken up by roads themselves, or whether the presence of roads results in the use of land simply because the land becomes more generally accesible. I assume it's the latter, but this should be made clear (and it opens up a wide range of policy-prescriptive issues about which land should be opened up for development - I don't think in that case roads are the issue but a bigger choice whether to develop (or destroy) this land or not; roads are just a tool for that).	Thanks, we will revise the text to make the ultimate causes clearer how a good planning can avoid deforestation.	Andy Reisinger	Ministry for the Environment	New Zealand
19751	33	21	33	21	add soil erosion	Accepted, if appropriate literature is available.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
73251	33	33			The work 'Laurance and Burgues (2017)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61189	33	35	33	40	From 2010 to 2050, the total length of paved roads is projected to increase by 25 million km (Dulac 2013) including large infrastructure-expansion schemes—such as China's One Belt One Road initiative (Laurance and Burgues 2017; Lechner et al. 2018) and the IIRSA program in South America (Laurance et al. 2001; Killeen 2007)—as well as widespread illegal or unplanned road building (Laurance et al. 2009; Barber et al. 2014). For example, in the Amazon, 95% of all deforestation occurs within 5.5 km of a road, and for every km of legal road there are nearly three km of illegal roads (Barber et al. 2014). It is logically unreasonable to combine infrastructure construction with the deforestation of the Amazon. The construction of infrastructure along the Belt and Road is not the cause of deforestation in the Amazon. It is recommended that such illogical cases be deleted. Page 34 Indochina?	The text mentions two separated examples. There is a robust body of literature about the impacts of road construction in the Amazon as a driver of deforestation.	Jianguo WU	chinese research academy of environmental sciences	China
15265	33	36	33	37	This is an inappropriate example. The "Belt and Road" initiative not only carries out large-scale infrastructure construction, but also actively promotes cooperation in ecological protection, taking the path of green development. For example, when the transmission line was built in Myanmar, high towers were used to erect the line without cutting down a single tree in order to protect forest resources. As such, the "Belt and Road" initiative cannot be used as an example of "Reducing the impacts of roads on deforestation". It is suggested to delete the statement "such as China's One Belt One Road initiative (Laurance and Burgues 2017; Lechner et al. 2018)".	Accepted, the specfic example will be removed.	Government of China	China Meteorological Administration	China
73253	33	37			The work 'Laurance and Burgues (2017)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73255	33	43	33	44	The work 'Laurance and Burgues (2017)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73257	34	2			The work 'Flyvberg (2009)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
17277	34	18	34	39	The latest images captured by the International Space Station reveal another phenomenon: a golden row in the Amazon. As the U.S. space agency explained, they show the prospecting wells for illegal mining, which appear as hundreds of water-filled basins surrounded by water-filled deforested areas. Such illegal mining is also poisoning nature, as tons of mercury are used to separate gold from other minerals. In January 2019, deforestation caused by gold mining destroyed approximately 9,000 hectares of the Peruvian Amazon in 2018, meaning that in just over a year, gold mining decimated the equivalent of more than 34,000 football fields in the Peruvian Amazon rainforest.https://www.unav.edu/web/global-affairs/detalle/-/blogs/la-mineria-ilegal-la-otra-destruccion-de-la-amazonia https://magnet.xataka.com/en-diez-minutos/rios-oro-peru-imagen-que-revela-alcance-mineria-ilegal-amazonas	Thanks for the reference. The impacts of mining on deforestation is already presented in the text.	carlos ramirez	AFA-ANDALUCIA	Spain
73259	34	18			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76799	34	19	34	20	The notion of "declining ore grades" is very pertinent and points to the broader issue of resource depletion. It should be generalised to all minerals (e.g., even certain grades of sand are becoming scarce, leading to increasing land pressure) and should be highlighted in the SPM, as it also poses a systemic challenge in terms of energy demand and related emissions.	Noted, due to space limitations we can´t expand further this topic but the use of mineral resources is also included in other chapters of the assessment.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
49841	34	20	34	20	may be more, not will be more. The choice of will or may is important here, and possibly bordering on 'policy prescriptive.'	Accepted.	Arthur Lee	Chevron Corporation	United States of America
56011	34	20	34	20	Sentence includes 'will' and 'may' - remove one.	Accepted.	Government of United States of America	U.S. Department of State	United States of America
27771	34	21	34	21	Add at the end of the sentence "especially for the production of panels and storage batteries".	Rejected, the text is already clear without the addition.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
49843	34	23	34	23	This sentence conflates mining in the mining industries with hydraulic fracturing in the oil and gas industry. The processes are not the same, and therefore the footprints are not the same, as anyone who has worked in both industries would know the difference. Further, this section 7.3.1.3 is about mining and should not be conflated with oil and gas production anyway. Oil and gas production, especially as explicitly stated by the writer of this sentence about hydraulic fracturing, has very small footprint compared to any kind of mining. Anyone who has worked in these two industries will know the difference.	Noted, the distinction will be made.	Arthur Lee	Chevron Corporation	United States of America
73261	34	23			Please distinguish which work it is among the ones conducted by 'UN Environment' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73263	34	26			The work 'Sonter et al. (2015)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73265	34	29			Please clarify the name of authors' written as 'Alvares-Berrios and Aide 2015;'.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73267	34	29	34	30	The work 'Caballero Espejo et al. (2018)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73269	34	33			The work 'Sonter et al. (2015)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
3855	34	34	34	39	Please refer also to the environmental impacts of coltan mining here.	Rejected, it is include in the demand of minerals for renewable energy. Due to space limitations, we could not add further details.	Rosa M Poch	ITPS and UdL	Spain
73271	34	38			Please distinguish which source it is among the ones by 'Ranjan' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
45959	34	40	35	17	The specific mentioning of the role wildfires can play on drained peat soils would add another valuable aspect to this chapter. This could prevent the reader from associating wildfire problems solely to forest ecosystems and increase the visibility of peatlands. See e.g. Jauhiainen et al. 2016, Crippa et al. 2016, or Uda et al. 2019 for references.	Accepted, and thank you for the references.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
61417	34	40	35	17	Here, should be additionally elaborated wildfire regimes on fire vulnerable region, where Mediterranian has been targeted as the most affected one within Europe. More examples besides tropical forests are needed.	Accepted, other ecosystems will be included.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
63693	34	40	35	17	Suggest to include more information pertaining to boreal ecosystems here.	Accepted, other ecosystems will be included.	Government of Canada	Environment and Climate Change Canada	Canada
12683	34	41	34	41	It is incorrect to refer to all wildland fires as "uncontrolled". It would be much more accurate to use the term "wildland fires", which then includes natural ignitions and prescribed burning of natural ecosystems. use the word "wildland" and eliminate the word "uncontrolled" and the sentence will be correct.	Accepted.	Donald Falk	University of Arizona	United States of America
56013	34	41	34	42	Provide supporting citation(s) to strengthen point on the 'slowdown of the area of certified forests'.	The sentence was deleted because certification is discussed in other sections.	Government of United States of America	U.S. Department of State	United States of America
10457	34	43	34	45	I suggest expanding the information provided to the reader at this point. Perhaps, it could be specified what is the proportion between natural and human-ignited fires in recent years (see e.g. Balch et al. 2017). Likewise, although fires affect all the major biomes, the degree of incidence and regional trends are quite different, so this information could be further detailed (see e.g. Andela et al. 2019; Bowman et al. 2020). References: Andela N., Morton D.C., Giglio L., Paugam R., Chen Y., Hantson S., ... & Randerson J.T. (2019). The Global Fire Atlas of individual fire size, duration, speed and direction. Earth System Science Data, 11(2), 529-552. https://doi.org/10.5194/essd-11-529-2019. Balch J.K., Bradley B.A., Abatzoglou J.T., Nagy R.C., Fusco E.J., & Mahood A.L. (2017). Human-started wildfires expand the fire niche across the United States. Proceedings of the National Academy of Sciences, 114(11), 2946-2951. https://doi.org/10.1073/pnas.1617394114. Bowman D.M., Kolden C.A., Abatzoglou J.T., Johnston F.H., van der Werf G.R., & Flannigan M. (2020). Vegetation fires in the Anthropocene. Nature Reviews Earth & Environment, 1(10), 500-515. https://doi.org/10.1038/s43017-020-0085-3.	Accepted, other ecosystems will be included.	Antonio Parra de la Torre	University of Castilla-La Mancha	Spain
21189	34	43	34	43	Worden et al. (2017) showed that biomass burning emissions of methane decreased by 3.7 (±1.4)Tg CH4 per year from the 2001-2007 to the 2008-2014 time periods using satellite measurements of CO and CH4, nearly twice the decrease expected from prior estimates (https://www.nature.com/articles/s41467-017-02246-0).	Noted, emission trends are presented in section 7.2.	Government of France	Ministère de la Transition écologique et solidaire	France
12685	34	44	34	45	Newer work to update the papers cited, some of which are a bit dated: (1) O'Connor CD, DA Falk, and GM Garfin. 2020. Projected climate-fire interactions drive forest to shrubland transition on an Arizona Sky Island. Frontiers in Earth Science 8: Article 137. https://doi.org/10.3389/fenvs.2020.00137; (2) Coop JD, SA Parks, CS Stevens-Rumann, S Crausbay, PE Higuera, MD Hurteau, A Tepley, E Whitman, T Assal, BM Collins, KT Davis, S Dobrowski, DA Falk, PJ Fornwalt, PZ Fulé, BJ Harvey, VR Kane, CE Littlefield, EQ Margolis, M North, M-A Parisien, S Prichard, KC Rodman. 2020. Wildfire-driven forest conversion in western North American landscapes. BioScience 70 (8): 659–673. https://doi.org/10.1093/biosci/biaa061; (3) Keeley JE, P van Mantgem, and DA Falk. 2019. Fire, climate and changing forests. Nature Plants 5 (8): 774-775. https://doi.org/10.1038/s41477-019-0485-x .	Thanks for the references, this topic will be revised.	Donald Falk	University of Arizona	United States of America
73273	34	45			The work 'Aragaao et al. (2018)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
10459	34	46	34	47	This sentence could be slightly modified, since changes in the fire regime not only affect land restoration, but also jeopardize the persistence of numerous species, reduce the resilience of several ecosystems and imply a very important challenge in current and future forest management. I suggest including some of these concepts in the text.	Accpeted, the text will be revised but considering the space limitation.	Antonio Parra de la Torre	University of Castilla-La Mancha	Spain
61319	34	46	34	47	Although fire frequency may have increased in many areas, there is also evidence that it has decreased over vast areas of Africa. See e.g. papers by Sally Archibald.	Thanks for the references, this topic will be revised.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
12687	34	47	34	47	It would be preferable to say "restoration and recovery", because most forests affected by wildland fire recover on their own, not through the application of intentional restoration actions. Better supporting references would be: (1) Marshall LA and DA Falk. 2020. Demographic trends in community functional tolerance reflect tree responses to climate and altered fire regimes. Ecological Applications e02197. https://doi.org/10.1002/eap.2197 ; and 92) van Mantgem PJ, DA Falk, EC Williams, AJ Das, and NL Stephenson. 2020. Intermediate- and long-term growth predict post-fire tree mortality for common conifers in western U.S. parks. International Journal of Wildland Fire 29(6) 513-518. https://doi.org/10.1071/WF19020	Noted, and thank you for the references. The recovery post-fire will be included.	Donald Falk	University of Arizona	United States of America
61317	34	47	34	47	It is unclear why the challenges here are for "restoration". Although fire regimes may pose challenges for restoration, I would assume that this is just a subset of where fire regimes are applicable. Would a term such as sustainable land management be more appropriate? Fire is a natural phenomenon in many ecosystems so post fire recovery of vegetation should not be seen as restoration.	Accepted, the recovery post-fire will be included.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
61361	35	1	35	2	In addition to precipitation deficits, forest fire riesk has strongly increased given global warming and the evolution of the atmospheric evaporative demand.	Accpeted, we will include a mention to fire-conducive conditions due to climate change.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa

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10461	35	2	35	4	I suggest revising the sentence, since not only tropical forests are particularly affected by changes in the fire regime. For example, it is well known for many years that increased fire frequency could drive Mediterranean forests towards more open shrub and herb dominated environments (e.g. Zedler et al. 1983). Moreover, in recent years it has been observed that this post-fire "herbalization" is exacerbated by drought, which could reduce the resilience of many Mediterranean forests and shrublands in the following years (e.g. Parra & Moreno 2018; Baudena et al. 2020). References: Baudena M., Santana V.M., Baeza M.J., Bautista S., Eppinga M.B., Hemerik L., ... & Rietkerk M. (2020). Increased aridity drives post-fire recovery of Mediterranean forests towards open shrublands. New Phytologist, 225(4), 1500-1515. https://doi.org/10.1111/nph.16252. Parra A., & Moreno J.M. (2018). Drought differentially affects the post-fire dynamics of seeders and resprouters in a Mediterranean shrubland. Science of the Total Environment, 626, 1219-1229. https://doi.org/10.1016/j.scitotenv.2018.01.174. Zedler P.H., Gautier C.R., & McMaster G.S. (1983). Vegetation change in response to extreme events: the effect of a short interval between fires in California chaparral and coastal scrub. Ecology, 64(4), 809-818. https://doi.org/10.2307/1937204.	Accepted, this will be revised to include other biomes.	Antonio Parra de la Torre	University of Castilla-La Mancha	Spain
12689	35	2	35	2	In addition to these cases, important to also name deserts, which burn very infrequently under natural conditions but which are now burning more frequently and severely due to invasion of non-native grasses, which create continuous fuels for spreading fires: Stevens J and DA Falk. 2009. Can buffelgrass Invasions Be Controlled in the American Southwest? Using invasion ecology theory to explain buffelgrass success and restoration potential in the American Southwest. Ecological Restoration 27(4): 417-427. http://doi:10.3368/er.27.4.417	Accepted, this will be revised to include other biomes.	Donald Falk	University of Arizona	United States of America
21191	35	3	35	3	Global and regional burned area trends result from the interaction of compensating trends in controls of wildfire at regional scales, acording to Forkel et al., 2019 (https://iopscience.iop.org/article/10.1088/2515-7620/ab25d2)	Noted, but due to space limitations we can add much more details to the text.	Government of France	Ministère de la Transition écologique et solidaire	France
12691	35	5	35	5	Cite: North, M., B. M. Collins, and S. Stephens. 2012. Using fire to increase the scale, benefits, and future maintenance of fuels treatments. Journal of Forestry 110:392-401.	Rejected. Unfortunately is not possible to include all references, especially the older ones.	Donald Falk	University of Arizona	United States of America
11793	35	6	35	15	Although FAO 2020 is cited for the statement "About 98 Mha of forest are estimated to have been affected by fire in 2015" – the data seems old (2015). Major forest fires have been since 2015. It has been pointed out that with increasing global temperatures increasing forest fires is to be expected (see line 14-15). As the main carbon source in forests is aboveground, these will release increasing amounts of forest carbon into the atmosphere while carbon stored belowground will, for the most, be protected. Therefore, grasslands that store carbon belowground should be considered – not only afforestation and reforestation – for long term carbon storage (Dass et.al 2018 – cited elsewhere in the report). Dass, P., Houlton, B.Z. Wang, Y. & Warlind, D. 2018. Grasslands may be more reliable carbon sinks than forests in California. Environ.Res.Lett. 13 (7): 074027.	FAO 2020 source is an important one because of the large cover and standardized data collection. We will add information related to the period after 2015 too.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
19753	35	6	35	17	this subject is very relevant you may addded the forest fire 2019 from brasil bolivia australia africa 50 Mha .Survey it please¡¡¡	Partially accepted. We will include recent fires, but due to space limitations we can not discuss all cases in detail.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
73275	35	6			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73277	35	8			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
10463	35	13	35	15	It is true that the wildfire risk is higher under climate change. However, recent studies show a global decreasing trend in the area burned (see e.g. Turco et al. 2016; Andela et al. 2017) due to, at least in part, an increased effort in fire management and prevention. I suggest revising the sentence to include this information. References: Andela N., Morton D.C., Giglio L., Chen Y., Van Der Werf G.R., Kasibhatla P.S., ... & Randerson J.T. (2017). A human-driven decline in global burned area. Science, 356(6345), 1356-1362. https://doi.org/10.1126/science.aal4108. Turco M., Bedia J., Di Liberto F., Fiorucci P., Von Hardenberg J., Koutsias N., ... & Provenzale A. (2016). Decreasing fires in Mediterranean Europe. PLoS ONE, 11(3), e0150663. https://doi.org/10.1371/journal.pone.0150663.	The subsection on fire will be revised to include references related to other biomes.	Antonio Parra de la Torre	University of Castilla-La Mancha	Spain
21193	35	13	35	13	A decrease in the number of fires and the area covered by fire is shown in the 40-year (five countries) and 30-year (26 other countries) time series updated to 2019, as reported in the JRC's European Forest Fire Information System 2020 report (EFFIS, 2020, https://ec.europa.eu/jrc/en/news/forest-fires-threaten-europe-s-nature-world-suffers-worst-year-record).	The revision will include different estimates in terms of fire frequency and burned area, globally.	Government of France	Ministère de la Transition écologique et solidaire	France
61363	35	13	35	17	Drivers of forest fires are usually much more complex and in whcih societal transformation and feedbacks with climate play a fundamental role. I recommend to have a look into: Fire regime changes in the Western Mediterranean Basin: From fuel-limited to drought-driven fire regime Pausas, J.G., Fernández-Muñoz, S. Climatic Change, 2012, 110(1-2), pp. 215–226	The subsection on fire will be revised to include references related to other biomes.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
21195	35	14	35	15	According to Doerr and Santín (2016), global area burned appears to have overall declined over past decades, and there is increasing evidence that there is less fire in the global landscape today than centuries ago (https://royalsocietypublishing.org/doi/10.1098/rstb.2015.0345). As well, Yang et al. (2014) suggested a notable declining rate of burned area globally (1.28 × 104 km2 yr-1), with a significant declining trend of burned area in tropics and extratropics and no significant trend detected at high latitudes (https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2013JG002532).	The revision will include different estimates in terms of fire frequency and burned area, globally.	Government of France	Ministère de la Transition écologique et solidaire	France
12693	35	15	35	15	Some very important work omitted here on increasing fire sizes and area burned, including: (1) Abatzoglou, J. T., C. A. Kolden, A. P. Williams, J. A. Lutz, and A. M. S. Smith. 2017. Climatic influences on interannual variability in regional burn severity across western US forests. International Journal of Wildland Fire 26:269-275; (2) Kitzberger T, DA Falk, AL Westerling, and TW Swetnam. 2017. Direct and indirect climate controls predict heterogeneous early-mid 21st century wildfire burned area across western and boreal North America. PLoS One 12(12): e0188486. https://doi.org/10.1371/journal.pone.0188486; (3) Parks, S., and J. Abatzoglou. 2020. Warmer and drier fire seasons contribute to increases in area burned at high severity in western US forests from 1985 to 2017. Geophysical Research Letters 47:e2020GL089858.	The revision will include different estimates in terms of fire frequency and burned area, globally.	Donald Falk	University of Arizona	United States of America
61321	35	15	35	17	Although climate change may well increase intensity of fires, human land transformation activities also reduce fire area , there is also evidence that fire size has decreased over vast areas of Africa. See e.g. papers by Sally Archibald.	The revision will include different estimates in terms of fire frequency and burned area, globally.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
79813	35	17	35	17	The paper Silva Junior, et al. Persistent fire foci in all biomes undermine the Paris Agreement in Brazil. Sci Rep 10, 16246 (2020). https://doi.org/10.1038/s41598-020-72571-w, presents an updated vision of carbon emissions in all Brazilian biomes (i.e., Amazon, Cerrado, Caatinga, Atlantic Forest, Pantanal and Pampa). I suggest to add as an additional literature in this chapter / item.	Thanks, the subsection on fire will be revised but due to space limitation we can not go into detail for all the regions or countries.	Lucia Helena ANJOS	UFRRJ	Brazil
9607	35	18	35	42	While these two paragraphs mention that over-extraction of wood can degrade mangrove forests, it fails to note that managed forests generally have a lower standing crop (biomass stock) than natural forests due to the effects of juvenilization on carbon stocks in forests. This effect is surely relevant on larger areas, and has a higher C effect, than the degradation of mangrove forests (which I do not want to downplay). Erb et al. (2018 nature doi 10.1038/nature25138) have quantified this effect (and there are large literatures to underpin this finding) and suggest that this effect reduces C stored in currently prevailing forests by 22-33% compared to their potential C stock, with the C loss amounting to 46-163 PgC around the year 2000. I do not understand why this very substantial effect is not even mentioned in these two paragraphs, even more when one considers that raising wood harvests will generally further aggravate this effect (see e.g. Holtsmark 2012, Climatic Change doi 10.1007/s10584-011-0222-6, and a flurry of subsequent publications, also by many other authors, e.g. Pingoud et al., 2018, J Env Manage, doi 10.1016/j.jenvman.2017.12.076). Also, I find it a bit surprising that this discussion, in particular the second paragraph, is grounded in so little literature, rather the impression emerges that these insights were derived from only one reference (Barger et al. 2018), which does not seem appropriate for text in an assessment report that is expected to critically assess the literature based on comparisons and discussion of various approaches and sources.	Noted, and thank you for the references.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
49895	35	18	35	42	This passage fails to represent a key "mechanism" of forestry, ie. that harvest lowers C-stocks in biomass and soil. This insight is so fundamental (and old, see Shurgart, Reichle, Harmon), but it needs an explicit mention here not to be interpreted that forest use, as long as it is not degrading, is not affecting the Cbudget. The twist to "overexploitation" in mangroves is blurring more than helping here. In Erb et al. 2018 10.1038/nature25138we show that used forests, on global average, contain only about 70% (64-76%) of the potential carbon stock, and I am not aware of any study that would show an opposite pattern. This effect is, furhtermore, important as it represents a massive historic C-emission but also offers options for C-resotration that are significant (again 10.1038/nature25138, 10.1111/gcb.13876). Furthermore, as we have returning forests in many regions of the North, a short passage on the forest transition (which is not in contrast to the above-mentioned relationships!) could be inserted explaining why we have, e.g. in Europe, net-c-sinks in forests while increasing harvest volumes: 10.1016/j.cosust.2019.04.005, 10.1016/j.landusepol.2015.04.027. Not memntioning these fundamental, quantitative relationships would result in a considerable bias and be misleading and near-fatal in my view.	Noted, and thank you for the references.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
61419	35	18	35	42	This subchapter should be extended and supported with references from other part of world besides tropical forests. Nothing about illegal logging that is frequently wide spread in developing countries underpinning floods, landslides etc.	Noted, references to other regions will be included but due to space limtiations that should remain concise.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
77669	35	18	35	42	Logging as a driver of both deforestation and forest degradation needs greater elaboration, especially as emissions from forest degradation are estimated to be of similar magnitude to those from deforestation (Curtis et al., Science 361, 1108–1111 (2018) and other references cited above). A clear articulation of the impact of industrial (including selective) logging is needed(i.e. forest management for commodity production). There has been virtually no update of modified commercial forestry practices (Puettmann et al. (2015) For Ecosyst 2(1). https://doi.org/10.1186/s40663-015-0031-x) and the various references cited above demonstrate that, the scientifically false statement that logging is either carbon neutral or even carbon positive" is maintained. Recent post 2019/20 bushfire analysis in Australia demonstrates that fuel dryness rather than fuel load contributed to the unprecedented extent and severity of that summers fires (Nolan et al. 2020 Global Change Biology DOI: 10.1111/gcb.14987. And as per the references cited above, that past logging exacerbates fire risk and severity, with previous prescribed burns having little or no impact on moderating fire once the Fire Danger Rating Index reached severe or catastrophic levels (McCaw, L. & Burrows, N. in Prescribed burning: The science, practice and politics of burning the bush (eds A. Leavesley, M. Wouters, & R. Thornton) (Australasian Fire and Emergency Services Authorities Council Limited, 2020).. The challenge posed to restoration from increasing fire severity and extent, points to the urgent need to re-think priorities for forest restoration to focus on achieving the most resilient, stable, long-lived outcomes and improve resistance to threats such as drought and fire. Given the clearly evident differences in fire severity between younger regrowth (10-30 yrs) and long unlogged forests (Taylor, C., McCarthy, M. A. & Lindenmayer, D. B. (2014). Nonlinear effects of stand age on fire severity. Conservation Letters, 7, 355-370), 'proforestation' should be elevated as a key forest restoration strategy. Allowing older previously logged forests to recover their biological potential has multiple climate mitigation, adaptation and biodiversity benefits (Moomaw et al. cited above) and if implemented at a landscape scale would improve overall ecosystem integrity and stability and deliver the lowest risk and large quantum of carbon sequestration and long-term storage. The evidence is clear as cited above that new market of bioenergy should be included as a driver of both deforestation and forest degradation. This is a serious oversight in this section. it has been long established and recognized that markets determine or at least heavily influence, the way forests are logged and which forests are deemed available to logging (ie are economically viable) (Dargavel 1995 Fashioning Australia's Forests, Oxford University Press, 1995). Evidence that this new market has resulted in previously unlogged forests being logged is clear and reductions in the age at which forests are. Serious questions about opportunity costs remain unanswered as do questions about where and how fully emissions from wood based bioenergy are accounted (Booth paper cited above)	Thank you for the comments that cover many aspects. Unfortunately, we can not develop all of the them in this section but we will include some consideration about the challenges involved in fire and forest management.	Virginia Young	Australian Rainforest Conservation Society	Australia
71797	35	19	35	23	Do these numbers add up or overlap?	The numbers add up according to the source used.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76801	35	19	35	19	Clarify what is meant by "the area of forest designated for production". If it is "forest available for wood supply", then that term should be used. If not, both should be reported and the difference mentioned.	The term is used by the Global Forest Resources Assessment (FAO)	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73279	35	23			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73281	35	28			Please distinguish which source it is among the ones from 'FAO' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
63697	35	30	35	32	This type of info can be easily generalized to many more ecosystems	Agreed, references will be added to include more ecosystems.	Government of Canada	Environment and Climate Change Canada	Canada
63695	35	33	35	42	This section seems very tropic oriented, and we suggest that more temperate and boreal contexts should be provided.	The text will be revised to include other biomes.	Government of Canada	Environment and Climate Change Canada	Canada
79911	35	34	35	43	On the drivers to deforestation another important factor on public policy is the massive public land redistribution. For example in Bolivia, this has occurred under governments, allowing resettlement of impoverished peasant farmers from the western highlands.	Noted, unfortunately, due to space limitations we can not go into detail for all the regions or countries.	Carlos Ruiz Garvia	UNFCCC	Panama
45961	35	36	35	38	Please provide a correct source and more details as to why the regional variability of total wood harvested used as fuelwood matters at this place in the report. Comment: The provided source (Barger et al. 2018) doesn't contain the given figures on regional percentage of total wood harvested used as fuelwood. Rather in the contrary the IPBES report in 3.3.3.1 opens with mentioning rising pressure on forests due to a rise of consumption of forest products by 50% in Europe given advanced economic development. Compared to this the figures in the Ch 7 of AR 6 seem to suggest less pressure due to smaller shares of fuel wood which is misleading (and wrongly quoted).	Thanks, the text, references and consistency will be revised.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
48745	35	39		42	In the chapter there is no distinction between exotic (often fast-growing monocultural) trees plantations and native species plantations. This is a critical point for assessing the overall impact and mitigation potential of forestry management. Native species are part of the local ecosystems, and therefore interact synergistically (I asume that this problem is related to the use of definition of forests by FAO, that do not differ explicitly between forests and plantations, and between exotic and native species, with no ecosystemic view. This is an old debate that needs to be addressed urgently: http://www.fao.org/3/Y4171E/Y4171E10.htm). Plantations with native species (specially with pioneer tree species) grow significativily more than natural old forests, besides avoiding the highly relevant negative impacts of exotic fast growing plantations. At least in southern temperate forests, there is a significative mayor stock of soil carbon in native forests in comparison with fast growing exotic species plantations. The difference iamong both s even higher for water quantity/quality at hydraulic basin scale, and dramatically higher in the case of biodiversity, which determines many other ecosystem services.	This section focusses on logging and fuelwood as direct drivers. Details on mitigation potential are addressed in section 7.4	Alfredo Erlwein	Soil Science Institute, Universidad Austral de Chile	Chile
48747	35	39		42	From above...Some references: *Montagnini, Florencia, Daniela Cusack, Bryan Petit, Markku Kanninen, 2004. Environmental Services of Native Tree Plantations and Agroforestry Systems in Central America. Journal of Sustainable Forestry 21(1):51-67 *Alvarez-Garreton, C., Lara, A., Boisier, J. P., & Galleguillos, M. (2019). The Impacts of Native Forests and Forest Plantation on Water Supply in Chile. Forests, 10(6), 473. *Malkamäki, A., D'Amato, D., Hogarth, N. J., Kanninen, M., Pirard, R., Toppinen, A., & Zhou, W., (2018). A systematic review of the socio-economic impacts of large-scale tree plantations, worldwide. Global environmental change, 53, 90-103. *Ojeda-González, P., Donoso, P., Erlwein, A., 2020. Synergy in mixed Nothofagus spp. plantations: the effect of deciduous/evergreen neighbourhood on tree growth in the Chilean Andes. New Zealand Journal of Forestry Science: (2020) 50:11. http://nzjforestryscience.nz/index.php/nzjfs/article/view/102	Thank you for the references. Please see above response.	Alfredo Erlwein	Soil Science Institute, Universidad Austral de Chile	Chile
48749	35	39		42	From above...Evidences of the impacts of plantation of exotic monocultures on biodiversity and carbon storage are increasingly found. Strong evidence linking fast growing exotic trees plantations to increased wildfires, droughts, local biodiversity extinctions, human conflicts, and the loss of native forest have been reported in Chile. Finally, the influence of lifespan of different tree species and wood use should be considered. In South America, but probably globally, exotic fast growing trees wood is mainly used for short term lifespan purposes, such as temporal wood structures or disposable paper, in comparison with higher quality woods that tend to be used in more lasting structures. This is important for an effective carbon sequestration in the mid and long-term:: *Heilmayr, R., Echeverría, C., & Lambin, E.F. (2020). Impacts of Chilean forest subsidies on forest cover, carbon and biodiversity. Nature Sustainability, 3, 701-709. https://doi.org/10.1038/s41893-020-0547-0 *Durán, A., Barbosa, O., 2019. Seeing Chile's forest for the tree plantations. Science Vol. 365, Issue 6460, pp. 1388. DOI: 10.1126/science.aaz2170 *MARCOS O. VALDUGA, RAFAEL D. ZENNI and JEAN R.S. VITULE. Ecological impacts of non-native tree species plantations are broad and heterogeneous: a review of Brazilian research. Anais da Academia Brasileira de Ciências (2016) 88(3 Suppl.): 1675-1688 (Annals of the Brazilian Academy of Sciences) http://dx.doi.org/10.1590/0001-3765201620150575 *Nath, C. D.; Schroth, G.; Burslem, D. F. R. P. Why do farmers plant more exotic than native trees? A case study from the Western Ghats, India. Agriculture, Ecosystems & Environment 2016 (230) 315-328 DOI 10.1016/j.agee.2016.05.013	Thank you for the references. Please see above response.	Alfredo Erlwein	Soil Science Institute, Universidad Austral de Chile	Chile
76803	35	39	35	40	"plantation forests [...] only partly alleviate the pressure on native forests": This seems like an understatement, given that many plantations replace native forests thus directly contribute to their loss. Whilst the often higher productivity of plantations can reduce demand for logging from (semi-)natural forests, logging in those forests is hardly mentioned in the chapter as a factor (either as a source of emissions or as a limitation). The presentation shoudl be more balanced.	Noted, this point will be considered. However, this section focusses on logging and fuelwood as direct drivers and details on mitigation potential are addressed in section 7.4	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
71799	35	41	35	42	Please provide reference and a reflection on to what extent the adoption of certification can serve as a proxy for the adoption of better practiccs. There is a lot of evidence showing that certification often often confirms existing practices and the rapid expnasion of certification (around the turn of hte century) was poorly correlated with changes in practices.	It is not possible to include a deeper discussion of certification schemes in this section but they are discussed in the Policy section (7.6).	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
1135	35	42	35	42	To be consistent with material later in the report, add the following sentence, which appears later in the Chapter: "Nevertheless, the area of forest under management plans has increased in all regions since 2000 by 233 Mha (FRA, 2020)." and add another sentence that helps put certification in context: " In regions representing the majority of industrial wood production, forests certified under sustainable forest management programs accounted for 51% of total managed forest area in 2017, an increase from 11% in 2000." Source: ICFPA 2019 "2019 ICFPA Sustainability Progress Report". Published by the International Council of Forest and Paper Associations. available at icfpa.org	Accepted.	Reid Miner	Private Consultant	United States of America

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49897	35	42	35	42	As currently reports are emerging that assert the forest certification schemes to be biased and not solid, I would suggest not to make such a claim, but rather to qoute a study that yields this insight.	Noted, the text will be revised.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
61365	35	44	35	44	There is an important aspect, which is missed here. The number of livestock is relevant but it is also very relevant to know the charcater of exploitation. Intensive vs. Extensve livestock is relevant and it has strongly different consequences in terms of sustainability and adpatation to Clim Cha. (see e.g. https://life-midmacc.eu/project/)	Noted. It is felt that the variation in intensity of livestock systems is sufficiently captured (even if indirectly) by discussing animal productivity. The section only concerns emissions and so discussion on wider sustainability is not included.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
66259	35	44	35	44	It is better to be replaced as "Livestock population and Productivity" I don't know how much you want to explain this livestock sector. But if it including the manure management, etc, I think livestock management will be include everything.	Accepted. The terms 'populations' and 'management' have been included.	Marissa Malahayati	National Institute for Environmental Studies	Japan
11795	35	45	35	48	Whether soils are a net source or sink for methane depends on the balance between methanogenesis (methane production) and methanotrophy (methane consumption) (Conrad, 2009; Praeg et al. 2014). Grasslands are, in general, an important methane sink (Mosier et al. 1991; Saggar et al. 2007; Holst et al. 2008; Wang et al. 2014). However, the relative abundance and community composition of methanotrophs is strongly affected by different environmental factors like land use, e.g. grazing and tillage (Abell et al. 2009; Jacinthe et al. 2014; Deng et al. 2019), water availability (Gao et al. 2018), and nutrient availability (Bodelier et al. 2004). Soil moisture is the major driver of temporal dynamics of methane fluxes (Rong et al. 2015; Shrestha et al. 2012; Praeg et al. 2014; Bai et al. 2018; Thomas et al. 2018). Ma et al. (2016) found that non-grazing (enclosures) changed the methanotrophic community structure with time, resulting in less abundance and activity and less methane uptake. Methane produced by grazers is taken up by the methanotrophs in the grassland. In industrial operations, with wet/muddy conditions, methanogens dominate and in the absence of methanotrophs, methane is released. Rong, Y.P., Ma, L., Johnson, D.A., 2015. Methane uptake by four land-use types in the agro-pastoral region of northern China. Atmos. Environ. 116:12–21. Shrestha, P.M., Kammann, C., Lenhart, K., Dam, B. & W. Liesack. 2012. Linking activity, composition and seasonal dynamics of atmospheric methane oxidizers in a meadow soil. The ISME International Society for Microbial Ecology Journal 6: 1115–1126. Praeg, N., Wagner, A.O. & P. Illmer. 2014. Effects of fertilisation, temperature and water content on microbial properties and methane production and methane oxidation in subalpine soils. European Journal of Soil Biology 65: 96-106. Bai, X., Li, X., Wen, W., Mi, X., Li, R., Huang, Q. & M. Zhang. 2018. CO2, CH4 and N2O flux changes in degraded grassland soil of Inner Mongolia, China. J Arid Land, 10(3):347–361. Ma, T., Chen, H., Wang, Y., Kang, X., Tian, J., Zhou, X., Zhu, Q., Peng, C., Liu, L., Hu, J., Zhan, W. & E. Zhu. 2016. Effects of enclosure time on the community composition of methanotrophs in the soils of the Inner Mongolia grasslands. J Soils Sediments. Thomas, B.W., Gao, X., Zhao, M., Bork, E.W. & X. Hao. 2018. Grazing altered carbon exchange in a dry mixed-grass prairie as a function of soil texture. Conrad R. 2009. The global methane cycle: recent advances in understanding the microbial processes involved. Env Microbiol Rep 1:285–292.	Noted. The authors thank the reviewer for their comments. All valid points, but unfortunately, relevance to the indicated sentences is unclear. The sentences in question concern enteric fermentation and manure management. Discussion aims to explore drivers of the emission trends outlined in 7.2. Soils are not identified as a direct source of CH4 in the associated data. Accordingly, no specific changes have been made to the text.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
21621	35	45	35	46	It would be convenient to better define the term "animal productivity" or include other terms that help to qualify it, such as "greenhouse gas emission intensities", "animal efficiency" or "production efficiency" (Grossi et al., 2019; Herrero et al., 2015; http://www.fao.org/gleam/results/en/#c303616). Citations: "There is a direct link between greenhouse gas emission intensities and animal efficiency. The more productive the animal is, the lower the environmental impact will be (on a per unit of product basis). Both management quality and expression of full genetic potential are necessary to increase production efficiency." (Grossi et al., 2019) "In addition to improved feed quality, there are several animal management options that can also improve animal and herd productivity. These include a combination of genetics, animal health, nutrition, and modern reproductive management to raise reproductive efficiency, reduce the burden of "unproductive" animals in herds, raise the productive lifespan of animals, and reduce mortality rates of calves and adult animals. These measures can reduce the breeding herd overhead and raise the production efficiency at the herd and animal levels, thereby reducing GHG emissions of per unit of product." (Herrero et al., 2015) References: Grossi G, Goglio P, Vitali A, Williams AG. 2019. Livestock and climate change: impact of livestock on climate and mitigation strategies. Animal Frontiers, 9(1):69–76. DOI: https://doi.org/10.1093/af/vfy034 Herrero M, Wirsenius S, Henderson B, Rigolot C, Thornton P, Havlik P, de Boer I and Gerber P. 2015. Livestock and the environment: what have we learned in the past decade? Annu. Rev. Environ. Resour. 40:177–202	Noted. The term animal productivity is now explained. The authors thank the reviewer(s) for the additional material.	Ainara Artetxe	NEIKER-Basque Institute of Agricultural Research	Spain
76805	35	45	35	46	The sentence seems to equate "animals" with cattle. Enteric fermentation is only an issue for ungulates and depend also on species, not just animal numbers and productivity.	Noted. The term 'ruminant' has been added to define the type of animal.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
53375	35	46	35	46	Change "function of both" to "function of animal species,"	Noted. The sentence has been modified in response to another comment.	Donald Smith	McGill University	Canada
21197	35	48	35	48	We suggest to add after source "(i.e. storage and application practices)"	Accepted. The suggested words have been added.	Government of France	Ministère de la Transition écologique et solidaire	France
21199	36	1	36	1	There is an evidence that the ruminant population must be reduced at a global scale, but how can we maintain grasslands and pastoral lands –which represent half of the agricultural area in the word - with less animals as they represent a source of biodiversity to maintain and a carbon sink? And how could we transfer fertility from grasslands to crop areas without ruminants? As well, reducing quality nutrient from animals can result in a change of land use, with the cultivation of grasslands (and the corresponding GHG emissions).	Noted. The reviewer(s) make(s) valid points but unfortunately, discussion on such matters is not deemed relevant to this specific section which solely explores emission drivers.	Government of France	Ministère de la Transition écologique et solidaire	France
11797	36	3	36	5	Whether soils are a net source or sink for methane depends on the balance between methanogenesis (methane production) and methanotrophy (methane consumption) (Conrad, 2009; Praeg et al. 2014). Grasslands are, in general, an important methane sink (Mosier et al. 1991; Saggar et al. 2007; Holst et al. 2008; Wang et al. 2014). However, the relative abundance and community composition of methanotrophs is strongly affected by different environmental factors like land use, e.g. grazing and tillage (Abell et al. 2009; Jacinthe et al. 2014; Deng et al. 2019), water availability (Gao et al. 2018), and nutrient availability (Bodelier et al. 2004). Soil moisture is the major driver of temporal dynamics of methane fluxes (Rong et al. 2015; Shrestha et al. 2012; Praeg et al. 2014; Bai et al. 2018; Thomas et al. 2018). Ma et al. (2016) found that non-grazing (enclosures) changed the methanotrophic community structure with time, resulting in less abundance and activity and less methane uptake. Methane produced by grazers is taken up by the methanotrophs in the grassland. In industrial operations, with wet/muddy conditions, methanogens dominate and in the absence of methanotrophs, methane is released.	Noted. This comment is repeated elsewhere (Comment ID: 11795) though with reference to a different sentence. The sentence identified here refers principally to N2O emissions - which is now clarified within the text. Accordingly, discussion on methanogenesis has not been included.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
11799	36	3	36	5	New references to added text same page and lindes: Mosier, A., D. Schimel, D. Valentine, K. Bronson & W. Parton. 1991. Methane and nitrous oxide fluxes in native, fertilized and cultivated grasslands. Nature, 350:330-332. Saggar, S., Hedley, C.B., Giltrap, D.L. S.M. Lambie. 2007. Measured and modelled estimates of nitrous oxide emission and methane consumption from a sheep-grazed pasture. Agriculture, Ecosystems and Environment, 122:357–365. Holst, J., Liu, C., Yao, Z., Brüggemann, N., Zheng, X., Giese, M. & K. Butterbach-Bahl. 2008. Fluxes of nitrous oxide, methane and carbon dioxide during freezing–thawing cycles in an Inner Mongolian steppe. Plant Soil 308:105–117. Deng, Y., Che, R., Wang, F., Conrad, R., Dumont, M., Yun, J., Wu, J., Hu, A., Fang, Z., Cui, X. & Y. Wang. 2019. Upland Soil Cluster Gamma dominates methanotrophic communities in upland grassland soils. Science of the Total Environment 670: 826–836. Jacinthe, P-A., Dick, W. A., Lal, R., Shrestha, R.K. & S. Bilen. 2014. Effects of no-till duration on the methane oxidation capacity of Alfisols. Biol Fertil Soils 50:477–486. Abell, G.C., Stralis-Pavese, N., Sessitsch, A. L. Bodrossy. 2009. Grazing affects methanotroph activity and diversity in an alpine meadow soil. Environmental Microbiology Reports, 1(5):457–465. Gao, X., Thomas, B.W., Beck, R., Thompson, D.J., Zhao, M., Willms, W.D. & X, Hao. 2018. Long-term grazing alters soil trace gas fluxes from grasslands in the foothills of the Rocky Mountains, Canada. Land Degrad. Develop. 29: 292–302. Rong, Y.P., Ma, L., Johnson, D.A., 2015. Methane uptake by four land-use types in the agro-pastoral region of northern China. Atmos. Environ. 116:12–21. Shrestha, P.M., Kammann, C., Lenhart, K., Dam, B. & W. Liesack. 2012. Linking activity, composition and seasonal dynamics of atmospheric methane oxidizers in a meadow soil. The ISME International Society for Microbial Ecology Journal 6: 1115–1126. Praeg, N., Wagner, A.O. & P. Illmer. 2014. Effects of fertilisation, temperature and water content on microbial properties and methane production and methane oxidation in subalpine soils. European Journal of Soil Biology 65: 96-106. Bai, X., Li, X., Wen, W., Mi, X., Li, R., Huang, Q. & M. Zhang. 2018. CO2, CH4 and N2O flux changes in degraded grassland soil of Inner Mongolia, China. J Arid Land, 10(3):347–361. Ma, T., Chen, H., Wang, Y., Kang, X., Tian, J., Zhou, X., Zhu, Q., Peng, C., Liu, L., Hu, J., Zhan, W. & E. Zhu. 2016. Effects of enclosure time on the community composition of methanotrophs in the soils of the Inner Mongolia grasslands. J Soils Sediments. Bodeliere, P.L.E. & H.J. Laanbroek. 2004. Nitrogen as a regulatory factor of methane oxidation in soils and Sediments. FEMS Microbiology Ecology 47: 265-277. Thomas, B.W., Gao, X., Zhao, M., Bork, E.W. & X. Hao. 2018. Grazing altered carbon exchange in a dry mixed-grass prairie as a function of soil texture. Wang, Y.F., Chen H., Zhu Q.A., Peng, C., Wu, N., Yang, G., Zhu, D., Tian, L., Kang, X., He, Y., Gao, Y. & X. Zhao. 2014. Soil methane uptake by grasslands and forests in China. Soil Biology and Biochemistry. 74:70–81.	Rejected. The authors thank the reviewer for the suggested references but following consideration it was decided not to include them due to (1) space restriction (2) the sentence simply aims to outlined the findings of the SRCCL, which in theory provides a synopsis of research at its time of publication (2019).	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
21201	36	5	36	5	The French agricultural research and international cooperation organization working for the sustainable development of tropical and Mediterranean regions (CIRAD) identified CH4 and N2O emissions hot spots in topical pastoral rangeland that are explained/drived by the movements of livestock. Emissions from the soil were significantly higher in the landscape units most frequently used by the animals, i.e. in the vicinity of the water point and settlements (Assouma et al., 2017). Assouma, M.H., Serça, D., Guérin, F., Blanfort, V., Lecomte, P., Touré, I., Ickowicz, A., Manlay, R., Bernoux, M., Vayssières, J., 2017. Livestock induces strong spatial heterogeneity of soil CO2, N2O, CH4 emissions within a semi-arid sylvo-pastoral landscape in West Africa. Journal of Arid Land 9, 210-221.	Noted. The authors thank the review for the suggested material. With consideration it was not included as (1) the sentence identified simply aims to summarise findings of the SRCCL and (2) there is a strict word count limit.	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21623	36	7	36	13	It would be convenient to better define the term "animal productivity" or include other terms that help to qualify it, such as "greenhouse gas emission intensities", "animal efficiency" or "production efficiency" (Grossi et al., 2019; Herrero et al., 2015; http://www.fao.org/gleam/results/en/#c303616). Citations: "There is a direct link between greenhouse gas emission intensities and animal efficiency. The more productive the animal is, the lower the environmental impact will be (on a per unit of product basis). Both management quality and expression of full genetic potential are necessary to increase production efficiency." (Grossi et al., 2019) "In addition to improved feed quality, there are several animal management options that can also improve animal and herd productivity. These include a combination of genetics, animal health, nutrition, and modern reproductive management to raise reproductive efficiency, reduce the burden of "unproductive" animals in herds, raise the productive lifespan of animals, and reduce mortality rates of calves and adult animals. These measures can reduce the breeding herd overhead and raise the production efficiency at the herd and animal levels, thereby reducing GHG emissions of per unit of product." (Herrero et al., 2015) References: Grossi G, Goglio P, Vitali A, Williams AG. 2019. Livestock and climate change: impact of livestock on climate and mitigation strategies. Animal Frontiers, 9(1):69–76. DOI: https://doi.org/10.1093/af/vfy034 Herrero M, Wirsenius S, Henderson B, Rigolot C, Thornton P, Havlik P, de Boer I and Gerber P. 2015. Livestock and the environment: what have we learned in the past decade? Annu. Rev. Environ. Resour. 40:177–202	Noted. As a preceding sentence now defines the term 'animal productivity' (in response the same comment concerning a different sentence) and considering the following discussion within the paragraph on meat/milk produced per animal, it is felt that further definition of animal productivity is not necessary.	Ainara Artetxe	NEIKER-Basque Institute of Agricultural Research	Spain
18353	36	10	36	13	These results are at odds with the majority of lifecycle assessments comparing agricultural production systems. Intensive production requires greater levels of inputs, including the importation of energy feedstuffs such as soya meal. However at the system level emissions tend to be lower for such systems given the productivity benefits that are leveraged. The conclusion that higher quality inputs result in more manure production is in my view specious - in any case the volume of manure is not the driving variable, rather the Vs and Bo of said manure, as well as the nitrogen excretion factor associated with the diet. A shift form predominantly grazed diets (which oversupply dietary protein for a target energy intake) to one with a higher proportion of maize and/or grains would reduce Nex. Suggest redrafting this paragraph with greter reference to both the lifecycle assessment literature, and livestock nutrition literature.	Rejected. It is accepted that intensification may in general, reduce emissions per unit of product at a systems level (which is already pointed out in the text), but it will not reduce emissions per animal or area. However, reference is now made to factors such as dietary manipulation, counteracting some of the potential, increased emissions per animal.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
24987	36	11		13	We strongly back the inclusion of the assertion that "increased individual animal productivity generally requires increased inputs (e.g. feed) and this generates increased outputs (e.g. manure), and associated emissions of CH4 and N2O". Add: "Poore and Nemecek (2018) found that there is considerable variation in the emissions intensity of meat production depending on production method. More intensive livestock farming generally tends to place meat production at the higher end of this emissions intensity spectrum	Noted. The authors are grateful for the reviewer's support and thank them for the suggested reference. Unfortunately, due to space limitations, it was not included.	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
21203	36	13	36	14	The livestock population increase can also be put in relation with the crop-livestock diversification strategy in land-fragmented and self-sufficiency households farms, most heavily concentrated in Asia and Africa (approximatively 80% of the world's 1.3 billion poor people) [FAO, 2006; McDermott et al, 2010; Alary et al. 2015]. In these small-scale farming systems where land property become too small, livestock is often the only opportunity to build up a heritage. Moreover, animal products accounted for an average of 33% of the protein in a daily balanced diet of the 864 million people worldwide who are undernourished or malnourished (FAO 2006). Livestock Report 2006	Accepted. The text has been modified accordingly and the two most recent mentioned references have been cited.	Government of France	Ministère de la Transition écologique et solidaire	France
71801	36	13	36	13	add: ..., "not least from the expansion of agricultural land used for the production of animal feed"	Accepted. Thank you (though the wording was slightly changed).	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
4451	36	36	36	36	pt. 7.3.2.2 ... Have sub-heads for major produces including rice	Rejected. Unfortunately, due to word count/space restrictions, text must be relatively brief and concise. Further division of discussion under sub-headings is not possible.	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
21205	36	47	36	48	Here it is mentioned that Asia is the largest contributor to emission through rice. But in the sentences that follows it becomes very confusing as Africa and Europe are mentionned with the highest numbers. The different time span makes it rather confusing. This paragraph might need some rewriting	Agreed. The sentence is somewhat confusing. It is hoped that modifications have addressed concerns.	Government of France	Ministère de la Transition écologique et solidaire	France
49839	37	8	37	8	The use of	Noted. It is unclear what this comment refers to. No changes were made.	Arthur Lee	Chevron Corporation	United States of America
11801	37	13	37	18	Nitrogen fertiliser use should also be correlated with higher yields, higher nitrogen efficiency (+30 percent in Sweden in the period 1987–2007 and higher carbon sequestration due to higher yields.	Rejected. Higher yields are already mentioned and while accepting increased NUE may lead to reduce N2O emissions per unit of product, this section deals with absolute N2O emissions and therefore, describes trends in total nitrogen fertilizer use. Additionally, the section concerns agricultural emissions (as outlined in Section 7.2) and does not include emissions from soil C loss	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
76807	37	14	37	14	Why "suggested"? It is not a fact?	Accepted. The word "identified" is now used.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
53377	37	15	37	15	Change "Latest" to "The latest".	Accepted. Relevant sentences have been changes.	Donald Smith	McGill University	Canada
18355	37	21	37	21	"Intensification of Livestock Production" - whilst fertiliser inputs to high quality feed crops are necessary (ca 180kgN ha-1), the overall requirements are generally lower than for grassland fertilisation (ca 250kgN ha-1). Note it is possible to feed a larger number of animals on a smaller area of land using more intensive diets (due to the productivity benefits leveraged) so overall fertilisation requirements are likely to be practically reduced by such strategies for a given level of aggregate deamnd. It would perhaps be better to link increased fertiliser requirements to an increased demand for livestock products in general, with a consequent increase in N inputs to feed and forage.	Accepted. Reference is now made to 'increased demand for livestock products'	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
21207	37	21	37	21	Increased yields are in response to increased demand for food, feed, fuel and fibre crops which in turn has been driven by a growing human population (FAO 2019), intensification of livestock production (Tian et al. 2020) and bioenergy policy (OECD-FAO 2019). insert "increase and" before "intensification". Feed demand is driven up not only by intensification (replacing grass with maize) but mostly by sheer increase in livestock production (more livestock require more feed, no matter the production practices).	Noted. The sentence has been changed in response to another comment. It is hoped that changes sufficiently satisfy the reviewer's comments.	Government of France	Ministère de la Transition écologique et solidaire	France
1409	37	27	37	36	Some data about Africa would be necessary especially as nitrogen fertiliser use is likely to keep increasing in the years to come to address the issue of yield gap for most of the crops in this region.	Unfortunately, this section was removed during final editing.	Julien Demenois	Cirad	France
21209	37	27	37	36	Some data about Africa would be necessary especially as nitrogen fertiliser use is likely to keep increasing in the years to come to address the issue of yield gap for most of the crops in this region.	Noted. This comment is repeated elsewhere (Comment ID: 1409)	Government of France	Ministère de la Transition écologique et solidaire	France
21211	37	33	37	36	This sentence should be under 7.3.2.2 Rice cultivation	Unfortunately, this section was removed during final editing.	Government of France	Ministère de la Transition écologique et solidaire	France
74685	37	33	37	37	May be added please - South Asia is a critical region regarding Nitrogen emissions. Fertilizer inputs especially Nitrogen have been projected to double, under increasing population and demand scenarios, to give the highest N inputs in the world by 2050. Nitrogen Use efficiency has halved since 1990. Increasing per capita intake of livestock products further reduces NUE. Given such a present and projected situation, nitrogen management is an intractable challenge for South Asia.	Unfortunately, this section was removed during final editing.	Muhammad Arif Goheer	GCISC	Pakistan
53379	37	35	37	35	Change "was" to "were".	Unfortunately, this section was removed during final editing.	Donald Smith	McGill University	Canada
29665	37	36	37	36	The description of drivers in agriculture omits emissions and removals from soil carbon. Please consider if this could be included in addition to livestock, rice and fertilizer.	Rejected. This section covers drivers of agricultural emissions trends (as described in 7.2.3). Though potentially having considerable mitigation potential (as outlined in 7.4.3), soil C sequestration on Ag. land, or indeed CO2 emissions from agricultural management, are not identified as key sources/drivers and accordingly, not discussed.	Government of Norway	Norwegian Environment Agency	Norway
70187	37	36	37	36	I miss a specific point about other no syhthetic fertiliser use for instance (manure, compost, biochar, other carbon sources)	Noted & rejected. Manure management and synthetic fertilizers are deemed the principal drivers of Ag (Section 7.2.3). emission trends and are discussed accordingly. Manure is included under livestock management. Other fertilizer types have been omitted as available data only identify and refer to N fertilizers.	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain
66257	38	1	38	2	I think you better separated the a and b part. The a part can be move to "livestock number and productivity", while the b part can be there still	Rejected. The reviewer's comment is noted. Regrettably space restrictions require the two graphs to be presented together. As no other comments were received concerning the Figure, no changes have been made.	Marissa Malahayati	National Institute for Environmental Studies	Japan
83231	38	1	38	7	why do the poultry numbers appear as connected dots and not as a simple bar like for the other animal classes?	Noted. Higher poultry numbers (and the associated desirable unit of measure) require a secondary axis, preventing bar like representation. This follows the approach employed in AR5.	Geden Oliver	German Institute for International and Security Affairs	Germany
71803	38	9	40	1	Indirect drivers need a much more in-depth treatment. Something comparable to the treatment of direct drivers. Also, not only do drivers need to be mentioned, a link between indirect and direct drivers needs to be made very explicitly, particularly for trade	We understand the point but, unfortunately, due to space limitations we could not extend further the section. Other recent reports (IPCC and IPBES) also include syntheses about direct and indirect drivers.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
64825	38		40		Unfair subsidies into agriculture, as applied by some countries (e.g. North-west Europe), lead to unnecessary globalization of food production, higher farming and food production intensity in priviledged countries and devastation of food production, social and economical stability in discriminated countries, being in direct contradiction with the UN SDG No. 10, 12, 13 and 15. In addition, it leads to higher demand for transport of raw and processed foods across the continents (mostly by heavy road trucks) with negative impact on GHG production.	Partly accepted. Market distorting subsidies are now briefly mentioned under 'Economic development & cultural factors', though the specific points the reviewer makes have not been included.	Radek Svoboda	Czech Nuclear Society	Czech Republic
61421	39	1	39	1	Science and technology VERY IMPORTANT: Any word about forestry management and sustainability, within improvement of education systems that relay on conventional forest management? Only agriculture is elaborated here.	Agreed, this will be revised.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
3857	39	4			Table 7.3., under Demography - Human Migration, need to mention climatic migration (climatic refugees). https://www.unhcr.org/climate-change-and-disasters.html	Agreed, this will be revised.	Rosa M Poch	ITPS and UdL	Spain
11803	39	4	39	4	Section Innovations and governance, Table 7.3: Changes in farming systems: Important to quantify potential in innovation, eg. precision agriculture, plant breeding. New breeding technologies (such as CRISPR Cas9) not mentioned at all. Sustainable intensification is mentioned here and in other parts of the document as an important measure to secure increased food production without having to increase the area of arable land. The importance of this cannot be overestimated. Section Institutions and governance, Agreements and Finance: The potential of the financial sector as an important driver is almost neglected. The new international taxonomy on sustainable investments (under development) will with the current regulations steer investments away from agriculture and forestry since they are not regarded as sustainable.	Noted & partly accepted. Point 1: Quantification of potential from innovation is regrettably beyond the scope of this section. Point 2: CRISPR Cas9 is now alluded to. Point 3: Agreed and it is hoped that a new Box on Sustainable Intensification will emphasise its importance and need for careful implementation. Point 4: the chapter now includes a box on private sector investment in Section 7.6. This is now refered to in the text.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
28711	39	4	39		In table 7.3, under culture: COVID pandemic has demonstrated strongly that lifestyle behavior, mainly change in unsustainable consumerism (beyond diet) can affect deeply the impact of human of natural resources. It would be worth addid these factors too.	It is an important point but it can not be explained in detail here. Other parts of the report will include analyses of the pandemic impacts.	louis lubango Mitondo	United Nations	Ethiopia
45963	39	4	40	1	[Table 7.3] Regrading changes in farming systems: drip irrigation can not only save water, but through rebound effects can lead to opposite effects. Please add literature which points to potentially problematic effects of increasing technical efficiency (e. g., Science Direct, Resources, Conservation and Recycling, Wheeler et.al., 2020, The rebound effect on water extraction from subsidising irrigation infrastructure in Australia, https://www.sciencedirect.com/science/article/pii/S092134492030077X).	Accepted. Reference to rebound effects is included and the suggested reference.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
45965	39	4	40	1	[Table 7.3] Global trade: Trade has positive and negative impacts on land use and emissions. See for example here: Science Direct, Global Environmental Change, Vol. 22, Issue 1, Schmitz /Biewald et.al., 2012, Trading more food: Implications for land use, greenhouse gas emissions, and the food system, https://www.sciencedirect.com/science/article/abs/pii/S0959378011001488 . Please add therefore also literature which clarifies the ambiguous character of trade.	Agreed, this will be revised.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
70189	39	4	39	4	I shoud include in the cultural factors row a specific mention on healthier diet, in order to be coherent with table 7.5	Rejected, diet is mentioned and cross-reference with section 7.4 is included.	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain
71805	39	4			add urbanization to demographic drivers	Rejected, urbanisation is considered in the Direct drivers subsection.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76343	39	4			Table 7.3 gives only one population projection (FAO, 2019). For this important topic, it would be highly recommended to a) represent and discuss ranges of existing projections and the uncertainty attached to such estimates, and b) ensure consistency across the report (e.g. cf. Fig.3.7 depicting numbers from the scenario literature).	Partially agreed - the indication of other estimates is relevant, but due to space limitations we can not extend the discussion on these estimates.	Gerrit Hansen	Robert Bosch Stiftung	Germany
21213	39		39		Table 7,3 1st line of "Culture:" : More recently, COVID enhanced the consumption of locally-produced food and other AFOLU derived goods	It is an important point but it can not be explained in detail here. Other parts of the report will include analyses of the pandemic impacts.	Government of France	Ministère de la Transition écologique et solidaire	France
8477	40	1			(Levang et al. 2015, Varghese et al. 2015). Always eparate different citation/refernces by ; not by dot or :. E.g. (Levang et al. 2015; Varghese et al. 2015).	Thank you, editorial comment.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10241	40	1	40	1	(Levang et al. 2015, Varghese et al. 2015). Always eparate different citation/refernces by ; not by dot or :. E.g. (Levang et al. 2015; Varghese et al. 2015).	Thank you, editorial comment.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
30755	40	1	40	1	[Institutions and governance] - [Agreement and Finance]: Please refer to the restoration of peatland, i.e., several countries adopted policies and committements to restore degraded land and peatland（Paustian et al., 2016, Nature, 532, 49-57.）.	Rejected, restoration and associated policies are considered in sections 7.4 and 7.6	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
49899	40	1	40	1	Under technological factor one could mention that biomass consumption showed almost identical changes than population, but that the biomass use efficience increased greatly leading in a decoupoling of biomass demand and land-use pressure (e.g. human appropriation of NPP): Krausmann 10.1073/pnas.1211349110	Thank you, this point will be included.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
70191	40	1	40	1	Sciece and thecnology row, I miss a specific mention to the change due to organic agriculture, cross refeerence to box 7.7. https://doi.org/10.1038/nplants.2015.221	Accepted. Reference to 'alternative farming approaches', a new box on Sustainable Intensification and Box 7.7 is now made.	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain
79815	40	1	40	1	Changes in farming systems in Brazil are well illustrated in the paper from Polidoro et al. - Potential impact of plans and policies based on the principles of CA on the control of soil erosion in Brazil. Land Degradtion and Development. 2021. https://doi.org/10.1002/ldr.3876.	Thank you for the reference. An example from Brazil is already included in this topic.	Lucia Helena ANJOS	UFRRJ	Brazil
3859	40				Table 7.3., the section Changes in farming systems gives the impression that new technologies go in the direction of higher environmental conservation, when it is not always (not often) so. In some cases they are threatening food security, since these high technology systems are not available for local population. See for instance: doi:10.1017/sus.2018.11	Accepted. A sentence indicating that changes may result in both positive and negative impacts is now included.	Rosa M Poch	ITPS and UdL	Spain
3861	40				Table 7.3., the section Agreements and Finance is too optimistic. The country regulations and company initiatives are minimal and with no much impact on global figures. As long as the outcomes of the COPs are only recommendations countries and big companies are not going to comply them. Some more realistic statements giving a more complete view on this matter should be included here.	Rejected, the discussion on policies is included in section 7.6 and also in a specific chapter of the report.	Rosa M Poch	ITPS and UdL	Spain
21215	40		40		Tavble 7,3 lines 6-7 (Research and techn.) : The mention of the article from Giller and Ewert, 2019 would be appropriate here. They nicely argue on the importance of the complementary of field trials and crop modelling to improve crop production in the context of climate change, using the example of Australian wheat breeding program: "Collaborative research utilizing field trials and whole farm crop simulation enables adaptation of Australian wheat crop practices. Novel varieties sown earlier enable a longer growing season, which facilitates wheat yield increases despite an increasingly challenging climate." Giller, K.E., Ewert, F., 2019. Australian wheat beats the heat. Nature Climate Change 9, 189. https://doi.org/10.1038/s41558-019-0427-7	Accepted. Giller's & Ewert's work is now referred to.	Government of France	Ministère de la Transition écologique et solidaire	France
21217	40		40		Citing Anderson et al 2020 would support the idea of the opportunity of a multicriteria systems approach, including crop breeding, for improving the sustainability of cropping systems and agriculture through their contribution to food security and GHG mitigation together. Particularly in the case or rice, a key player in this context. Robyn Anderson, Philipp E Bayer, David Edwards, Climate change and the need for agricultural adaptation, Current Opinion in Plant Biology, Volume 56, 2020, Pages 197-202, ISSN 1369-5266, https://doi.org/10.1016/j.pbi.2019.12.006. (https://www.sciencedirect.com/science/article/pii/S1369526619301219). Abstract: Agriculture and food security are predicted to be significantly impacted by climate change, though the impact will vary by region and by crop. Combined with the increasing global population, there is an urgent need for agriculture to adapt to ensure future food security for this growing population. Adaptation strategies include changing land and cropping practices, the development of improved crop varieties and changing food consumption and waste. Recent advances in genomics and agronomy can help alleviate some of the impacts of climate change on food production; however, given the timeframe for crop improvement, significant investment is required to realise these changes. Ultimately, there is a limit as to how far agriculture can adapt to the changing climate, and a political will to reduce the impact of burning of fossil fuels on the global climate is essential for long term food security.	Accepted. Reference is now made to Anderson et al.	Government of France	Ministère de la Transition écologique et solidaire	France
21219	40		40		Over the period 2016-2020 we can see the increasing market development of vegetable fat powder blends (based on palm oil), as substitute to milk powder (Duteurtre et al, 2020; Chatellier, 2020), redebating the environmental impact of the palm tree development (Meijaars et al, 2018). Duteurtre G., Corniaux C., De Palmas A., 2020 : « Lait, commerce et développement au Sahel : Impacts socioéconomiques et environnementaux de l'importation des mélanges MGV européens en Afrique de l'Ouest ». Rapport pour les Groupes « Les Verts » et « S&D » du Parlement Européen, CIRAD, Montpellier, 74 p. + annexes, Document téléchargeable sur https://agritrop.cirad.fr/597139/. Chatellier V. 2020. La dépendance de l'Afrique de l'ouest aux importations de produits laitiers. INRAE. Productions Animales, (2) : 125-140. Meijaard E., Garcia-Ulloa J., Sheil D., Wich S.A., Carlson K.M., Juffe-Bignoli D., Brooks T.M. 2018. Palmiers à l'huile et biodiversité : Analyse de la situation par le Groupe de travail de l'UICN sur les palmiers à huile. Union International pour la Conservation de la Nature. 147 p.	Noted. Following examination, it was decided not to include the suggested material and indicated references, maily due to space limitations.	Government of France	Ministère de la Transition écologique et solidaire	France
76809	41	1	106	12	Section 7.4 should more consistently consider (identify and quantify) trade-offs. For example, "foregone sequestration" is mentioned only once, in the context of soil carbon sequestration, pointing out that the impacts on "foregone sequestration do not apply" to that measure. It is not mentioned for many measures where it does apply. E.g., for biochar, only the benefits of applying char to soils are mentioned, but the benefits foregone by using biomass for biochar (as opposed to soil enrichment or other purposes) is not considered. The rebound effect is also not considered in this section, although it would seem relevant.	Noted, we revised the sub-sections and harmonized to more consistently consider tradeoffs.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
45967	41	3	41	3	The term "land-based climate change mitigation" is introduced here. This term and the term "land-based mitigation" play an important role throughout the chapter. It would be good to specify how the terms are used, as there is no definition of it in the glossary, and how it relates to other defined terms like nature-based solutions and ecosystem-based solutions. Please add these terms to the glossary and use them consistently throughout the report.	Accept. We specified these terms in the introduction	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
83233	41	5	41	8	Please use language consistent with the AR6 glossary definition of CDR. No need to refer to terms that were in widespread use in the past, but are kind of sidelined now (NETs and GGR - see COGS)	Partially accept. We will revise to reflect the glossary definition, but it is also important to note how these terms were referred to in the past	Geden Oliver	German Institute for International and Security Affairs	Germany
3863	41	6	41	7	soils are missing in the sentence (bold italics): "...dead organic material, in soils or in geological stores.."	Rejected. Vegetation, litter layer and soils are already captured in "live or dead organic material or geological stores". It is also defined as such in the SRCCL	Rosa M Poch	ITPS and UdL	Spain
21221	41	6	41	6	Please, add « in soil » after dead organic material	Rejected. Vegetation, litter layer and soils are already captured in "live or dead organic material or geological stores". It is also defined as such in the SRCCL	Government of France	Ministère de la Transition écologique et solidaire	France
73283	41	8			Please distinguish which source it is among the ones by 'Rogelj et al.' in 2018.	Accept, the references have been revised	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73285	41	8			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Accept, the references have been revised	Raehyun KIM	National Institute of Forest Science	Republic of Korea
29671	41	19	41	20	The text discusses mitigation measures, which include reduced emissions and increased removal. In line 19-20, these are further categorised into, i.e. (4) demand side measures. Hence, it is a question whether demand-side measures also could include demand for removal - which will give more balanced discussion including both emissions and uptake (currently, the focus of demand-side measures are restricted to emissions - of which we want less, and omits removals - of which we want more). Please also consider if the definition of demand side measures in the glossary is appropriate since it seems to not include removals.	Yes, demand-side measures can include emission reductions and enhanced removals. We will ask to include in the Glossary.	Government of Norway	Norwegian Environment Agency	Norway
76811	41	37	41	37	The reference to estimating mitigation potentials against a counterfactual baseline is welcome and should be followed. However, it is not clear whether it is implemented in the chapter in a consistent manner. For example, for "sustainable forest management", it is not clear what the baseline would be: a primary forest, or abandonment of management, unsustainable management or the continuation of well-established practices. All of these are possible, but not all are considered, and under certain scenarios the measure may not even constitute "mitigation".	Noted, we clarified forest management counterfactual	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
8479	42	5			use ; not comma here	Unclear comment. Editorial will address	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10243	42	5	42	5	use ; not comma here	Unclear comment. Editorial will address	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73287	42	5			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Accept, the references have been revised	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21223	42	12	42	12	Remembering what "individual measures" is refering to could enhance the clarity of the sentence.	Accept, clarified by adding definition	Government of France	Ministère de la Transition écologique et solidaire	France
71807	42	13	42	20	It would be important to at least mention the contrast in atmospheric lifetime between CH4, N2O and CO2. In particular since there are important pros & cons to prioritising SLCFs or long-lived gases (without starting a common metrics debate).	Accept, added GWP values	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21225	42	21	42	21	Please consider adding to this section somehting along the lines of: A more global analysis (potential vs cost, key side effects and cost/potential trends beyond 2050) based on the literature data on the six main NETs has highlighted two potential and promising technologies (afforestation/reforestation and soil carbon sequestration) and to a lesser extent BECCS (Fuss et al. 2018, Minx et al., 2018). Minx J.C., and Coauthors, 2018: Negative emissions - Part 1: Research landscape and synthesis. Environ.Res. Lett., 13, https://doi.org/10.1088/1748-9326/aabf9b (the other reference is already used by the authors)	Reject, we discuss this in later sections	Government of France	Ministère de la Transition écologique et solidaire	France
72653	42	21	43	13	Need a paragraph discussing the issue of permanence. Permanence is simply assumed in this text, but it is a real concern, particularly for avoided conversion practices, which are very easy to reverse. Restoration activities (including forest expansion) also face the challenge of remaining in the restored state indefinitely. In general, most of these practices have to contindue indefinitely in order to maintain their stated benefits. The potential lack of permanence should be a clearly identified risk in tables 7.6, 7.7, and 7.8. Leakage, or indirect land change due to preservation or restoration of some area, should also be discussed here, as it can negate permanence.	We couldn't add a paragraph because of space constraints, but we added a sentence on permanence a& leakage	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
84801	42	21	43	14	Discussion at sction 7.4.1.2 regarding co-benefits and risks may benefit from linking discussion regarding environmental laws and emphasising additionality. A number of countries have parallel regulatory frameworks that restrict or prevent the removal of native vegetation and require assessment and avoidance, minimimisation or offsetting of various impacts on the environment (eg: biodiversity and native vegetation offsets). The confluence between carbon offset co-benefits (or climate mitigation co-benefits) and these existing frameworks is increasing (as we see with overlap between Convention on Biological Diversity and UNFCCC matters). This section may benefit from the inclusion of some discussion/emphasis in relation to how transparency and traceability of co-benefits are critical to integrity (transparency), particularly in regions with other environmental market mechanisms.	Noted, we added in a sentence on transparency	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
11247	42	22	42	36	The absence ofa detaillied impact assessement on biodiveristy might be considered as an important flows of the SRCCL. Might be worth to mention it	Reject, we are limited by space and discuss biodiversity in detail in the following para and each sub-section	Bertrand Guenet	CNRS	France
77671	42	22	42	48	When considering 'net effects, it's important to bear in mind that many natural assets are irreplaceable in relevant time frames (2030 and 2050), especially given the rate of ecosystem decline and escalating threats from already locked in climate change. All primary forests and other carbon dense ecosystems are irreplaceable in these time frames. The fact that forests sequester more carbon in the second half and sometimes last quarter of their lives and that up half of all above ground living biomass is in the largest 1% diameter of trees, points to the urgent need to avoid trade offs and prioritise improved conservation management and protection (Mackey et al, Understanding the importance of primary tropical forest protection as a mitigation strategy, Mitigation and Adaption Strategies for Global Change, 2020). The risks associated with trading off biodiversity and ecosystems in good ecological condition for economic gain were well articulated by the IPBES 2019 and Millennium Ecosystem Assessment 2005. Restoration is pointless - whether for biodiversity or climate mitigation and adaptation - if we keep fragmenting and degrading relatively undisturbed natural ecosystems, given the time it takes ecosystems to recover their depleted carbons stocks (Matricardi et al. 2020 Science 369, 1378–1382), for ecological communities to reassemble providing stability and resilience (Gibson et al. Nature volume 478, pages378–381), and for the irreplaceable value of primary forests for biodiversity (Barlow et al, 2007 www.pnas.orgcgidoi10.1073pnas.0703333104).	We mention this in the sections on conversion (deforestation and conversion of peatlands)	Virginia Young	Australian Rainforest Conservation Society	Australia

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
80655	42	25	42	29	Bioenergy should not be included as mitigation measures. It also contradicts the realization of the land-based mitigation potential. Essentially, bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways	Reject, we include all land-based measures with estimates that provide mitigation	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80799	42	25	42	29	Bioenergy should not be included as mitigation measures. It also contradicts the realization of the land-based mitigation potential. Essentially, bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways	Reject, we include all land-based measures with estimates that provide mitigation	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
11805	42	26	42	26	Here it is stated that there are- with high confidence- land management options that mitigate climate change as well as land degradation, food security, SDG and NCP and these are primarily agriculture and soil based land management options. The current report under review has main focus on reforestation and afforestation as an carbon mitigation potential (see Table 7.5). In this table, the emphasis is strongly on forest mitigation potential. Under „Reducing conversion of savannah and grasslands" there is no regional data provided. This is especially disturbing as The World Resource Institute estimates that grasslands cover about 40 % of the earth's ice-free surface and store about 34% of terrestrial soil carbon stocks (White et al. 2000). Grasslands store 50% more carbon than forests worldwide and represent around 20% of global soil organic carbon (Conant et al. 2017). Several recent regional studies and global reviews have shown that grassland soils may be an important carbon mitigation sink (Conant et al. 2017, McSherry and Ritchie 2013, Lal 2004, 2008, Soussana et al. 2007; Soussana and Lüschert 2007, Smith 2014, Ward et al. 2014, Teague et al. 2016, Viglizzo et al. 2019). Under "Agriculture" – "Soil carbon management in grasslands", there is only one reference given for regional mitigation potential, "Soils Revealed" – and that citation is not in the reference list. For other regional mitigation potential, only one reference is for the most given, - and one "Griscom et al. 2017 dominates. To build guidance for the world´s climate policy based on data given in table 7.5 to 2050 is not trustworthy. Conant, R.T., Cerri, C.E.P., Osborne, B.B., Paustian, K., 2017. Grassland management impacts on soil carbon stocks: a new synthesis. Ecological Applications, 27:662–668. White R., Murray S., Rohweder M. 2000. Pilot Analysis of Global Ecosystems (PAGE): Grassland Ecosystems World Resources Institute, Washington, DC. McSherry, M. E., and M.E. Ritchie, 2013. Effects of grazing on grassland soil carbon: a global review. Global Change Biology, 19(5):1347-57. Lal, R. 2004. Carbon sequestration in dryland ecosystems. Environ. Mgmt. 33(4):528-544. Lal, R. 2008. Sequestration of atmospheric CO2 in global carbon pools. Energy Environ. Sci., 1:86–100. Soussana, J. F.; Allard, V.; Pilegaard, K.; Ambus, P.; Amman, C.; Campbell, C.; Ceschia, E.; Clifton-Brown, J.; Czobel, S.; Domingues, R.; Flechard, C.; Fuhrer, J.; Hensen, A.; Horvath, L.; Jones, M.; Kasper, G.; Martin, C.; Nagy, Z.; Neftel, A.; Raschi, A.; Baronti, S.; Rees, R. M.; Skiba, U.; Stefani, P.; Manca, G.; Sutton, M.; Tubaf, Z.; Valentini, R. 2007. Full accounting of the greenhouse gas (CO2, N2O, CH4) budget of nine European grassland sites. Agriculture, Ecosystems and Environment, 121:121-134. Soussana, J.F. and Lüschert, A. 2007. Temperate grasslands and global atmospheric change: a review. Review Article. Grass and Forage Science, 62 :127-134. Smith, P. 2014. Do grasslands act as a perpetual sink for carbon? Global Change Biology, 20:2708–2711. Teague W.R., Apfelbaum S., Lal R., Kreuter U.P., Rowntree J., Davies C.A., Conser R., Rasmussen M., Hatfield J., Wang T., Wang F., and Byck P. 2016. The role of ruminants in reducing agriculture's carbon footprint in North America. Journal of Soil and Water Conservation 71(2): 156-164. Viglizzo, E.F., M.F. Ricard, M.A. Taboada, G. Vázquez-Amábile. 2019. Reassessing the role of grazing lands in carbon-balance estimations: Meta-analysis and review. Science of the Total Environment 661: 531–542. Wang, YF, Chen H, Zhu QA et al. 2014. Soil methane uptake by grasslands and forests in China. Soil Biology and Biochemistry, 74:70–81. Ward, A.; Dargusch, P.; Thomas, S.; Liu, Y.; Fulton, E.A. 2014. A global estimate of carbon stored in the world's mountain grasslands and shrublands, and the implications for climate policy. Glob. Environ. Change, 28:14–24.	We rely on a comprehensive literature review that includes all of the citations you mentioned to develop the global estimate of soil carbon sequestration in grasslands. unfortunately, there are no other sources that provide regional potential across all regions. We also state in the A/R section that afforesting grasslands generates negative trade-offs.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
19755	42	42	42	42	land and soil resources	revised	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
71809	42	42	42	47	It's hard to disagree with the statement, but it does not say much either	noted	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
66101	42	44	42	44	Change to: "...efficacy and scale of..."	revised	Aaron Smith	Norwegian Institute of Bioeconomy Research	Norway
3865	42	45	42	46	soil is missing in the part within brackets: "(e.g. soil, biome, climate, food system, land ownership)"	accepted	Rosa M Poch	ITPS and UdL	Spain
73289	42	46			The work 'Hurlbert et al. (2019)' cannot be found in the References.	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77673	43	1	43	13	The good suggestions in this section for navigating and avoiding unacceptable trade offs would be enhanced by including reference to the analysis and three pillar framework developed by Morgan et al. in 2020 (Integrating forest management across the landscape: a three pillar framework, Journal of Environmental Planning and Management https://doi.org/10.1080/09640568.2020.1837747	noted, will consider adding to forest management section	Virginia Young	Australian Rainforest Conservation Society	Australia
61323	43	10	43	13	A link to the global commitment to Land Degradation Neutrality (LDN) should be included. This is both a commitment from SDG 15.3 as well as the UNCCD. Most courtiers have committed to the UNCCD LDN targets. Achieving LDN would have substantive GHG benefits.	Accept, added	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
63699	43	10	43	10	Toensmeier 2016 is not listed in the reference section	addressed	Government of Canada	Environment and Climate Change Canada	Canada
73291	43	10			The work 'Toensmeier (2016)' cannot be found in the References.	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73293	43	10			The work 'Francis (2016)' cannot be found in the References.	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73295	43	10			Please distinguish which source it is among the ones by 'Smith et al.' in 2019.	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
84573	43	10	43	10	Please add: "Karlsson, M., Alfredsson E. & Westling N. (2020) Climate policy co-benefits: a review, Climate Policy 20, 292-316. DOI: 10.1080/14693062.2020.1724070".	Accept, added	Mikael Karlsson	KTH Royal Institute of Technology	Sweden
73297	43	13			The work 'Longva et al. (2017)' cannot be found in the References.	revised	Raehyun KIM	National Institute of Forest Science	Republic of Korea
45969	43	14	43	14	It could be helpful to include a more prominent discussion on the sustainable mitigation potential (see ch.7, p.41, line 40f) in the first half of this chapter to prevent misinterpretation and counterbalance the fact that quantified potentials are only available for technical and economic potentials. If this is not included, a different title to the chapter should be considered, directly hinting to the focus on technical and economic potentials, e.g.: "Overview and assessment of global and regional technical and economic mitigation potentials". It would be helpful in this case to hint to the discussion on sustainability issues in other chapters.	Accept, added a sentence	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
50831	43	14	62	13	In this section various estimates of the AFOLU mitigation potential are discussed. However, for the SRCCL numbers the "full range of technical, economic and sustainability potential" (quote) is given, while for the more recent literature the numbers for economic (<$100/tCO2) and technical potential are presented separately, both for sectoral and IAM studies (table 7.4). This makes comparison very difficult. What is more problematic is that in the SPM (C.9) only the economic potential numbers for cost levels <$100/t are shown, while that cost level is unnecessarily limiting the potential in a net zero context. It would be more appropriate to use the technical potential.	We revised to focus on economic (<$100/tCO2) and technical for better comparison to AR5	Bert Metz	European Climate Foundation	Netherlands
76813	43	14	62	14	It is unclear how bioenergy is taken into account. Only BECCS seems to be consistently considered for mitigation in AFOLU, and only for its direct direct carbon impacts, not its substitution benefits (which are counted in the energy sector). "Bioenergy from residues" is sometimes mentioned (e.g., Table 7.4), although its use for energy generally increases (rather than reduces) emissions in AFOLU, and its benefits come entirely from substitution in the energy sector. But bioenergy from other sources (biofuels, biogas and other bioenergy based on dedicated energy crops, diversion of food crops or increased forest harvest) is not considered, although they are widely used for mitigation. Although their substitution benefits appear in the energy sector, they do have a significant GHG cost in AFOLU, which should be made explicit here, both because they are not considered under the energy sector and to allow the evaluations of trade-offs.	Section 7.4.4 describes this in detail, which we highlight in section 7.4.1	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
79915	43	14	43	14	Suggest to add public conservation initiatives for payments of ecosystems services (such as Costa Rica) or conservation payments such as the "Adopt a Park" by the Brazilian Government, established in the NDCs. Would be interesting to report on scientific data regarding ecological particularly mitigation benefits achieved through the Sustainable Forest Management programmes.	Comment seems misplaced	Carlos Ruiz Garvia	UNFCCC	Panama
77675	43	15	43	30	'Proforestation' (Moomaw et al. 2019 Front. For. Glob. Change, 11 June 2019 https://doi.org/10.3389/ffgc.2019.00027) should be included in the assessment of global forest potential. As Moomaw et al. note, allowing secondary natural forests to naturally regrow and recover their ecosystem carbons tocks is low cost to land, requires little or no establishment costs and provides the most resilient and secure pathway for long-term forest recovery. Landscape approaches that utilise 'proforestation' and other forms of natural regeneration to buffer and reconnect smaller remnant areas of primary (old growth) forests offer significant mitigation (adaptation and biodiversity) benefits in all forest biomes and need to be assessed (Moomaw et al, 2020, Clara Missing Pathways 2019, Morgan et al. 2020 https://doi.org/10.1080/09640568.2020.1837747).	Added to our global literature review	Virginia Young	Australian Rainforest Conservation Society	Australia
73299	43	17			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73301	43	17			The work 'Fran et al. (2020)' cannot be found in the Refences.	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73303	43	17	43	18	The work 'Baker et al. (2019)' cannot be found in the Refences.	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73305	43	18			The work 'Doelman et al. (2019) cannot be found in the Refences.	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73307	43	18	43	19	Please distinguish which source it is between the ones by 'Rogelj et al.' in 2018.	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
84943	43	20	43	24	Suggest rewrite to "According the estimate of SRCCL, the potential for AFOLU emission reduction in the supply-side is greatest in the reduced deforesttion and forest degradation (0.4-5.8 GtCO2-eq yr-1) and combined agriculture measures (0.3-3.4 GtCO2-eq yr-1) sectors. Potential for emission reduction in the demand-side is greatest in the shifting diet towards healthy and sustainable form (0.7-8.0 GtCO2-eq yr-1) and reducing food loss and waste (0.8-4.5 GtCO2-eq yr-1)."	Reject, the sentence was revised to another formulation	Singfoong Cheah	Independent consultant, formerly more than 10 years with the National Renewable Energy Laboratory, USA	United States of America
21227	43	21	43	21	can you categorise this into one of the categories listed at the beginning of section 7.4 / or is it a category missing at the beginning of section 7.4?	Accept, added information in 7.4 introduction	Government of France	Ministère de la Transition écologique et solidaire	France
51695	43	22	43	24	Mitigation potential numbers given for demand-side measures are completely inconsistent, e.g. with the number of 1.9 GtCO2 eq given on page 44 line 19. Consistency should be ensured.	Aceept, revised to clarify that some estimates consider diverted production, while others consider the full value chain	Florin Vladu	UNFCCC Secretariat	Germany
49845	43	24	43	24	should be 'which had the highest demand-side potential	Revised	Arthur Lee	Chevron Corporation	United States of America
73309	43	24			There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61325	43	25	43	26	The potential for carbon sequestration in croplands and grasslands is almost the same as for forests based on the figures given here, however, through almost the entire report there is a huge emphasis on forests and reforestation, with scant recognition of the potential in degraded non-forested land, despite these figures.	We try to balance this; the potential for SCS is across many more millions of ha and landowners which may reduce the potential	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
21229	43	27	43	27	"High confidence" was already given in the SRCCL but still is surprising given uncertainty, which is quoted in Roe et al. 2017 "The higher range of potentials are largely theoretical, as many estimates do not consider economic and political feasibility, contain uncertainty related to carbon gains and permanence, and require locating available, suitable land that limits food insecurity and biodiversity concerns.". In other places in the present text "medium confidence" is given, e.g. in 7.4.3 "there is medium confidence that enhanced soil carbon management in croplands has a global technical mitigation potential of 0.4-6.7."	Corrected to medium confidence	Government of France	Ministère de la Transition écologique et solidaire	France
49847	43	27	43	27	Table 7.4 on page 45 shows a differenet end value, 0.5 - 11.3 GtCO2eq yr-1, comparedd to the 0.4 - 11.3 here in the text. Is the 0.5 end value an update, thus updating 0.4?	Yes, the reduced range is an updated value	Arthur Lee	Chevron Corporation	United States of America
21231	43	28	43	29	The sentence seems a bit misleading because some estimates above (e.g. the maximum soil carbon sequestration for croplands and grasslands) do not consider the economic potentials and are technical potentials only (see also the previous comment).	Noted, we clarified the various estimates and provided descriptions on how they were calculated	Government of France	Ministère de la Transition écologique et solidaire	France
56015	43	31	43	31	Table 7.4 should be moved closer to paragraphs discussing it in text.	Noted, it follows the section on mitigation potential estimates	Government of United States of America	U.S. Department of State	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
63701	43	33	43	33	This Figure should not be listed as Figure 7.9?	Revised	Government of Canada	Environment and Climate Change Canada	Canada
14805	43	34	43	35	Should this not say 'for the 2030s" rather than 'in 2030'? Drawing implications from the average of a 3 decade period for results in a single year (2030) seems questionable.	We revised this paragraph and removed the mentioned sentence	Elizabeth Bush	Environment and Climate Change Canada	Canada
9609	44	4	44	12	What does it mean that for Demand-Side Measures, no data are available on cost-effective potentials according to the two USD/tCO2 abatement cost thresholds (see Table 7.4)? Indeed many demand-side measures may even save costs (Tukker et al. 2011, Ecol Econ, doi 10.1016/j.ecolecon.2011.05.001), i.e. would be available at negative costs per unit of CO2 saved, but seem to be excluded from the estimates of cost-effective measures. Moreover, many of these measures may also have positive health co-benefits, such as eating less animal products in regions where overconsumption abounds (e.g. see https://www.sciencedirect.com/science/article/pii/S2542519618302067)	Noted, we revised to clarify the estimates / description	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
49849	44	5	44	6	The ranges here in the text differ from the same categories of median values in the ranges in Table 7.4 on page 45. In the <USD 100 column for LULUCF, the median and the ranges are respectively, 6.8 (5 - 8.7) and 4.1 (-1.4 - 5.6). Here in the text, the median and the ranges are 6.8 (-0.2 - 10.5) and 4.1 (-0.1 - 9.5) GtCO2eq yr-1.	We revised and updated all the estimates including most recent literature up to Oct 2021	Arthur Lee	Chevron Corporation	United States of America
18357	44	13	44	22	This paragraph should note the regional constraints to some of these measures - increasing soil carbon in agricultural soils is of significant benefit in some parts of the world, particularly where historic soil damage (e.g. dust bowl) has occurred. In other regions more mature soilscapes and settled patterns of land use significantly limit the potential for soil carbon sequestration. We should also note risks and concerns around technologies such as Biochar for soil contamination (heavy metals, PAH atc).	Noted, we revised to address	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
49901	44	13	44	13	The term "enhanced management" needs to be specified. If it means increased harvest pressure / volumes, it is hardly in line with reducing emissions in short term against an no-mitigation counterfactual (as stated pg41 ln 37). Harvest mobilizes stocks that need time to recover, if not harvested, used forest continue to grow towards a steady state. Or, in cases where forests return, harvest immediately reduced she preveailing (net)sink functin. But the net-sinks are required to meet the GHG mitigation targets. See: Holtsmark 10.1007/s10584-011-0222-6, Schulze 10.1111/j.1757-1707.2012.01169.x, Booth https://doi.org/10.1111/gcbb.12716, Pingoud 10.1016/j.jenvman.2017.12.076 and many more, even back to Schlamadinger and Marland 10.1016/0961-9534(95)00113-1, 10.1016/S0961-9534(97)00027-5 So, enhanced management needs to be substantiated in order to stay in the list iwht the other measures.	Noted, we revised to improved management to be in line with the 'improved forest management' section	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
56017	44	13	44	16	In this write up here of the most prevalent forestry-related options, there is no mention of afforestation or reforestation, only restoration. Per this chapter's definitions, these are distinct efforts, and most models (sectoral or IAM) include AF/RF but not restoration. Most of the sectoral models cited in the chapter do include AF/RF so it is not clear if this omission is an oversight/typo. Make clear the role of AF/RF in overall estimates provided. Same comment provided for same text on page 5 (Executive Summary).	Noted, we clarify that A/R is considered, but given sustainability concerns, reforestation is prioritized	Government of United States of America	U.S. Department of State	United States of America
61327	44	13	44	22	Links should be made to the SDG 15.3 and UNCCD land degradation neutrality targets.	Noted, we added LDN reference in the previous section on co-benefits	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
76815	44	15	44	16	In addition to higher "mitigation densities", it could also be noted that "measures to protect" tend to deliver benefits faster. E.g., preventing the clearance of an area of forest (as opposed to clearing it) will have immediate benefits, but afforestating a sililar area may deliver comparable benefits over a much longer period.	Accept, we added this point	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
80657	44	16	44	17	Table 7.4; The estimated mitigation potential of BECCS and bioenergy should take into account that bioenergy, especially harvesting forest biomass for energy, is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Even when the bioenergy comes from burning forest residue, research shows that bioenergy is not carbon neutral within 10 years and often not carbon neutral for much longer. Repo, A., et al. (2012) Forest bioenergy climate impact can be improved by allocating forest residue removal, GLOBAL CHANGE BIOLOGY BIOENERGY, 4:202-212, 209 ("The results of this study show that using forest residues for energy production is neither GHG emission free nor carbon neutral. This is mainly because the combustion of forest residues releases the carbon into the atmosphere much faster than natural decomposition of the residues. Hence, the energy use of forest residues decreases the carbon stocks of the forests and increases the atmospheric concentrations of GHGs compared to situation in which harvest residues are not used for energy (e.g. Palosuo et al., 2001; Holmgren et al., 2007; Kujanpa ̈a ̈ et al., 2010; Walker et al., 2010; Zanchi et al., 2010)."); Booth, M. S. (2018) Not Carbon Neutral: Assessing the Net Emissions Impact of Residues Burned for Bioenergy, ENVIRONMENTAL RESEARCH LETTERS 13:1–10, 8. Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual	Reject, we include all land-based measures with estimates that provide mitigation	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
80801	44	16	44	17	Table 7.4; The estimated mitigation potential of BECCS and bioenergy should take into account that bioenergy, especially harvesting forest biomass for energy, is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Even when the bioenergy comes from burning forest residue, research shows that bioenergy is not carbon neutral within 10 years and often not carbon neutral for much longer. Repo, A., et al. (2012) Forest bioenergy climate impact can be improved by allocating forest residue removal, GLOBAL CHANGE BIOLOGY BIOENERGY, 4:202-212, 209 ("The results of this study show that using forest residues for energy production is neither GHG emission free nor carbon neutral. This is mainly because the combustion of forest residues releases the carbon into the atmosphere much faster than natural decomposition of the residues. Hence, the energy use of forest residues decreases the carbon stocks of the forests and increases the atmospheric concentrations of GHGs compared to situation in which harvest residues are not used for energy (e.g. Palosuo et al., 2001; Holmgren et al., 2007; Kujanpa ̈a ̈ et al., 2010; Walker et al., 2010; Zanchi et al., 2010)."); Booth, M. S. (2018) Not Carbon Neutral: Assessing the Net Emissions Impact of Residues Burned for Bioenergy, ENVIRONMENTAL RESEARCH LETTERS 13:1–10, 8. Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual	Reject, we include all land-based measures with estimates that provide mitigation	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
19757	44	17	44	17	soil organic carbon recabonization and management	Reject, we are limited by word count	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21233	44	18	44	18	would sustainalbe intensification not be a better term (it will include nutrient management, but also for example systems diversification)	Reject, We reference mitigation measures detailed in the following sub-sections	Government of France	Ministère de la Transition écologique et solidaire	France
66175	44	18	44	22	We could not find the reference for the value of 1.9 GtCO2-eq. This value is used both in a FAQ and in the SPM, hence it is important to provide full traceability. Could you please check the value and add a reference? What is the meaning of "only diverted agricultural production" in the case diet shifts? Could a value fully representing food system changes, including avoided land-use change, be provided?	We revised to clarify	Government of Belgium	Belgian Federal Science Policy (BELSPO)	Belgium
24623	44	20	44	20	The potential for healthy diets is described, however the effect does not take into account land use change. Would it not be possible to include the full effect of the measure? It is suggested to add a sentence about the potential effects if LUC and indirecte LUC are considered.	Noted, we revised to address	Government of Denmark	Danish Meteorological Institute	Denmark
21235	44	22	44	22	Emissions reductions related to land use change associated with change in diet has been estimated as being more important than change in production emissions, although the way yearly equivalent are computed may influence the results (Searchinger et al., 2018). https://www.nature.com/articles/s41586-018-0757-z	Noted, we revised to address	Government of France	Ministère de la Transition écologique et solidaire	France
76817	44	23	44	36	the regional discussion should reflect on how world regions are connected through commodity markets and how trade-off and synergies may involve far-away places.	Noted, we revised to address	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
83235	44	23	44	25	You indicated early on where the 100 USD threshold comes from, but isn't a uniform threshold applied to all regions a little problematic in terms of equity? Is the implicit assumption that climate finance or offsetting schmes would provide for tapping these potentials where it is cheapest? You should probably mention this at least once early on, could be taken up in the policy section later	We actually find that there is a relatively even application of mitigation potential across regions at the $100/tCO2 (if removing reduced deforestation which is little to zero in developed countries), so we didn't mention in the 7.4.1 section. But carbon pricing is taken up in the policy section.	Geden Oliver	German Institute for International and Security Affairs	Germany
21237	44	42	44	42	As importantly, avoiding deforestation by protecting forest can lead to a leakage effect, natural vegetation being cleared elsewhere to satisfy demand (Lambin et al. 2011). The cost of intensification or the decrease in food availability complementary to forest protection is in general not imputed to forest protection. https://www.pnas.org/content/108/9/3465	Unclear comment	Government of France	Ministère de la Transition écologique et solidaire	France
48013	45	0	46	0	The numbers presented for BECCS by IAMs in Table 7.4 are wildly different from those found in regional assessments in Table 7.5 for the same carbon cost (US$ 100/t), and also massively deviate from the technical potential of BECCS, a strange result that does not conform to previous estimations and something that is not adequately explained in the report. We strongly question the economic potential for BECCS as derived from IAMs, in a way not transparently explained or referenced in the report. As shown also in Cap 7, p. 99, l 17-19, a very low economic potential is given without no further explanation. As hinted in p. 96, l 39-44, there have been recent runs of IAMs that artificially limited BECCS, which would then have the effect of reducing its economic potential in the model results in a way that is completely circular and pre-determined by the models as an assumption. It would be completely inappropriate, therefore, to use those runs to inform a fair comparison of economic potential with other solutions. Moreover, Table 7.4 does not account other mitigation impacts of bioenergy such as increasing terrestrial carbon stocks (SOC) (when dedicated biomass is used) and displacement of other non-energy products (such as the co-production of DDG, meal etc). In fact, only the CDR component of BECCS is being considered. The substitution effects of bioenergy use in the energy sector are covered in the chapters covering Energy, Industry and Transport. The role of bioenergy substituting products in other sectors is missing. The role of Bioenergy enhancing carbon stocks is in SOC or increasing terrestrial biomass is also missing. These gaps should be carefully revisited by the authors in a reassessment of the mitigation potential of BECCS. The footnote should make clear this clear, as well as provide an additional figure highlighting the full mitigation potential of a BECCS strategy. This is a common recurring problem throughout the WGIII report: BECCS mitigation potentials are alternately presented with only bioenergy fossil displacement values or CDR sequestration values, when the true benefit of BECCS, of interest to policy makers, is the fact that it combines both. Table 7.4 should also be updated by including results from Strapasson et al 2017 (Strapasson, A., Woods, J., Chum, H., Kalas, N., Shah, N., & Rosillo-Calle, F. (2017). On the global limits of bioenergy and land use for climate change mitigation. Gcb Bioenergy, 9(12), 1721-1735). The study shows that "Under the extreme mitigation scenario, bioenergy could provide up to 11 GtCO2eq year−1 of GHG savings by 2050, representing approximately 13% of total emissions for all sectors compared to a business-as-usual scenario in which there is no significant increase in bioenergy over the same period. In addition, the GHG savings could be higher if bioenergy was enhanced with the use of negative emissions technologies, for example bioenergy with carbon capture and storage (BECCS) and biochar. Under the high mitigation scenario, the projected emission reductions would be very significant, approximately 7 GtCO2eq year−1 by 2050." Additional references: Moreira, J. R., Romeiro, V., Fuss, S., Kraxner, F., & Pacca, S. A. (2016). BECCS potential in Brazil: Achieving negative emissions in ethanol and electricity production based on sugar cane bagasse and other residues. Applied Energy, 179, 55-63. Baik, E., Sanchez, D. L., Turner, P. A., Mach, K. J., Field, C. B., & Benson, S. M. (2018). Geospatial analysis of near-term potential for carbon-negative bioenergy in the United States. Proceedings of the National Academy of Sciences, 115(13), 3290-3295. According to this study, there is a viable potential of BECCS between 360 to 630 360 Mt CO2·y-1to 630 Mt CO 2 ·y -1 in 2040, just in the United States. The study also recommends ways to perform a global study. This study should to be cited.	We removed the table and created a figure to focus on the mitigaiton scales, activities and regions	Marcelo moreira	UNICAMP - Agroicone	Brazil

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
50933	45	0	46	0	The numbers presented for BECCS by IAMs in Table 7.4 are wildly different from those found in regional assessments in Table 7.5 for the same carbon cost (US$ 100/t), and also massively deviate from the technical potential of BECCS, a strange result that does not conform to previous estimations and something that is not adequately explained in the report. We strongly question the economic potential for BECCS as derived from IAMs, in a way not transparently explained or referenced in the report. As shown also in Cap 7, p. 99, l 17-19, a very low economic potential is given without no further explanation. As hinted in p. 96, l 39-44, there have been recent runs of IAMs that artificially limited BECCS, which would then have the effect of reducing its economic potential in the model results in a way that is completely circular and pre-determined by the models as an assumption. It would be completely inappropriate, therefore, to use those runs to inform a fair comparison of economic potential with other solutions. Moreover, Table 7.4 does not account other mitigation impacts of bioenergy such as increasing terrestrial carbon stocks (SOC) (when dedicated biomass is used) and displacement of other non-energy products (such as the co-production of DDG, meal etc). In fact, only the CDR component of BECCS is being considered. The substitution effects of bioenergy use in the energy sector are covered in the chapters covering Energy, Industry and Transport. The role of bioenergy substituting products in other sectors is missing. The role of Bioenergy enhancing carbon stocks is in SOC or increasing terrestrial biomass is also missing. These gaps should be carefully revisited by the authors in a reassessment of the mitigation potential of BECCS. The footnote should make clear this clear, as well as provide an additional figure highlighting the full mitigation potential of a BECCS strategy. This is a common recurring problem throughout the WGIII report: BECCS mitigation potentials are alternately presented with only bioenergy fossil displacement values or CDR sequestration values, when the true benefit of BECCS, of interest to policy makers, is the fact that it combines both. Table 7.4 should also be updated by including results from Strapasson et al 2017 (Strapasson, A., Woods, J., Chum, H., Kalas, N., Shah, N., & Rosillo-Calle, F. (2017). On the global limits of bioenergy and land use for climate change mitigation. Gcb Bioenergy, 9(12), 1721-1735). The study shows that "Under the extreme mitigation scenario, bioenergy could provide up to 11 GtCO2eq year−1 of GHG savings by 2050, representing approximately 13% of total emissions for all sectors compared to a business-as-usual scenario in which there is no significant increase in bioenergy over the same period. In addition, the GHG savings could be higher if bioenergy was enhanced with the use of negative emissions technologies, for example bioenergy with carbon capture and storage (BECCS) and biochar. Under the high mitigation scenario, the projected emission reductions would be very significant, approximately 7 GtCO2eq year−1 by 2050." Additional references: Moreira, J. R., Romeiro, V., Fuss, S., Kraxner, F., & Pacca, S. A. (2016). BECCS potential in Brazil: Achieving negative emissions in ethanol and electricity production based on sugar cane bagasse and other residues. Applied Energy, 179, 55-63. Baik, E., Sanchez, D. L., Turner, P. A., Mach, K. J., Field, C. B., & Benson, S. M. (2018). Geospatial analysis of near-term potential for carbon-negative bioenergy in the United States. Proceedings of the National Academy of Sciences, 115(13), 3290-3295. According to this study, there is a viable potential of BECCS between 360 to 630 360 Mt CO2·y-1to 630 Mt CO 2 ·y -1 in 2040, just in the United States. The study also recommends ways to perform a global study. This study should to be cited.	We removed the table and created a figure to focus on the mitigaiton scales, activities and regions	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
45971	45	1	45	17	It seems useful to integrate in this figure (e.g. in a new column) and its caption ideas on the sustainable mitigation potential (see Chapter 7, p.41, line 40f) and in which scale it reduces the technical and economic potential. Otherwise readers might cite these numbers without regarding the sustainability aspects beyond costs. A short parallel discussion of sustainability issues in the caption can therefore prevent misinterpretation and prohibit misunderstandings.	We added a note in section 7.4.1 on the lack of available sustainable potential for all activities / regions, and the need to develop such estimates	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
56019	45	1	45	18	Why doesn't Table 7.4 also include a 2050 estimate for the sectoral model? For comparability with the IAM results presented, it would help to include the sectoral 2050 estimates too.	We rely on the existing literature, and some provide estimates for 2020, 2030, 2050 or an average across, so we averaged to include more literature	Government of United States of America	U.S. Department of State	United States of America
56021	45	1	45	18	It is not clear in Table 7.4 where these estimates of bioenergy from residues comes from or how it relates to the estimates above. Many sectoral models do not restrict bioenergy options to residues, though some IAMs do. It is essential to better explain where these are derived.	The table has been completely revised into a overview figure to address reviewer comments. We discuss the estimates and related references for each measure in their respective sub-section 7.4.2-7.4.5	Government of United States of America	U.S. Department of State	United States of America
83237	45	1	45	18	Right now, the accounting for negative CO2 delivered by BECCS does not happen in the countries/sectors that grow the biomass, but where the geological storage happens/is organized (see https://www.nature.com/articles/nclimate3369 and https://www.tandfonline.com/doi/full/10.1080/14693062.2018.1509044). Same goes for biomass growth vs. use. You should mention in the caption or in a footnote that your table is not entirely consistent with standard accounting systems or national inventories (IPCC 2006, not sure if there was any relevant change on that in IPCC TFI 2019)	Noted, we revised to address	Geden Oliver	German Institute for International and Security Affairs	Germany
49851	45				Table 7.4. Please ake the column headings consistent with the same label, which should be GtCO2eq yr-1	The table has been completely revised into a overview figure to address reviewer comments.	Arthur Lee	Chevron Corporation	United States of America
49853	45				Table 7.4. The 6.8 Gt number is not the same as on page 44 line 6. The range here is 6.8 (5 - 8.7). The text on page 44 line 6 is 6.8 (-0.2 - 10.5). The 4.1 (-1.4 - 5.6) in the table is different from the text on page 44, 4.1 (-0.1 - 9.5).	The table has been completely revised into a overview figure to address reviewer comments. We discuss the estimates and related references for each measure in their respective sub-section 7.4.2-7.4.5	Arthur Lee	Chevron Corporation	United States of America
48015	46	0	46	0	Table 7.5 should be updated by including results from Strapasson et al 2017 (Strapasson, A., Woods, J., Chum, H., Kalas, N., Shah, N., & Rosillo-Calle, F. (2017). On the global limits of bioenergy and land use for climate change mitigation. Gcb Bioenergy, 9(12), 1721-1735). The study shows that "Under the extreme mitigation scenario, bioenergy could provide up to 11 GtCO2eq year−1 of GHG savings by 2050, representing approximately 13% of total emissions for all sectors compared to a business-as-usual scenario in which there is no significant increase in bioenergy over the same period. In addition, the GHG savings could be higher if bioenergy was enhanced with the use of negative emissions technologies, for example bioenergy with carbon capture and storage (BECCS) and biochar. Under the high mitigation scenario, the projected emission reductions would be very significant, approximately 7 GtCO2eq year−1 by 2050." Moreira, J. R., Romeiro, V., Fuss, S., Kraxner, F., & Pacca, S. A. (2016). BECCS potential in Brazil: Achieving negative emissions in ethanol and electricity production based on sugar cane bagasse and other residues. Applied Energy, 179, 55-63. Bioenergy with carbon capture and storage (BECCS) is widely utilized in ambitious climate mitigation scenarios as a negative-emissions technology. However, the future technical potential of BECCS remains uncertain. Two significant deployment barriers that have largely been overlooked by previous studies are the suitability of existing storage sites and the availability of transportation of biomass and/or CO2. This study assesses the near-term deployment potential of BECCS in the United States in the absence of long-distance transportation networks. Considering these constraints, 30% of the projected available 2020 biomass resources can be utilized for BECCS, yielding a negative-emissions potential of 100 Mt CO2y−1. The analysis further pinpoints areas. Baik, E., Sanchez, D. L., Turner, P. A., Mach, K. J., Field, C. B., & Benson, S. M. (2018). Geospatial analysis of near-term potential for carbon-negative bioenergy in the United States. Proceedings of the National Academy of Sciences, 115(13), 3290-3295.	Noted, we added to BECCS section	Marcelo moreira	UNICAMP - Agroicone	Brazil
50935	46	0	46	0	Table 7.5 should be updated by including results from Strapasson et al 2017 (Strapasson, A., Woods, J., Chum, H., Kalas, N., Shah, N., & Rosillo-Calle, F. (2017). On the global limits of bioenergy and land use for climate change mitigation. Gcb Bioenergy, 9(12), 1721-1735). The study shows that "Under the extreme mitigation scenario, bioenergy could provide up to 11 GtCO2eq year−1 of GHG savings by 2050, representing approximately 13% of total emissions for all sectors compared to a business-as-usual scenario in which there is no significant increase in bioenergy over the same period. In addition, the GHG savings could be higher if bioenergy was enhanced with the use of negative emissions technologies, for example bioenergy with carbon capture and storage (BECCS) and biochar. Under the high mitigation scenario, the projected emission reductions would be very significant, approximately 7 GtCO2eq year−1 by 2050." Moreira, J. R., Romeiro, V., Fuss, S., Kraxner, F., & Pacca, S. A. (2016). BECCS potential in Brazil: Achieving negative emissions in ethanol and electricity production based on sugar cane bagasse and other residues. Applied Energy, 179, 55-63. Bioenergy with carbon capture and storage (BECCS) is widely utilized in ambitious climate mitigation scenarios as a negative-emissions technology. However, the future technical potential of BECCS remains uncertain. Two significant deployment barriers that have largely been overlooked by previous studies are the suitability of existing storage sites and the availability of transportation of biomass and/or CO2. This study assesses the near-term deployment potential of BECCS in the United States in the absence of long-distance transportation networks. Considering these constraints, 30% of the projected available 2020 biomass resources can be utilized for BECCS, yielding a negative-emissions potential of 100 Mt CO2y−1. The analysis further pinpoints areas. Baik, E., Sanchez, D. L., Turner, P. A., Mach, K. J., Field, C. B., & Benson, S. M. (2018). Geospatial analysis of near-term potential for carbon-negative bioenergy in the United States. Proceedings of the National Academy of Sciences, 115(13), 3290-3295.	Noted, we added to BECCS section	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
1137	46	1	50	20	Why are there no estimates for the mitigation potentials associated with more productive agriculture and forestry? It is clear from the discussion earlier in this chapter that increased productivity is key in preventing additional conversion of natural forest and grassland.	Sustainable intensification is discussed in a box, and includes measures we detail: enteric fermentation, manure, rice, nutrient management. Also we provide estimates for improved forest management	Reid Miner	Private Consultant	United States of America
29037	46	1	50	1	On 'Reduce deforestation': How can the economic potential be higher than the technical potential? Why did this option get the colour category for large global potential if the median value doesn't meet the requirement (> 3 GtCO2/a)? The same question goes for a lot of other colours in the table, several mitigation options' median values do not meet the assigned category. And the medians should be used for this, rather than the high end values of the ranges. Some median values are given as zero, I assume this was when there weren't enough data points to derive a median but then the value should be left out, not presented as zero.	The estimates have now been updated with more recent literature, and no longer have that issue	Jasmin Kemper	IEAGHG	United Kingdom (of Great Britain and Northern Ireland)

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
29673	46	1	46	1	For "reduce deforestation" the proposed economical potential is higher (2469 Mt) than the technical potential (1485 Mt), which is surprising and should be explained.	The estimates have now been updated with more recent literature, and no longer have that issue	Government of Norway	Norwegian Environment Agency	Norway
45973	46	1	50	1	Like with table 7.4, it seems useful to integrate in this figure and its caption ideas on the sustainable mitigation potential as well (see ch.7, p.41, line 40f). Otherwise readers might cite these numbers without regarding the sustainability aspects beyond costs. A short parallel discussion of sustainability issues in the caption can therefore prevent misinterpretation and prohibit misunderstandings.	The estimates have now been updated with more recent literature, and no longer have that issue	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
51697	46	1	46	70	Table 7.5: How can the economic potential for reducing deforestation be higher than the technical potential in Latin America and Caribbean? Not plausible, requires explanation.	The estimates have now been updated with more recent literature, and no longer have that issue	Florin Vladu	UNFCCC Secretariat	Germany
56023	46	1	46	18	In Table 7.5, how can the sectoral economic potential global estimate for reduced deforestation be smaller than the biophysical potential? Is that a typo or the actual outcome? If the latter, this merits explanation.	The estimates have now been updated with more recent literature, and no longer have that issue	Government of United States of America	U.S. Department of State	United States of America
79913	46	1	46	1	On table 7.5, I suggest to split the information provided on forest fires management separating the efforts of combatting fires and preventing the fires both under fires management.	Reject, there is not enough data to split this category	Carlos Ruiz Garvia	UNFCCC	Panama
21239	46		46		According to the map below , it would be clearer to rename this column "Northern and Central Asia". All of Europe is light or dark blue, so "Developped countries" ..	Reject, the regions are the universally used and accepted regional grouping for IPCC AR6 WG3 chapters	Government of France	Ministère de la Transition écologique et solidaire	France
50823	46		46		caption table 7.5 how can economic potential be presented without a clear definition of the carbon price cut off? As can be seen from table SPM 7.4 the cutoff level for costs in the IAM calculations is $100/tCO2e. That is too low to get meaningful numbers for the period till 2050, when global emissions need to be near zero or at least very low. So using those $100/t numbers in table 7.5 is misleading	Reject, the $100 threshold and lower are used standarly throughout the AR6 report. We provide higher level estimates for $100-200 in Ch 12	Bert Metz	European Climate Foundation	Netherlands
73311	46				Regarding the colomn of 'Refs(Global)' in the table, 'Busch & Engelmann 2017' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73313	46				Regarding the colomn of 'Refs(Global)' in the table, 'Carter 2015' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.9	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73315	46				Regarding the colomn of 'Refs(Global)' in the table, 'Favero et al 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.10	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73317	46				Regarding the colomn of 'Refs(Global)' in the table, 'Houghton et al 2015' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.11	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73319	46				Regarding the colomn of 'Refs(Global)' in the table, 'Project Drawdown 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.12	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73321	46				Regarding the colomn of 'Refs(Global)' crossing the row of 'Afforestation and/or Reforestation' in the table, 'Smith et al 2013' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
80659	46		50		Table 7.5; Burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels. BECCS is further complicated by the fact that it is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.").	Noted	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80803	46		50		Table 7.5; Burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels. BECCS is further complicated by the fact that it is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.").	Noted	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
49903	47	1	47	1	Table: the definitions of Improved and Sustainable forest managment seems to be tautological or at least normative and not realistic. This needs to be made operational and explicitly explained. In particular the trade-off between harvest and carbon stock is importnat here. The funcitons and aims listed here (now in the future relevant ecological, economic and social functions...) are not synergistic, but in harsh trade-off relationships here. One cannot easily increase harvest and carbon stocks and biodiversity in forests at the same time. See Camia et al from JRC: Camia, A., J. Giuntoli, R. Jonsson, N. Robert, N.E. Cazzaniga, G. Jasinevicius, V. Avitabile, G. Grassi, J.I. Barredo, und S. Mubareka. The use of woody biomas for energy production in the EU. Bd. EUR 30548 EN. Luxembourg: Publications Office of the European Union, 2021. ISBN 978-92-76-27867-2. Furthermore, I am not convinced the qoutes are about the topic, please cross-check. See also pg 53	The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
56025	47	1	47	18	In Table 7.5, how can the sectoral economic potential global estimate for IFM/SFM be smaller than the biophysical potential? Is that a typo or the actual outcome? If the latter, this merits explanation.	The estimates have now been updated with more recent literature, and no longer have that issue - in Fig 7.11	Government of United States of America	U.S. Department of State	United States of America
63703	47	1	47	1	At row "Fire management", We think it should not be "0" for Eastern Europe and West-Central Asia, there should have potential, at least for Eurasian boreal forest	The table has been updated into a figure and are based on a literature review. We only provide estimates where there is data	Government of Canada	Environment and Climate Change Canada	Canada
11807	47	3	47	3	Table 7.5. Include a section on damage to forests (other than fire). For example, insect damage, fungal damage, etc. cause significant emissions of carbon and should therefore be included. These damages are also possible to reduce through forest management.	Reject, there is not enough data to split this category	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
72965	47	7	47	16	The following reference should be added to provide evidence of the linkage between forest management and food security in developing countires such as Nepal: Paudel, Jayash. "Community-managed forests, household fuelwood use and food consumption." Ecological Economics 147 (2018): 62-73.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Jayash Paudel	Boise State University	United States of America
6055	47		47		Table 7.5, line 4 column 2, it reads "soil carbon losses by oxidation" it would be more correct to say "soil carbon losses by mineralization"	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Remigio Paradelo	Universidade de Santiago de Compostela	Spain
21241	47		47		Similarly to "forest management", it should be "Improved and sustainable" afforestation and/or reforestation. There are many examples of unsustainable afforestation, especially in Southeast Asia (rubber tree, teaks) where soil organic matter is removed by severe soil erosion : Ribolzi et al., 2017, Lacombe et al., 2018., Neyret et al., 2020	Noted. We deleted the table and provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21243	47		47		2nd raw : This definition of IFM should be precised. Favero et al. 2020 have in mind "increased investment in harvesting and replanting, thinning, fertilizing, and other actions" while Griscom et al 2017 has in mind the exact opposite "timber harvests are halted during this century across all native forests currently under timber production". The other 3 references are not in the final list of references. On the sole basis of the two aforementioned references, the definition of Griscom should be preferred: in Favero et al., ~80% of the carbon effect studied in the paper comes from afforestation and the carbon effect from "IFM" is unclear. The effect size from Griscom is also more consistent with the figures proposed than with the figures from Favero which, if restricted to "IFM" would be much smaller (max 400 MtCO2/yr globally, if not negative). If you use Griscom's definition (decreased harvest), you can then use many references to support the claim and numbers for several temperate areas: (Agostini et al., 2013; Braun et al., 2016; Hudiburg et al., 2011; Lecocq et al., 2011; Roux et al., 2017; Valade et al., 2018). More generally, a supplementary material showing how the figures are derived from the quoted references would be welcome, for example in the form of a calculation sheet where one could see the original figure from each reference and how they are combined into this table. Agostini, A., Giuntoli, J., Boulamanti, A., 2013. Carbon accounting of forest bioenergy (JRC Technical Report). European Commission, Joint Research Centre, Ispra, Italy. Braun, M., Fritz, D., Weiss, P., Braschel, N., Büchsenmeister, R., Freudenschuß, A., Gschwantner, T., Jandl, R., Ledermann, T., Neumann, M., Pölz, W., Schadauer, K., Schmid, C., Schwarzbauer, P., Stern, T., 2016. A holistic assessment of greenhouse gas dynamics from forests to the effects of wood products use in Austria. Carbon Management 7, 271–283. https://doi.org/10.1080/17583004.2016.1230990. Hudiburg, T.W., Law, B.E., Wirth, C., Luyssaert, S., 2011. Regional carbon dioxide implications of forest bioenergy production. Nature Climate Change 1, 419–423. https://doi.org/10.1038/nclimate1264. Valade, A., Luyssaert, S., Vallet, P., Njakou Djomo, S., Jesus Van Der Kellen, I., Bellassen, V., 2018. Carbon costs and benefits of France's biomass energy production targets. Carbon Balance Manage 13, 26. https://doi.org/10.1186/s13021-018-0113-5	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Government of France	Ministère de la Transition écologique et solidaire	France
21245	47		47		How can the "147" in the last raw be so small? In the EU alone current peatland emissions are 100-200 MtCO2e/yr (eg. FAO 2020c). Peatlands are cheap to restore (cf Smith et al 2014 quoted here): actual costs are negligible (cutting drains, ...) and opportunity costs are limited to current, usually low-yield, agricultural or forestry use. For the EU only, Barthelmes et al (2018) estimate the potential at 109 MtCO2e/yr. Barthelmes, A., 2018. Reporting greenhouse gas emissions from organic soils in the European Union: challenges and opportunities, Proceedings of the Greifswald Mire Centre. Greifswald Mire Centre.	We updated the potentials with recent literature and illustrate in Fig 7.11	Government of France	Ministère de la Transition écologique et solidaire	France
73323	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Afforestation and/or Reforestation' in the table, 'Bastin et al 2019' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73325	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Afforestation and/or Reforestation' in the table, 'Favero et al 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.9	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73327	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Afforestation and/or Reforestation' in the table, 'Houghton et al 2015' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.10	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73329	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Afforestation and/or Reforestation' in the table, 'Kreidenweis 2016' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.11	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73331	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Afforestation and/or Reforestation' in the table, 'Liu et al 2016' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.12	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73333	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Afforestation and/or Reforestation' in the table, 'Sonntag et al 2016' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73335	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Afforestation and/or Reforestation' in the table, 'Project Drawdown 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.14	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73337	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Improved and sustainable forest management' in the table, 'Favero et al 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.15	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73339	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Improved and sustainable forest management' in the table, 'Golub et al 2009' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.16	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73341	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Improved and sustainable forest management' in the table, 'Sasaki et al 2012' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.17	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73343	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Improved and sustainable forest management' in the table, 'Sasaki et al 2016' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.18	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73345	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Fire management(forest, savanna and grasslands)' in the table, 'Tacconi 2016' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.19	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73347	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Reduce conversion of savannas and grasslands' in the table, 'Kruase et al 2017' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.20	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73349	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Reduce conversion of savannas and grasslands' in the table, 'Project Drawdown 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.21	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73351	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Reduce conversion and degradation of peatlands' in the table, please clarify the citation and the reference of 'Humpenöder et al 202'.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.22	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73353	47				Regarding the colomn of 'Refs(Global)' crossing the row of 'Reduce conversion and degradation of peatlands' in the table, 'Project Drawdown 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.23	Raehyun KIM	National Institute of Forest Science	Republic of Korea
6057	48		48		Table 7.5, under "Agriculture", first section about "carbon management in croplands" should include a part about "application of organic amendments", and not just making reference to biochar	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.23	Remigio Paradelo	Universidade de Santiago de Compostela	Spain

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
9921	48				Row Reduce conversion of coastal wetlands: add references Murdiyarso et al. (2015) and Arifanti et al. (2019) (in bold) Arifanti et al. (2019) "Carbon dynamics and land use carbon footprints in mangrove-converted aquaculture: The case of the Mahakam Delta, Indonesia" Virni Budi Arifantia, Boone Kauffmana, Deddy Hadriyanto, Daniel Murdiyarso, Rita Diana Published: Forest Ecology and Management: Volume 432, 15 January 2019, Pages 17-29 https://www.sciencedirect.com/science/article/abs/pii/S0378112718301427 Murdiyarso et al. (2015) "The potential of Indonesian mangrove forests for global climate change mitigation" Daniel Murdiyarso, Joko Purbopuspito, J. Boone Kauffman, Matthew W. Warren, Sigit D. Sasmito, Daniel C. Donato, Solichin Manuri, Haruni Krisnawati, Sartji Taberima & Sofyan Kurnianto Published: 27 July 2015 https://www.nature.com/articles/nclimate2734 Donato et al 2011; Griscom et al 2017; Griscom et al 2020; Howard et al 2017; Kauffman et al 2017; Pendleton et al 2012; Project Drawdown 2020; Murdiyarso et al. (2015); Arifanti et al. (2019)	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.23	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
21247	48		48		We suggest to add in the first raw of Agriculture : Corbeels, M., Cardinael, R., Naudin, K., Guibert, H., Torquebiau, E., 2019. The 4 per 1000 goal and soil carbon storage under agroforestry and conservation agriculture systems in sub-Saharan Africa. Soil and Tillage Research 188, 16–26. https://doi.org/10.1016/j.still.2018.02.015	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.23	Government of France	Ministère de la Transition écologique et solidaire	France
21249	48		48		We suggest to delete the mention to reduced tillage which has been shown to have no impact on soil C when the entire soil profile (down to 1 metre depth) is accounted for (Haddaway et al., 2017). Haddaway, N.R., Hedlund, K., Jackson, L.E., Kätterer, T., Lugato, E., Thomsen, I.K., Jørgensen, H.B., Isberg, P.-E., 2017. How does tillage intensity affect soil organic carbon? A systematic review. Environ Evid 6, 30. https://doi.org/10.1186/s13750-017-0108-9	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.23	Government of France	Ministère de la Transition écologique et solidaire	France
21251	48		48		This number "423" in the line "soil carbon …" seems high. In France (a country with ~10 Mha of grassland), it is close to zero, because a) current practices are already rather good and b) nutrient management has a null GHG impact as increased carbon storage is offset by increase emissions from fertilizer use. See Pellerin, S., Bamière, L., Constantin, J., Launay, C., Martin, R., Schiavo, M., Angers, D., Augusto, L., Balesdent, J., Basile Doelsch, I., Bellassen, V., Cardinael, R., Cécillon, L., Ceschia, E., Chenu, C., Darroussin, J., Delacote, P., Delame, N., Gastal, F., Graux, A.-I., Guenet, B., Houot, S., Klumpp, K., Letort, E., Martin, M., Mary, B., Menasseri, S., Meziere, D., Mosnier, C., Morvan, T., Roger-Estrade, J., Saint-André, L., Therond, O., Viaud, V., Rechauchère, O., Richard, G., 2019. A model-based assessment of the soil C storage potential at the national scale: A case study from France. Presented at the Food security and climate change: 4 per 1000 initiative new tangible global challenges for the soil.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We updated the potentials based on recently reviewed literature	Government of France	Ministère de la Transition écologique et solidaire	France
21253	48		48		In the las raw, we suggest to add the reference Corbeels, M., Cardinael, R., Naudin, K., Guibert, H., Torquebiau, E., 2019. The 4 per 1000 goal and soil carbon storage under agroforestry and conservation agriculture systems in sub-Saharan Africa. Soil and Tillage Research 188, 16–26. https://doi.org/10.1016/j.still.2018.02.015	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.23	Government of France	Ministère de la Transition écologique et solidaire	France
24625	48		48		To the text about 'Soil carbon management in croplands'. Aarhus University published a rapport in 2020 about Conservation Agriculture in Denmark and didn't find evidence that 'reduced tillage intensity' leads to accumulation of soil organic carbon. https://dcapub.au.dk/djfpdf/DCA_rapport_nr177_web.pdf	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.23	Government of Denmark	Danish Meteorological Institute	Denmark
24627	48		48		To the text about Agroforestry. Under Dansih conditions, the effect seems small and depends on management and the enviroment. Report to the Agricultural Agency Ref: https://pure.au.dk/portal/files/145801483/Levering_Skovlandbrug_del_1.pdf.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.23	Government of Denmark	Danish Meteorological Institute	Denmark
73355	48				Regarding the colomn of 'Refs(Global)' crossing the row of 'Peatland restoration' in the table, 'Couwenberg 2010' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73357	48				Regarding the colomn of 'Refs(Global)' crossing the row of 'Peatland restoration' in the table, 'Joosten & Couwenberg 2009' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.9	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73359	48				Regarding the colomn of 'Refs(Global)' crossing the row of 'Peatland restoration' in the table, 'Project Drawdown 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.10	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73361	48				Regarding the colomn of 'Refs(Global)' crossing the row of 'Reduce conversion of coastal wetlands' in the table, 'Donato et al 2011' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.11	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73363	48				Regarding the colomn of 'Refs(Global)' crossing the row of 'Reduce conversion of coastal wetlands' in the table, 'Kauffman et al 2017' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.12	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73365	48				Regarding the colomn of 'Refs(Global)' crossing the row of 'Reduce conversion of coastal wetlands' in the table, 'Project Drawdown 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73367	48				Regarding the colomn of 'Refs(Global)' crossing the row of 'Coastal wetland restoration' in the table, 'Project Drawdown 2020' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.14	Raehyun KIM	National Institute of Forest Science	Republic of Korea
11809	49	1	49	45	Table 7.5. The loss of substitution effect arising from the production of biochar, as well as when biochar is buried in the soil, should be included more clearly.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.11	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
72967	49	34	49	39	Improving nutrient management can improve water quality significantly. For example, Paudel and Crago (2020) provide evidence on the relationship between nitrogen and phosphorus fertilizer application and water quality in the United States using data from 1950 to 2005. The reference is: Paudel, J. and Crago, C.L. (2021), Environmental Externalities from Agriculture: Evidence from Water Quality in the United States. American Journal of Agricultural Economics, 103: 185-210. https://doi.org/10.1111/ajae.12130	The table has been deleted, and the co-benefits/risks information placed in the respective sub-section text and summarized in Figure 7.12	Jayash Paudel	Boise State University	United States of America
24629	49		49		To the text about 'Improve manure management'. Is biogas not mentionable as a way to reduce methane emissions? The sentence: 'improved storage and application practices' does this include frequent emptying of slurry from the pigsty basin, which is a cost effective way to reduce emissions? Also, does the mitigatioin measure include slurry cooling, which reduces methane emissions? ref: https://lbst.dk/fileadmin/user_upload/NaturErhverv/Filer/Tvaergaaende/Klima/Raadgivningsordning_.pdf	Yes, we include it as a measure and provide details in the subsection. We replaced the table with an overview figure 7.11	Government of Denmark	Danish Meteorological Institute	Denmark
81909	49		49		Table 7.5: The potentials for biochar applications in table 7.5 seem to include not only waste biomass but all biomass which would also include land conversion and in particular forest conversion for biochar production. This is not properly explained and the technical and economic potentials should only include the conversion of residues and waste biomass into biochar, as any forest biomass conversion to biochar will produce significant additional GHG emissions and will no longer represent a mitigation options. Please carefully review the quoted sources fpr the potentials whether they only refer to waste biomass and exclude any sources that assume forst conversion to biochar for the estimation of mitigation potentials.	I understand that the studies cited include only "sustainably-sourced biomass", ie exclude forest conversion, deforestation while some (Woolf for example) include purpose-grown biomass on "unused land".	Anke Herold	Oeko-Institut e.V.	Germany
1353	50	0	50	0	The increase of legume consumption instead of ruminant products in Europe from 2.7 to 11.4 kg/cap/year in Europe could lead to a reduction of emissions of 253 MtCO2e in 2050. Prudhomme et al. (2020) Assessing the impact of increased legume production in Europe on global agricultural emissions. Regional Environmental Change. Other studies have been carried out on the impact of dietary changes in Europe on emissions (e.g. 464 MtCO2eq in Westhoek et al, (2014) Food choices, health and environment: Effects of cutting Europe's meat and dairy intake). This figure reflects a bias in the analysis of the literature in this table towards IAM outputs.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.11	Rémi Prudhomme	CIRED	France
11811	50	1	50	45	Table 7.5 It is likely that the climate benefit from the use of wood products is underestimated. New technologies and applications can quickly increase the substitution effect. The opportunities for innovation are considered to be great. See, for example: Gustavsson, L., Truong, N.L., Sathre, R., Tettey, U.Y.A. (2021). Climate effects of forestry and substitution of concrete buildings and fossil energy. Renewable & sustainable energy reviews. 136. 1-15. Truong, N.L., Gustavsson, L. (2020). Production of district heat, electricity and/or biomotor fuels in renewable-based energy systems.Energy. 202. 1-12. Piccardo, C., Dodoo, A., Gustavsson, L. (2020). Retrofitting a building to passive house level: A life cycle carbon balance. Energy and Buildings. 223. 1-13.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.11	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
51699	50	1	50	70	Table 7.5: "Enhance use of wood products" is missing a row on economic potential (probably grey, but still important to have the table complete)	We added potentials and updated the table to a summary figure 7.11	Florin Vladu	UNFCCC Secretariat	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
24989	50	20		20	Add: "Unabated, the livestock sector could account for 49% of the world's allowable GHG budget by 2030 under the 1.5°C target (Harwatt, 2019). Without significant dietary change or food waste reduction, emissions from global agriculture and agriculture-related land use change could account for up to 77% of the world's allowable GHG budget by 2050 under a 2°C target (Bajželj, 2014)."Replace: "and food waste (discarded food in distribution, retail, food service and consumption)" With: "and food waste (food wasted intentionally or due to socio-economic factors at all stages of the supply chain)" Justification: Significant volumes of food waste also occurs in the food supply chain prior to the consumer due to socio-economic relations between powerful supply chain actors and their suppliers – including overproduction, cosmetic out-grading, and unfair trading practices (Gille, 2012; Gunders, 2012; Colbert and Stuart, 2015; Colbert, 2017a, 2017b; Bowman, 2018; Devin and Richards, 2018; Gascón, 2018; Soma, 2018; Johnson et al., 2019; Sinclair Taylor, Parfitt and Jarosz, 2019; Stangherlin, Duarte Ribeiro and Barcellos, 2019; Markou et al., 2020; Messner, Johnson and Richards, 2021).	We consider this in the livestock sub-section. The table was revised into a summary figure 7.11	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
21255	50		50		First raw of demand-side : The increase of legume consumption instead of ruminant products in Europe from 2.7 to 11.4 kg/cap/year in Europe could lead to a reduction of emissions of 253 MtCO2e in 2050. Prudhomme et al. (2020) Assessing the impact of increased legume production in Europe on global agricultural emissions. Regional Environmental Change	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Government of France	Ministère de la Transition écologique et solidaire	France
21257	50		50		First raw of demand-side :(Smyth et al., 2014) is a very interesting study at national scale in Canada on the mitigation potential of changes in wood uses (very large) vs changes in forest management (rather small). Smyth, C.E., Stinson, G., Neilson, E., Lemprière, T.C., Hafer, M., Rampley, G.J., Kurz, W.A., 2014. Quantifying the biophysical climate change mitigation potential of Canada's forest sector. Biogeosciences 11, 3515–3529. https://doi.org/10.5194/bg-11-3515-2014	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Government of France	Ministère de la Transition écologique et solidaire	France
50825	50		50		The numbers for the economic potential of BECCS are inconsistent with those in table 7.4. In table 7.4 the economic potential (for costs<$100/tCO2e) is given as 0.8-3.5 Gt for the sectoral analyses (CDR only), while in table 7.5 the number is 0.5-3.5 (CDR plus fossil substitution). The numbers in table 7.5 ought to be higher than those in table 7.4. The same holds for the IAM analyses, where table 7.4 gives the average 2020-2050 potential for BECCS as 0.6 (0-2.8) for cost levels <$100/t, while table 7.5 gives 0.6(1-2.8). Also here the numbers in table 7.5 ought to be higher as subsitution would add potential	We updated Table 7.3 and revised 7.4 into a figure 7.11; all have consistent estimates	Bert Metz	European Climate Foundation	Netherlands
73369	50				Regarding the colomn of 'Refs(Global)' crossing the row of 'BECCS' in the table, 'Koornneef et al 2013' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.8	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73371	50				Regarding the colomn of 'Refs(Global)' crossing the row of 'BECCS' in the table, 'Turner et al 2018' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.9	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73373	50				Regarding the colomn of 'Refs(Global)' crossing the row of 'Enhance use of wood products' in the table, 'Miner & Gaudreault 2016' cannot be found in the Refernces.	Noted, thank you. The table has been completely revised into a overview figure to address reviewer comments. We provide the definitions, estimates and related references for each measure in their respective sub-section 7.4.2-7.4.10	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8129	51	1	51	1	Figure 7.12: Please revise figure. In both panels, the cost effective potential matrix in the lower-right sub-panel lacks the discription of the x-axis, so what is indicated here?	Figure has been completely revised and designed to address collective reviewer comments	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
3867	51				In Fig. 7.12, it is only after a while that I found out that the colours of the cost effective potential refer to each macroregion. It is not explained in the graph and it is not necessary, it only adds noise to the map, and it is confounded with the colours of the sectors. So, only one colour scale for the whole world map.	Figure has been completely revised and designed to address collective reviewer comments	Rosa M Poch	ITPS and UdL	Spain
15267	51				In Figure7.12, the background colors of the maps of Taiwan Province and Chinese mainland are inconsistent. The East Section of China-India Border is wrongly drawn and the Dotted Line of South China Sea, Nanhai Zhudao, Diaoyu Dao and its affiliated islands of China are missing. It is suggested to use a color block map, delete the national boundary lines, adjust the base color of Taiwan province to be consistent with Chinese mainland, and mark the island points. As for the East Section of China-India Border, it is suggested to use a color block map or mark the line as claimed by the two sides in the disputed area.	Figure has been completely revised and designed to address collective reviewer comments	Government of China	China Meteorological Administration	China
19759	51		59		W =regulated hidrological cycle of watershed and SR= Recarbonization of soil	Noted, we consider in the overview figure 7.11	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21259	51		51		We recommend to move up or delineate the legend « for T, C and M as it takes a bit of time to understand it is related to the histograms, you may alternatively write it stands for the histograms x-axis label.	Figure has been completely revised and designed to address collective reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
61191	51		51		Figure 7.12 is deleted, the national boundaries are inaccurate, and it is easy to cause controversy. The cited documents are still under review, not publicly published documents.	Figure has been completely revised and designed to address collective reviewer comments	Jianguo WU	chinese research academy of environmental sciences	China
63045	51		51		Change "table 7.4" to "table 7.5"	Revised	Changke WANG	National Climate Center, China Meteorological Administration	China
71811	51		51		Developed countries is not a regional grouping.	It is the universally used and accepted regional grouping for IPCC AR6 WG3 chapters	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
1139	52	1	55	20	In the header to the table, "co-benefits" should be changed to "potential co-benefits" and "risks" should be changed to "potential risks"	Table has been deleted, and the co-benefits/risks information placed in the respective sub-section text and summarized in Figure 7.12	Reid Miner	Private Consultant	United States of America
1411	52	1	52	1	That would be necessary to specify how the TRL was assessed. For instance reduce deforestation or soil organic carbon management have a TRL of 8-9 while their large scale implementation is still a challenge and therefore their mitigation benefits are still mostly a potential. Generally, the discrepancy between the potential of mitigation in the AFOLU sector and its effectiveness on the last decades was highlighted at lines20-22, page 6, of this chapter. Therefore those values of TRL look a little bit in contradiction with this statement.	Table has been deleted, and the co-benefits/risks information placed in the respective sub-section text and summarized in Figure 7.12	Julien Demenois	Cirad	France
11813	52	1	52	45	In Table 7.6, the "categories" for mitigations measures is questioned. Under "Forest and other ecosystems" – "Afforestation and Reforestation" is grouped together. Afforestation – defined in Box 7.2 – is "The conversion to forest of land that historically has not contained forests" and Reforestation is "Reforestation Conversion to forest of land that has previously contained forests but that has been converted to some other use." There is a fundamental ecological difference between these. Afforestation can often be highly questioned as natural or semi-natural occurring ecosystems are converted to forest. More often these are "plantations" with very low biodiversity, often labelle "green deserts". In many countries in N-Europe, afforestation campaigns for climate mitigation is threatening natural, biodiverse ecosystems and causing SOC losses and ecosystem function from soil disturbance during ecosystem conversion. Further, often introduced/foreign and highly invasive tree species are used (i.e. Pinus contorta, Sitka spruce Picea sitchensis, Cottonwood, Populus trichocarpa), threatening native ecosystems (i.e. Iceland, Ireland, Norway, New Zealand, Chile and Argentina).It is very important that guidelines from IPCC make a clear division between Afforestation and Reforestation and raise warnings against tree plantations with invasive species that threaten biodiversity (see https://www.cabi.org/isc/). The note in "Best practices" on avoiding conversion of grasslands, planting monocultures and albedo is very important but should also be highlighted specially in the report (see also 7.4.2.2) as these are practiced today in many countries and needs to be specially warned in the Critical assessment and conclusion (page 63). The note on Risk in "Reduce grasslands and savannas conversion" limits land use for farming and food production is a highly questionable statement as most pastoral food production is based on grazing grasslands.	Noted, We discuss this in the A/R sub-section 7.4.2	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
11815	52	1	52	45	Table 7.6. Forest tree breeding should be included in the sections afforestation/reforestation or sustainable forest management since there is such great potential in traditional breeding methods, but also through new technology, see e.g.: Rosvall O, Bradshaw RHW, Egertsdotter U, Ingvarsson PK, Mullin TJ, Wu H. 2019. Using Norway spruce clones in Swedish forestry: implications of clones for management Scand. J. For Res. 34(5):390-404.	Noted, we will consider for the forest management section	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
15729	52	1	60	1	The column heading "risk" seems unrelated to what we typically think of as risks (uncertain events). A more appropriate wording could be "co-costs" or "negative effects".	Table has been deleted, and the co-benefits/risks information placed in the respective sub-section text and summarized in Figure 7.12	Katarina Elofsson	Aarhus University	Denmark
29647	52	1	53	1	Please consider if it is appropirate including substitution of fossile emissions as a co-benefit in the appropriate row category.	Table has been deleted, and the co-benefits/risks information placed in the respective sub-section text and summarized in Figure 7.12	Government of Norway	Norwegian Environment Agency	Norway
45975	52	1	52	1	In the column "afforestation and reforestation", the best practices to reduce risks should not only hint to avoiding plantation monocultures in grasslands, but in all ecosystems. The afforestation of peatlands or the reforestation of forested areas with non-native species can be detrimental to biodiversity as well.	Table has been deleted, and the information placed in the respective sub-section text and summarized in Figure 7.12	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
61329	52	1	52	1	This table deals extensively with degradation/transformation of forests, and restoring forest, but misses out on degradation and restoration of non-forest land. This despite other sections suggesting that GHG gains from this other land may be in the same order of magnitude as from forests. Land degradation/ restoration in non-forest land (e.g. grasslands, savanna) needs to be included beyond simply fire management. (see e.g. page 43-;line 25.	Table has been deleted, and the information placed in the respective sub-section text and summarized in Figure 7.12	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
61331	52	1	52	1	Afforestation and reforestation should be separated into 2 different issues. One is the restoration of a natural environment, the second is changing both the structure and ecological function of an environment into something totally different from its natural state. From an ecological and biodiversity perspective this is a huge difference. Afforestation can have multiple negative impacts and trade-offs, especially where it takes place in natural grasslands.	We discuss A and R in the subection text. Table has been deleted, and the co-benefits/risks information placed in the respective sub-section text and summarized in Figure 7.12	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
63705	52	1	52	1	Please specify what means the value reported in the "Readiness" column	Table has been deleted	Government of Canada	Environment and Climate Change Canada	Canada

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
70193	52	1	52	1	Reduce deforestation, include also a reduction of desertification https://doi.org/10.1029/96GL03925	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.11	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain
84803	52	1	60	1	Table 7.6 - this comment relates to the one immediately above, regarding co-benefits and risks and other environmental market mechanisms which have the potential to overlap (and measures needed to preserve integrity in climate change mitigation co-benefits - particularly, additionality). A number of countries have parallel regulatory frameworks that restrict or prevent the removal of native vegetation and require assessment and avoidance, minimimisation or offsetting of various impacts on the environment (eg: biodiversity and native vegetation offsets). The confluence between carbon offset co-benefits (or climate mitigation co-benefits) and these existing frameworks is increasing (as we see with overlap between Convention on Biological Diversity and UNFCCC matters). This section may benefit from the inclusion of some discussion/emphasis in relation to how transparency and traceability of co-benefits are critical to integrity (transparency), particularly in regions with other environmental market mechanisms.	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
3869	52				Table 7.6. the caption indicates LD for Land Degradation, but it does not appear in the table, so it could be removed from the caption.	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.13	Rosa M Poch	ITPS and UdL	Spain
3871	52		60		Tables 7.6., 7.7 and 7.8: Remove "Soil Fertility" and change to "Soil", as it is done with the other resources Water, Air or Biodiversity, which do not have any qualifier.	Noted. We update in the summary Figure 7.12	Rosa M Poch	ITPS and UdL	Spain
11249	52		52		For reduce deforestation, I found a bit contradictory to write in the co benefit column that it reduce deforestation increase yield and land availability and in the risk wrote that it limits land used for farming and food production. I see through which mechanisms reducing deforestation may increase the yield?	Intact forests maintain water and nutrient cycles which are critical for agricultural systems. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.13	Bertrand Guenet	CNRS	France
11251	52				For Afforestation and reforestation, same comment as above. Here perhaps I don't get right what you mean by yield. To me it means crop yield if you mean something else perhaps it is better to clarify	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.13	Bertrand Guenet	CNRS	France
21261	52		52		That would be necessary to specify how the TRL was assessed. For instance reduce deforestation or soil organic carbon management have a TRL of 8-9 while their large scale implementation is still a challenge and therefore their mitigation benefits are still mostly a potential.Generally, the discrepancy between the potential of mitigation in the AFOLU sector and its effectiveness on the last decades was highlighted at lines20-22, page 6, of this chapter. Therefore those values of TRL look a little bit in contradiction with this statement	The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.13. TRL was not retained	Government of France	Ministère de la Transition écologique et solidaire	France
21263	52		52		The scale used for TRL should be introduced here in order for the reader reading such a table for the first time to be able to understand the numbers.	The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.13. TRL was not retained	Government of France	Ministère de la Transition écologique et solidaire	France
21265	52		52		Bottom-right cell : Perhaps considering Duveiller et al. (2018) as well. "We show that perturbations in the surface energy balance generated by vegetation change from 2000 to 2015 have led to an average increase of 0.23 ± 0.03 °C in local surface temperature where those vegetation changes occurred. Vegetation transitions behind this warming effect mainly relate to agricultural expansion in the tropics, where surface brightening and consequent reduction of net radiation does not counter-balance the increase in temperature associated with reduction in transpiration" (https://doi.org/10.1038/s41467-017-02810-8)	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Government of France	Ministère de la Transition écologique et solidaire	France
21267	52		52		For high latitude in the last raw we suggest to add "Maintening understorey, avoiding fire or herbicides in plantation forests"	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Government of France	Ministère de la Transition écologique et solidaire	France
21269	52		52		The title of the last raw should be written "sustainable afforestation" because afforestation is not invariably sustainable	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Government of France	Ministère de la Transition écologique et solidaire	France
21271	52		52		In the 4th column of the last raw, it should be added "S - Increase erosion where understorey is removed by fire or herbicides"	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Government of France	Ministère de la Transition écologique et solidaire	France
21273	52		52		Neyret et al., 2020 and Ribolzi et al., 2017 suggested as a reference to be added in the bottom-right cell	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Government of France	Ministère de la Transition écologique et solidaire	France
61193	52		52		Afforestation and Reforestation, C-Change surface albedo (at higher latitudes) and evapotranspiration regime producing a net warming Effect, the warming effect is not necessarily in the high dimensions, but also occurs in the middle and low dimensions, and is related to the forest structure. Sustainable forest management-Affect albedo and evapotranspiration B-Decrease in biodiversity in case improved management is seen as short rotations, Continuous forest management is not closely related to short rotation periods. What is the impact on albedo and evapotranspiration?	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Jianguo WU	chinese research academy of environmental sciences	China
61195	52		59		Need to compare the conclusions of Table 7-7 and Table 7-8 with the content of SRCCL (IPCC 2019), and compare the inconsistent aspects	The tables have been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12. We provide an overview of differences from AR5 and SRCCL in section 7.4.1	Jianguo WU	chinese research academy of environmental sciences	China
61367	52		52		Reaforestation may also have negative environmental consequences that should be considered (see e.g.: Rewilding and restoring cultural landscapes in Mediterranean mountains: Opportunities and challenges García-Ruiz, J.M., Lasanta, T., Nadal-Romero, E., Lana-Renault, N., Álvarez-Farizo, B. Land Use Policy, 2020, 99, 104850) A more balanced assessment should be considered as carbon storage in soils of grasslands can be also be very relevant: Soil quality and soil organic carbon storage in abandoned agricultural lands: Effects of revegetation processes in a Mediterranean mid-mountain area Lasanta, T., Sánchez-Navarrete, P., Medrano-Moreno, L.M., Khorchani, M., Nadal-Romero, E. Land Degradation and Development, 2020, 31(18), pp. 2830–2845 , The effects of land abandonment and long-term afforestation practices on the organic carbon stock and lignin content of Mediterranean humid mountain soils Campo, J., Stijsiger, R.J., Nadal-Romero, E., Cammeraat, E.L.H. European Journal of Soil Science, 2019, 70(5), pp. 947–959	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
63047	52		52		Warming effect does not only occur at high latitudes, but also at middle and low latitudes, and it is also related to forest structure.	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Changke WANG	National Climate Center, China Meteorological Administration	China
63707	52		52		In Table 7.6, best practices could also include "Targeted protection of threatened, high density carbon and high biodiversity areas" in the first mitigation measure (Reduce deforestation), or it could be included as a separate measure called "Protection". References include Asner et al. 2014. Targeted carbon conservation at national scales with high-resolution monitoring. PNAS - https://doi.org/10.1073/pnas.1419550111, and Dinerstein et al. 2020. A "Global Safety Net" to reverse biodiversity loss and stabilize Earth's climate. Science Advances 04 Sep 2020 Vol. 6, no. 36. DOI: 10.1126/sciadv.abb2824. Sustainable forest management measure could also include "Proforestation (growing forests to older age before harvesting them)" as one of the best practices. Reference: Enhancing Canada's Climate Change Ambitions with Natural Climate Solutions, Risa Smith, ISBN 978-1-7773950-0-1, October 2020	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Government of Canada	Environment and Climate Change Canada	Canada
71813	52		60		Maybe it would be possible to color-code co-benefits and risks and thereby provide an indication of the scale of effects (where possible)	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.12	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73375	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Barlow et al., 2016' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.8	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73377	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Bayrak & Marafa, 2016' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.9	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73379	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Benayas, Newton, Diaz, & Bullock, 2009' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.10	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73381	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Caplow, Jagger, Lawlor, & Sills, 2011' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.11	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73383	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Curtis, Slay, Harris, Tyukavina, & Hansen, 2018' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.12	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73385	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Hosonuma et al., 2012' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73387	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Houghton, Byers, & Nassikas, 2015' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.14	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73389	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Lewis, Edwards, & Galbraith, 2015' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.15	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73391	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Pelletier, Gélinas, & Skutsch, 2016' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.16	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
73393	52				Regarding the 'Reference' colomn crossing 'Afforestation and Reforestation' row in the table, 'Bonan, 2008' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.17	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73395	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Boysen, Lucht, & Gerten, 2017' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.18	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73397	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Brundu & Richardson, 2016' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.19	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73399	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Cherubini et al. 2017' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.20	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73401	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Ciais et al., 2013' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.21	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73403	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Findell et al., 2017' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.22	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73405	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Kongsager et al. 2016' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.23	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73407	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Kreidenweis et al., 2016' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.24	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73409	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Medugu, Majid, Johar, & Choji, 2010' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.25	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73411	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Salvati et al. 2014' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.26	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73413	52				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Smith et al., 2013' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.27	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76819	52				The afforestation/reforestation has been practiced since long before climate change became a concern and would likely continue in the baseline. The presentation should reflect that it would only constitute mitigation to the extent it goes beyond BaU and if the climate benefits (e.g., through sequestration) outweight the GHG costs.	This is noted in the text. The table has since been deleted and turned into overview figure	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
86237	52		52		Table 7.7: Air pollution reduction is mentionned for every mitigation measure. However except for fire management, it's hard to see the link with air pollution, is it each time compared with case of replacement of forest, mangroves etc by cities/industries? Otherwise it appears a bit overemphasized here. Are there any real quantification of that or it just a supposition in the paper cited?	Various studies quantify air quality with the various land-based measures listed: intact forests, reduced CH4/N2O, etc. We revised the table into a summary table and more detail is provided in the sub-sections	Sophie Szopa	LSCE	France
1145	53	1	53	20	In the column "best practices to maximise benefits and reduce risks", in the row for "sustainable forest management" add "expanded use of SFM certification"	The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.11	Reid Miner	Private Consultant	United States of America
11817	53	1	53	45	Table 7.6. Evidence is not presented in the text on the value of "ProSilva type of management or continuous cover forest management" as climate mitigation measures to justify inclusion of in the table listing "best practices to maximise benefits and reduce risks" even though there are other features of these practices (e.g. biodiversity) that are documented in the text. On land where forest production is allowed, a central feature of forest management for climate mitigation is the rate of forest growth. The evidence we are aware of indicates that the growth rates achieved by continuous cover forestry in relation to other management alternatives are dependent on site conditions and management history (Lundmark et al., 2016; Lundqvist et al., 2017). This makes it difficult to see a general endorsement of continuous cover forestry as a best management practice for climate mitigation, which inclusion in Table 7.6 implies. A comparison of carbon balances between conventional even-aged management with clear-cutting and continuity forestry is published in: Lundmark, T., Bergh, J., Nordin, A. et al. (2016). Comparison of carbon balances between continuous-cover and clear-cut forestry in Sweden. Ambio 45, 203-213. A summary of growth differences between conventional stand management with clear-cutting and continuous cover forestry is published in: Lundqvist. 2017. Tamm Review: Selection system reduces long-term volume growth in Fennoscandic uneven-aged Norway spruce forests For Ecol. Manage. 391, 262-375.	Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.11	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
20403	53	1	53	1	In Table 7.6, Sustainable forest management is a too broad term to characterize the mitigation potential of forests. It would be better to state the mitigation contributions more explicitly, e.g. increasing carbon stocks of managed forests and the production of biomass to help mitigation actions in other sectors.	We revised the term. Noted. The table has been deleted, and the information detailed in the respective sub-section text and summarized in Figure 7.11	Tommi Ekholm	Finnish Meteorological Institute	Finland
49905	53	1	53	1	The line Sustainable forest management qoutes improves biodiversity and ecosystem services along with improves crop (!) productivity. Not many ofthe papers qouted show this, or claim it, but rather show that a reduction of harvest /restoration has a high potential for carbon sequestration (including my own paper Erb et al., 2018). Furthermore, no-management options have strong effects on regulating services, see 10.1016/j.foreco.2019.03.047, stronger than any management.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
56027	53	1	53	1	In Table 7.6, for Grassland fire management, one column says "conserves biodiversity" and next says "negative impact on biodiversity". Reconcile these and/or make distinctions clearer.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of United States of America	U.S. Department of State	United States of America
72655	53	2	53	2	A risk of sustainable forest management that is not listed is the potential reduction in wood product production, which is a socioeconomic or ressources and technology risk. If the same area is managed on longer rotations, or switched from clearcut to partial cut, or any other switch that reduces output, then this risk exists. Unless more area is brought under management. So another risk is indirect land use change (which can fall under several of the categories, C, B, LD) in order to make up the production deficit.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
11253	53				For sustainable forest management, once again the link between forest management and crop productivity is not clear to me except for agroforestery, forest and cropland are generally located at different places.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Bertrand Guenet	CNRS	France
11255	53				For grassalnd fire management, since it is clearly written that it conserves biodiversity in rangeland it worth mentionning that the negative impact are for other type of grassland	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Bertrand Guenet	CNRS	France
21275	53		53		Line "Sustainable forest ..." : These are all nice co-benefits of SFM but the list of best practices in the 5th column does not correspond to those for which the mitigation potential is assessed in table 7.5. So this is highly misleading. There are a few studies on the mitigation potential of RIL and improved regeneration, and none on the other practices listed here : "better (what does better mean?) schedule, intensity, ... and continuous cover."	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21277	53		53		We suggest to add in last line 3rd column "C - Affect albedo and evapotranspiration"	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21279	53		53		last line 3rd column : Although using LEDs may be questionable if energy and GHG emissions costs are taken into account in the global C budget (production, transport, utilization and recycling).	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
73415	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Stanturf et al., 2015' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.8	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73417	53				Regarding the 'Reference' colomn crossing 'Sustainable forest management' row in the table, 'Ashton et al. 2012' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.9	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73419	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'D'Amato, Bradford, Fraver, & Palik, 2011' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.10	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73421	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, please clarity which source it is between the work by 'Erb et al' in 2018.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.11	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73423	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, please clarify the reference of 'Grassi, Pilli, House, Federici, & Kurz, 2018'.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.12	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73425	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Jantz, Goetz, & Laporte, 2014' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73427	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Kurz, Smyth, & Lemprière, 2017' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.14	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73429	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Locatelli, 2011' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.15	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73431	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Pingoud, Ekholm, Sievänen, Huuskonen, & Hynynen, 2018' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.16	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73433	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Putz et al., 2012' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.17	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73435	53				Regarding the 'Reference' colomn crossing 'Reduce deforestation' row in the table, 'Seidl, Schelhaas, Rammer, & Verkerk, 2014' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.18	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76821	53				"Sustainable forest management" should be replaced with "improved forest management". This to indicate that mitigation should go beyond the baseline (consistent with the definition) and to make it consistent with the description, which talks about "improved managemet" and lists benefits and trade-offs that are consistent with improved practices, but not with BaU.	Agree, we made this revision	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
11257	54				For reduce grassalnd and savannah conversion, again I disagree here if we conserve natural land then it decrease the land availability for other uses like food production	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Bertrand Guenet	CNRS	France
21281	54		54		1rst line 5th column : Preservation of nomadic herding should also be mentionned as a way to reduce conversion to agriculture. See as reference: Leif V. Brottem. Environmental Change and Farmer-Herder Conflict in Agro-Pastoral West Africa. Human Ecology (44)5, 1-17. DOI 10.1007/s10745-016-9846-5	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21283	54		55		1rst line 4th column : Contradiction with the fact that this section refers to grasslands and savannah. The sentence should be transformed into "SE-Restrict the rights and access of local people to forest ressources…	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21285	54		54		last line 5th column : Why to mention only indigenous land tenure ? Peasant and more broadly community tenure should also be mentioned.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
73437	54				Regarding the 'Reference' colomn crossing 'Reduce peatland conversion' row in the table, 'Lilleskov et al., 2019' cannot be found in the References.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Raehyun KIM	National Institute of Forest Science	Republic of Korea
11819	55	1	55	45	Table 7.6. Peatland restoration. Include "avoid ditch-cleaning (where the production effect is weak)", as ditches will fill in again. Afforested peatlands can often be climate neutral, or have a positive effect on the greenhouse gas balance as long as good forest growth continues.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
11821	55	1	55	45	Table 7.6. For temperate and boreal conditions, we question the recommendation to remove planted trees from peatlands since afforested peatlands can often be climate neutral or have a positive effect on the greenhouse gas balance as long as good forest growth continues.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
6059	55		55		Table 7.6, in the section about peatland restoration, "removal of degraded topsoil" is mentioned as one of the best practices, it is not clear to what kind of degradation it refers, and in general removing topsoil is not a good practice in any case	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Remigio Paradelo	Universidade de Santiago de Compostela	Spain
11259	55				For Reduce mangroves conversion, I disagree that it will increase land availbility, fisherie production deforest mangrove to use the land so except if fisheries production management change drastically here again we have competition for the land	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Bertrand Guenet	CNRS	France
73439	55				Regarding the 'Reference' colomn crossing 'Peatland restoration' row in the table, 'Bonn et al., 2016' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.8	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73441	55				Regarding the 'Reference' colomn crossing 'Peatland restoration' row in the table, 'Limpens et al., 2008' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.9	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73443	55				Regarding the 'Reference' colomn crossing 'Peatland restoration' row in the table, 'Munang et al., 2014' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.10	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73445	55				Regarding the 'Reference' colomn crossing 'Reduce mangrove conversion' row in the table, 'Macreadi et al., 2019' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.11	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73447	55				Regarding the 'Reference' colomn crossing 'Reduce mangrove conversion' row in the table, 'Friess et al., 2020' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.12	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73449	55				Regarding the 'Reference' colomn crossing 'Reduce mangrove conversion' row in the table, 'Lotze et al., 2006' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73451	55				Regarding the 'Reference' colomn crossing 'Reduce mangrove conversion' row in the table, 'Munang et al., 2014' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.14	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73453	55				Regarding the 'Reference' colomn crossing 'Reduce mangrove conversion' row in the table, 'Naylor et al., 2000' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.15	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73455	55				Regarding the 'Reference' colomn crossing 'Reduce mangrove conversion' row in the table, 'Chow 2018' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.16	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73457	55				Regarding the 'Reference' colomn crossing 'Reduce mangrove conversion' row in the table, 'Widham-Myers et al., 2018' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.17	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73459	55				Regarding the 'Reference' colomn crossing 'Mangrove restoration' row in the table, 'Macreadi et al., 2019' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.18	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73461	55				Regarding the 'Reference' colomn crossing 'Mangrove restoration' row in the table, 'Friess et al., 2020' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.19	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73463	55				Regarding the 'Reference' colomn crossing 'Mangrove restoration' row in the table, 'de los Santos et al., 2019' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.20	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73465	55				Regarding the 'Reference' colomn crossing 'Mangrove restoration' row in the table, 'Lotze et al., 2006' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.21	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73467	55				Regarding the 'Reference' colomn crossing 'Mangrove restoration' row in the table, 'Munang et al., 2014' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.22	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73469	55				Regarding the 'Reference' colomn crossing 'Mangrove restoration' row in the table, 'Naylor et al., 2000' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.23	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1141	56	1	58	20	In the header to the table, "co-benefits" should be changed to "potential co-benefits" and "risks" should be changed to "potential risks"	Accept, we revised in the summary figure	Reid Miner	Private Consultant	United States of America
1147	56	1	58	20	Again, why is there no discussion of the benefits of sustainably intensified agriculture?	We discuss sustainable intensification in the box in 7.4	Reid Miner	Private Consultant	United States of America
1413	56	1	56	1	For trade-offs between SOC and N2O, see also : Guenet Bertrand, Gabrielle Benoît, Chenu Claire, Arrouays Dominique, Balesdent Jérôme, Bernoux Martial, Bruni Elisa, Caliman Jean-Pierre, Cardinael Rémi, Chen Songchao, Ciais Philippe, Desbois Dominque, Fouche Julien, Frank Stefan, Hénault Catherine, Lugato Emanuele, Naipal Victoria, Nesme Thomas, Obersteiner Michael, Pellerin Sylvain, Powlson David, Rasse Daniel, Rees Frédéric, Soussana Jean-François, Su Yang, Tian Hanqin, Valin Hugo, Zhou Feng. 2021. Can N2O emissions offset the benefits from soil organic carbon storage?. Global Change Biology, 27 (2) : 237-256. https://doi.org/10.1111/gcb.15342	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Julien Demenois	Cirad	France
11823	56	1	56	45	In Table 7.7, the "categories" for mitigations measures is questioned and were Soil organic carbon in croplands and grasslands is grouped together. Grasslands and croplands are very different ecosystems, especially in terms of SOC were grasslands (specially permanent grasslands) can mitigate carbon while croplands usually emit carbon caused by plowing and tilling of soil for seeding (see also 7.4.2.5). Most global croplands are on previous permanent grasslands as natural grasslands have deep, SOC rich soils good for cultivation. It is important to distinguish between grasslands and croplands for mitigation measures. Why it is difficult to monitor and verify Resources and Technology under risk needs explanation.	The table has been deleted, and the text on SCS (7.4.3) detailes SCS in grasslands separately from croplands	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
30757	56	1	56	1	As the number of livestock and the amount of manure increase worldwide（Hirata et al., 2013, Agric. For. Meteorol., 177, 57-68.）, we suggest to add "organic amandments" to the text that refers to cropland and grassland.	Mentioned in SCS text in 7.4.3, table has been deleted	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
56029	56	1	56	20	In Table 7.7, first row, Soil organic carbon, explicitly describe the negative sides, such as monoculture becoming encouraged by some of the positive actions.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of United States of America	U.S. Department of State	United States of America
56031	56	1	56	20	In Table 7.7, Rice cultivation, describe negatives if managed inappropriately, particularly methane emissions from rice paddies as well as N2O and lesser but important CO2 emissions.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of United States of America	U.S. Department of State	United States of America
64861	56	1	60	1	Table 7.6. Rather than use the word 'reduce' in the context of reduce forest/peatland/ mangrove etc conversion, can you change it to 'protect forest /peatland / mangrove' etc. It gives a stronger message and is less open to misinterpretation.	We use 'protect' in section 7.4, but also still use 'reduce' as it is commmon in the literature	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
64863	56	1	60	1	Table 7.6 please do not combine afforestation and re-afforestation. Use re-afforestation for naturally forested land, afforestation for land which would not naturally support tree cover (including savannas and some temperate peatlands). In this context it makes clear that re-afforestation is largely positive but afforestation is almost entirely negative. This is worth a separate line	A and R is discussed separately in the subsection. The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the sub-section text	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)
64865	56	1	60	1	Table 7.6 Can you expand the line on mangroves to include other coastal ecosystems such as salt marsh please - they are included in 7.5 and have similar co-benefits	The sub-section details other ecosystems in coastal wetlands. The table has been deleted	Michael Morecroft	Natural England	United Kingdom (of Great Britain and Northern Ireland)
3873	56		60		Tables 7.7 and 7.8: LD Land degradation and desertification is a rather abstract concept here that overlaps with soil. It only appears in "Enteric Fermentation" (Table 7.7) in the threat " Land use change from increased production of feed"; and in "Enhance wood products" (Table 7.8) in the threat "Degradation through unsustainable wood production systems". Both could be substituted in the respective threat cells by S: Soil degradation.	The table has been deleted, information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Rosa M Poch	ITPS and UdL	Spain
6061	56		56		Table 6.6, Agriculture, I would suggest adding a section of "Use of organic amendments", similarly to the section about biochar, since the potential of this practice as well as amounts available are much more important than biochar, which use at a real scale is anecdotic	We have nutrient management as a category, which includes organic amendments	Remigio Paradelo	Universidade de Santiago de Compostela	Spain
21287	56		56		line 1 - column 6 : we suggest to add Guenet, B., Gabrielle, B., Chenu, C., Arrouays, D., Balesdent, J., Bernoux, M., Bruni, E., Caliman, J.-P., Cardinael, R., Chen, S., Ciais, P., Desbois, D., Fouche, J., Frank, S., Henault, C., Lugato, E., Naipal, V., Nesme, T., Obersteiner, M., Pellerin, S., Powlson, D.S., Rasse, D., Rees, F., Soussana, J.-F., Su, Y., Tian, H., Valin, H., Zhou, F., 2021. Can N2O emissions offset the benefits from soil organic carbon storage? Glob. Chang. Biol. 27, 237–256. doi:10.1111/gcb.15342 Pöpleau et al 2018 Agriculture, Ecosystems and Environment 265 (2018) 144–155 + Guenet Bertrand, Gabrielle Benoît, Chenu Claire, Arrouays Dominique, Balesdent Jérôme, Bernoux Martial, Bruni Elisa, Caliman Jean-Pierre, Cardinael Rémi, Chen Songchao, Ciais Philippe, Desbois Dominque, Fouche Julien, Frank Stefan, Hénault Catherine, Lugato Emanuele, Naipal Victoria, Nesme Thomas, Obersteiner Michael, Pellerin Sylvain, Powlson David, Rasse Daniel, Rees Frédéric, Soussana Jean-François, Su Yang, Tian Hanqin, Valin Hugo, Zhou Feng. 2021. Can N2O emissions offset the benefits from soil organic carbon storage?. Global Change Biology, 27 (2) : 237-256. https://doi.org/10.1111/gcb.15342	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21289	56		56		line 1 - column 6 : Also very relevant, this review of several carbon sequestrating pratices and the trade-off between SOC storage and N2O emissions: Guenet, B., Gabrielle, B., Chenu, C., Arrouays, D., Balesdent, J., Bernoux, M., Bruni, E., Caliman, J.-P., Cardinael, R., Chen, S., Ciais, P., Desbois, D., Fouche, J., Frank, S., Henault, C., Lugato, E., Naipal, V., Nesme, T., Obersteiner, M., Pellerin, S., Powlson, D.S., Rasse, D., Rees, F., Soussana, J.-F., Su, Y., Tian, H., Valin, H., Zhou, F., 2021. Can N2O emissions offset the benefits from soil organic carbon storage? Glob. Chang. Biol. 27, 237–256. doi:10.1111/gcb.15342	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21291	56		56		line 1 - column 5 : Sustainable intensification must be achieved decreasing greatly both ruminants (as they are important contributors of GHG) and mineral fertilizers (idem). But how could we maintain soil fertility, close nutrient cycling and increase production with less manure and fertilizers? Even increasing hardly pulses crops, it will not be enough	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21295	56		56		line 1 - column 6 : we suggest to add Corbeels, M., Cardinael, R., Naudin, K., Guibert, H., Torquebiau, E., 2019. The 4 per 1000 goal and soil carbon storage under agroforestry and conservation agriculture systems in sub-Saharan Africa. Soil and Tillage Research 188, 16–26. https://doi.org/10.1016/j.still.2018.02.015 +Berre, D., Diarisso, T., Andrieu, N., Le Page, C., Corbeels, M., 2021. Biomass flows in an agro-pastoral village in West-Africa: Who benefits from crop residue mulching? Agricultural Systems 187, 102981. https://doi.org/10.1016/j.agsy.2020.102981	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21297	56		56		line 1 - column 6 : For potential conflict between farmers (private interest vs. communal use of the ressources) Berre et al. 2021 showed that despite potential yield increase due to mulching, the field received less manure because the cattle had to migrate :"With mulching, the amount of available maize residues for cattle feeding during the dry season decreased, so did the amount of animal manure available for soil amendment as cattle had to leave the village to search for feed elsewhere.' Berre, D., Diarisso, T., Andrieu, N., Le Page, C., Corbeels, M., 2021. Biomass flows in an agro-pastoral village in West-Africa: Who benefits from crop residue mulching? Agricultural Systems 187, 102981. https://doi.org/10.1016/j.agsy.2020.102981	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21301	56		56		line 1 - column 6 : we suggest to add Stahl, C., Fontaine, S., Klumpp, K., Picon-Cochard, C., Grise, M.M., Dezecache, C., Ponchant, L., et al. 2017. Continuous soil carbon storage of old permanent pastures in Amazonia. Global Change Biology, 23(8): 3382–3392 [online]. https://doi.org/10.1111/gcb.13573	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21303	56		56		line 2 - column 4 : We do not understand this comment. All agricultural practices disturb to a certain extent the native ecosystem. Why only mentioning that for agroforestry, which is probably one of the techniques that disturbs the less the native ecosystem?	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21305	56		56		line 2 - column 6 : regarding "Improves soil quality ..., we suggest to add Cardinael, R., Mao, Z., Chenu, C., Hinsinger, P., 2020. Belowground functioning of agroforestry systems: recent advances and perspectives. Plant Soil 453, 1–13. doi:10.1007/s11104-020-04633-x	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
24633	56		56		To the text about ' Soil organic carbon in croplands and grasslands' the risk column: Could increased pesticide use resulting from direct seeding be a potential risk?	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of Denmark	Danish Meteorological Institute	Denmark
70011	56		57		Table 7.7, Line/Section "Agroforestry" in column "References" add: Córdova et aL. 2019	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Markku Kanninen	University of Helsinki	Finland
73471	56				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Antwi-Agyei, Stringer, & Dougill, 2014' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.8	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73473	56				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Benjamin, Ola, & Buchenrieder, 2018' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.9	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73475	56				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'den Herder et al., 2017' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.10	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73477	56				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Guo, Wang, Wang, Wu, & Cao, 2018' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.11	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73479	56				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Mbow et al., 2014' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.12	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73481	56				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Mosquera-Losada et al., 2018' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73483	56				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Mutuo, Cadisch, Albrecht, Palm, & Verchot, 2005' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.14	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73485	56		57		Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Nair & Nair, 2014' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.15	Raehyun KIM	National Institute of Forest Science	Republic of Korea
86287	56		56		Table 7.7: Line 'Soil organic carbon in croplands and grasslands'. Where it reads "tillage operations" it should be read as "zero-tillage"	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text	Pedro Luiz Oliveira Almeida Machado	Embrapa - Brazilian Agricultural Research Corporation	Brazil
11825	57	1	57	45	Bottom of Table 7.7. Enteric fermentation. What is the link between enteric fermentation and animal welfare? No reference provided and not intuitive? Rumination has a positive effects on well being.	The table has been deleted, and information on potential co-benefits/risks including animal welfare is detailed in the respective sub-section text	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
30759	57	12	57	12	[Biochar from crop residues] -[Risks] SE - "leading to lack of confidence" is not true because IPCC 2019 Refinement has developed a methodology for applying biochar to mineral soils for cropland and grasslands.	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
30761	57	12	57	12	[Biochar from crop residues] -[References] please add the IPCC 2019 Refinement (Volume 4, Chapter 2).	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
30763	57	12	57	12	[Biochar from crop residues] - In addition to crop residues, biochar can also be produced from other unused local biomass. Please explain if there is a reason to limit it to crop residues.	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21307	57		57		line 1 - column 6 : To be added to the list: Water Quality: Zhu, X., Liu, W., Chen, J., Bruijnzeel, L.A., Mao, Z., Yang, X., Cardinael, R., Meng, F.-R., Sidle, R.C., Seitz, S., Nair, V.D., Nanko, K., Zou, X., Chen, C., Jiang, X.J., 2020. Reductions in water, soil and nutrient losses and pesticide pollution in agroforestry practices: a review of evidence and processes. Plant Soil 453, 45–86. doi:10.1007/s11104-019-04377-3 . Soil quality: Cardinael, R., Mao, Z., Chenu, C., Hinsinger, P., 2020. Belowground functioning of agroforestry systems: recent advances and perspectives. Plant Soil 453, 1–13. doi:10.1007/s11104-020-04633-x . Soil biodiversity (earthworms): Cardinael, R., Hoeffner, K., Chenu, C., Chevallier, T., Béral, C., Dewisme, A., Cluzeau, D., 2019. Spatial variation of earthworm communities and soil organic carbon in temperate agroforestry. Biol. Fertil. Soils 55, 171–183. doi:10.1007/s00374-018-1332-3	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21309	57		57		line 1 - column 3 : after "regulates hydro; cycle, we suggest to add "and improves water quality" : Zhu, X., Liu, W., Chen, J., Bruijnzeel, L.A., Mao, Z., Yang, X., Cardinael, R., Meng, F.-R., Sidle, R.C., Seitz, S., Nair, V.D., Nanko, K., Zou, X., Chen, C., Jiang, X.J., 2020. Reductions in water, soil and nutrient losses and pesticide pollution in agroforestry practices: a review of evidence and processes. Plant Soil 453, 45–86. doi:10.1007/s11104-019-04377-3	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21311	57		57		line 2- column 3 : We guess that the mention of improved air quality is mainly for reduction in soil N2O emissions but application of biochar also releases black carbon aerosols, not sure this is very good for air quality: Genesio, L., Vaccari, F.P., Miglietta, F., 2016. Black carbon aerosol from biochar threats its negative emission potential. Glob. Chang. Biol. 22, 2313–2314. doi:10.1111/gcb.13254	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21313	57		57		line 2 - column 4 : we do not agree with the finding about albedo . Several studies suggested this is highly significant: Bozzi, E., Genesio, L., Toscano, P., Pieri, M., Miglietta, F., 2015. Mimicking biochar-albedo feedback in complex Mediterranean agricultural landscapes. Environ. Res. Lett. 10. doi:10.1088/1748-9326/10/8/084014 . Genesio, L., Miglietta, F., Lugato, E., Baronti, S., Pieri, M., Vaccari, F.P., 2012. Surface albedo following biochar application in durum wheat. Environ. Res. Lett. 7, 014025. doi:10.1088/1748-9326/7/1/014025 . Verheijen, F.G.A., Jeffery, S., Velde, M. Van Der, 2013. Reductions in soil surface albedo as a function of biochar application rate: implications for global radiative forcing. Environ. Res. Lett. 8, 1–7. doi:10.1088/1748-9326/8/4/044008	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21317	57		57		line 1 - column 4 : Some evidences suggest that biochar can also have direct and negative effects on soil biodiversity Lehmann, J., Rillig, M.C., Thies, J., Masiello, C.A., Hockaday, W.C., Crowley, D., 2011. Biochar effects on soil biota - A review. Soil Biol. Biochem. 43, 1812–1836. doi:10.1016/j.soilbio.2011.04.022 . Weyers, S.L., Spokas, K.A., 2011. Impact of Biochar on Earthworm Populations: A Review. Appl. Environ. Soil Sci. 2011, 1–12. doi:10.1155/2011/541592	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21319	57		57		line 1 - column 5 : studies even mix biochar with kaolin or other brighter material to avoid the negative impact on albedo	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21321	57		57		line 1 - column 5 : We suggest to add "or soil cover (mulch and/or cover crops)" after "soil incorporation"	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21323	57		57		line 1 - column 1 : the line title is misleading because it is not enteric fermentation that "improves air quality", but "Improved enteric fermentation" Please consider that every table must be read and used independently from the whole text.	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
24631	57		57		To the text about 'Enteric fermentation'. It is unclear how the mitigation measure will improve animal welfare.	The table has been deleted, and information on potential co-benefits/risks including animal welfare is detailed in the respective sub-section text	Government of Denmark	Danish Meteorological Institute	Denmark
24635	57		57		To the text: 'Enteric fermentation' under co-benefit. It is not clear how this measure leads to improved anamal welfare considering the risks mention about potential toxicity of feed additives.	The table has been deleted, and information on potential co-benefits/risks including animal welfare is detailed in the respective sub-section text	Government of Denmark	Danish Meteorological Institute	Denmark
73487	57				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Ram et al., 2017' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.8	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73489	57				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Sain et al., 2017' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.9	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73491	57				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Santiago-Freijanes et al., 2018' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.10	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73493	57				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Sida, Baudron, Hadgu, Derero, & Giller, 2018' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.11	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73495	57				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Vignola et al., 2015' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.12	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73497	57				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Yirdaw, Tigabu, & Monge, 2017' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73499	57				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Kay et al., 2019' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.14	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73501	57				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Muchane et al., 2019' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.15	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73503	57				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Bargues-Torbella et al., 2019' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.16	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21325	58		58		line 1 - column 4 : One risk is missing: one major option to reduce enteric emissions is using more digestible diets often based on concentrate feeds (e.g. cereals) that increase competition between animal feeding and humand food. A good reference is: Mottet, A., de Haan, C., Falcucci, A., Tempio, G., Opio, C., Gerber, P., 2017. Livestock: On our plates or eating at our table? A new analysis of the feed/food debate. Global Food Security 14, 1-8.	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21327	58		58		line 3 - column 6 : "Reduce yields" is contradictory with the column "Co-benefits" where it is written "Improves yields"	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21329	58		58		line 3 - column 6 : We suggest to add Gram G, Roobroeck D, Pypers P, Six J, Merckx R, Vanlauwe B (2020) Combining organic and mineral fertilizers as a climate-smart integrated soil fertility management practice in sub-Saharan Africa: A meta-analysis. PLoS ONE 15(9): e0239552. https://doi.org/10.1371/journal.pone.0239552 Alvarez, S., Rufino, M.C., Vayssières, J., Salgado, P., Tittonell, P., Tillard, E., Bocquier, F., 2014. Whole-farm nitrogen cycling and intensification of crop-livestock systems in the highlands of Madagascar: An application of network analysis. Agricultural Systems 126, 25-37. Vayssières J., Rufino M.C., 2012. Managing nutrients cycles in crop and livestock systems with green technologies. In: Arcand Y. & Boye J.I. (Eds), Green Technologies in Food Production and Processing. Springer, New York, USA, p 151-182.	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21331	58		58		line 4 - column 1 : The title is misleading because it is not Rice cultivation that "improves air quality", but "Improved paddy rice cultivation" Please consider that every table must be read and used independently from the whole text.	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
24637	58		58		To the text: Nutrient management - under risk. Can a lack of nutrient cycling lead to loss of soil organic carbon?	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of Denmark	Danish Meteorological Institute	Denmark
1143	59	1	60	20	In the header to the table, "co-benefits" should be changed to "potential co-benefits" and "risks" should be changed to "potential risks"	Accept, we revised in the summary figure	Reid Miner	Private Consultant	United States of America
11863	59	1	59	10	Table 7.8: Here and in other places the expression a "healthy sustainable diet" is used and then it is written that it means reduced consumption of animal products in some countries. However, there is little evidence that reduced consumption of animal products is the most important factor for a healthy food. The Lancet Volume 393, ISSUE 10184, P1958-1972, May 11, 2019 demonstrates clearly that most other diet related issues are much more important (more vegs, more whole grain, less sugar etc.). It also shows that too low consumption of milk is a bigger health problem than high red meat consumption. Therefore it is misleading to qualify a healthy diet with a reduction in animal sourced foods. It is recommended, that the whole food system and different consumption patterns and diets are improved in future reports.	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
15731	59	1	59	10	In the row shift to sustainabke healthy diets, under the column "risks" it should be mentioned that people experience a disutility from dietary restrictions, reflected e.g. in a low price elasticity of meat products. This is for example observed in many studies on climate motivated meat taxes.	Noted. The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Katarina Elofsson	Aarhus University	Denmark

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
45977	59	1	60	1	Unclear: How will the shift to a "sustainable, healthy diet" lead to the risk of "shift to unsustainable fisheries"? (If the fishery is unsustainable, the diet resulting from it should not be considered sustainable" …? Please clarify.	reducing meat-based protein may lead to more fish intake, and thus unsustainable fishery development. The table has been deleted and relevant info placed in the sub-section text	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
21333	59		59		line 1 - column 3 : we suggest to add: R - Sustainability of small-scale and integrated crop-livestock farm systems for which livestock diversification constitutes a net-safety	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21335	59		59		line 2 - column 6 : We suggest to Alexander et al. 2016 Ansah et al 2017 Billen et al 2019 Bradford et al 2018 Chaboud et al 2017 Göbbel et al 2015 Ingram et al 2016 Kissinger et al 2019 Kumar et al 2017 Kummu et al 2012 Ritzema et al 2017 Sheahan et al 2017 Smith et al 2013 Vermeulen et al 2012 Wilhem et al 2016	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
21337	59		59		line 1 - column 5 : we suggest to add at the end "and improve the recovery of food wastes via animal sectors to reduce the pressure on fodder crops and grazing lands;"	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of France	Ministère de la Transition écologique et solidaire	France
24639	59		59		To the text 'Shift to sustainable, healthy diets' under risk. Is there not at risk of loss of cultural preferences and traditions, when reducing meat consumption?	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Government of Denmark	Danish Meteorological Institute	Denmark
24991	59				In the "Reduce food waste" row, and "Best practices to maximise benefits and reduce risks" column of Table 7.8: After "expand the "dry chain"": Add: "; regulation of unfair trading practices, mandatory food waste reporting and targets for businesses, relaxation of cosmetic standards to reduce product rejections." Explanation: It is important recognise regulatory solutions to food waste arising in the pre-consumer supply chain – such as unfair trading practices legislation (EU Platform on Food Losses and Food Waste, 2019, p. 10; Sinclair Taylor, Parfitt and Jarosz, 2019) and mandatory food waste reporting and targets (HM Government, 2018; EU Platform on Food Losses and Food Waste, 2019, p. 27; Tesco PLC, 2019). Creative marketing of cosmetically imperfect practices can significantly reduce cosmetic outgrading (Federico, Dewitz and Magdalena, 2017; van Giesen and de Hooge, 2019).	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
63049	59		59		The conclusions in table 7-7 and table 7-8 need to be compared with the contents in the SRCCL, and the inconsistent aspects need to be compared.	The table has been deleted, we compare AR5 and SRCCL findings to this report	Changke WANG	National Climate Center, China Meteorological Administration	China
71815	59				There are great differences between food waste and food losses. The two should not be combined as they require vastly different responses. The table refers to food losses only.	We discuss them separately in the sub-section text. The table has been deleted	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
9611	60	1	60	1	Enhancing the use of wood-products does not under all circumstances reduce GHG emissions. In AR5 there was a quite elaborated discussion, based on LCA and other methods and a substantial amount of literature - more than is cited here -, that highlighted conditions in terms of forest management and many other aspects of product use and implementation (e.g., longevity of products) under which conditions enhanced use of wood products can help reducing GHG emissions. In my view it is misleading to suggest, as is done here, that enhanced use of wood products were a climate-change mitigation measure. This is only the case in specific circumstances, e.g. if very emission-intensive products are replaced, the forest is managed in the right manner, etc. See ch11, WGIII, AR5	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
49907	60	1	60	1	Unclear: why and how should enhance wood products reduce GHG emissions, and conserve biodiversity etc? First, wood products need to substitute for GHG-intensive materials to have positive mitigation effects, which is not necessarily the case (10.1038/nclimate1451). Second, increasing harvest mobilized carbon stocks that would otherwise be left standing and even continue growing. And regrowth relates to fluxes requires time to reach the stocks again (note, the reference level is the no-action counterfactual). Third, wood is more GHG intensive per unit of energy than most fossil fuels. Fourth, carbon residence times in forests are quite long (almost all forest can reach easily ages of 250 years) but wood in long-lasting artefacts (buildings) does only in rare cases stay for such long periods; most of wood actually is entering short-lived compartiments, even if the primary product is aimed to be long-lasting (due to the residues of harvest and during processing that cannot easily be converted in longlasting products). Fifth: when harvesting, large biomass fluxes are triggered: in forest biomass and soils (residues, open forests), along the wood processing chain (residues will be used for paper, panel or energy - all shortlived on the average). And last, the key effect of GHG mitigation is susbistutin of fossil fuels. This effect is bound to become smaller the more decarbonizned the industrial system is. Here, again, the timing of the mitigations potentials is key and deserves more explicit elaboration. There is quite a body on literature on this, e.g. Norton 10.1111/gcbb.12643, Ter-Mikaelian 10.5849/jof.14-016, Pingoud 10.1016/j.jenvman.2017.12.076, Holtsmark 10.1007/s10584-011-0222-6, 10.1016/j.ecolmodel.2012.10.006, Schulze 10.1111/j.1757-1707.2012.01169.x, Schlesinger 10.1126/science.aat2305, DeCicco 10.1073/pnas.1814120115, Eggers 10.1073/pnas.1814120115, Searchinger 10.1038/s41467-018-06175-4, etc, and there is much material in the AR5 and SRCCL that is apparently not taken into account in the assessment here.	The table has been deleted, and information on potential co-benefits/risks and best practices is detailed in the respective sub-section text and summarized in Figure 7.11 addressing reviewer comments	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
73505	60				Regarding the 'Reference' colomn crossing 'Enhance wood products row in the table, 'Baumgartner, 2017' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73507	60				Regarding the 'Reference' colomn crossing 'Agroforestry' row in the table, 'Pendrill et al., 2019' cannot be found in the References.	Noted, thank you. The table has been deleted. We provide related references for each measure in their respective sub-section 7.4.2-7.4.13	Raehyun KIM	National Institute of Forest Science	Republic of Korea
51701	61	1	62	14	Box 7.2 is strange to be inserted here. And introduce new and partly controversial terms. Suggest to include necessary terms in Annex A. However, at the absolute bare minimum, the definitions given in box 7.2 shall be consistent with the definitions in the Glossary, e.g. including the UNFCCC reference to decision 1/CP.16 for REDD+	Accepted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Florin Vladu	UNFCCC Secretariat	Germany
54333	61	1	63	13	This is a useful list, but I suggest to thoroughly go through this again, remove duplicates, check citations and also look at the glossaries of the Special Reports to have consistent definitions, e.g. compare CDR to definitions in SRCCL and SR1.5.	Noted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Sabine Fuss	MCC Berlin	Germany
56033	61	1	61	45	Suggest alphabetizing Box 7.2.	Noted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Government of United States of America	U.S. Department of State	United States of America
8131	61	2	62	13	Please delete Box 7.2 and integrate definitions in the Glossary.	Accepted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
21339	61	2	61	2	We suggest to add a definition of "Agroforestry". Agroforestry is a generic term that includes a lot of practices, but depending on definitions some systems are included or not under this term, it would clarify things	Noted. Though Box 7.2 has been removed, the inclusion of Agroforestry in the Glossary will be considered	Government of France	Ministère de la Transition écologique et solidaire	France
31315	61	2			Not sure why definitions are needed here when there is a glossary. Suggest delete Box or at least use same definitions as in the Glossary	Accepted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Ralph Sims	Massey University	New Zealand
43343	61	2	61	45	Box 7.2: the defintion of Certified forests (FSC, PEC) should also be mentioned since it is part of some mitigation measures for forest, and is the counter part of Agroecology in agriculture.	Box 7.2 has been removed but inclusion of Certified Forests in the IPCC Glossary will be considered.	jean-christophe domec	Bordeaux Sciences Agro	France
45979	61	2	61	13	Please remove this box and add all terms to the glossary. In addition, there are some inconsistencies with the glossary, e.g. for CDR and NET, that should be removed.	Accepted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
45981	61	2	62	13	[Box 7.2] The definitions that are explained in this box do not correspond to the definitions used in the glossary. This is especially important for definitions of CDR and negative emissions. Please make sure to align both definitions in the glossary and the box to each other. For CDR, the definition should include the enhancement of biological sinks through activities such as restoration or management of ecosystems. Therefore, please amend the definition as proposed in the comment to Annex A.	Noted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
56035	61	2	61	2	Box 7.2 seems out of place. Shouldn't it be at the beginning of the section or somewhere else?	Accepted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Government of United States of America	U.S. Department of State	United States of America
61197	61	2	63	13	The content of Box 7.2 is duplicated with the glossary, please delete .	Accepted. Box 7.2 has been removed.	Jianguo WU	chinese research academy of environmental sciences	China
71817	61	2	62	13	Would it make sense to move this to the glossary and save some space? These terms should be used consistently across the whole report.	Accepted. Box 7.2 has been removed and readers are referred to the Glossary	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
81287	61	2			I have a significant problem with this box because many of the definitions given here are not consistent with the glossary. Most are close, but miss out important words that the glossary very deliberately includes. Please make 100% sure to be fully consistent with the glossary. If you feel the glossary wording is too difficult to understand, add a further explanatory sentence, but please don't leave readers of this report with two alternative definitions of the same terms in this chapter and the glossary. Also it would help to have a cross-reference to the glossary here.	Noted & Accepted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Andy Reisinger	Ministry for the Environment	New Zealand
82843	61	2	62	13	Another term possibly useful in this table and section is "Alternative Food Networks". Market alternatives are usually linked to products of organic farming, agroecology, regenerative agriculture or at least local production. Non-market products are represented by home food production - food with lower emission, locally produced, often in organic quality. Vávra et al. (2018a) estimate GHG mitigation of self-grown fruits, vegetables and potatoes of gardeners in Czechia to be 42-92 kg CO2eq/person/year, which is approx. 3-5 % of overall food emission of Czech households. Moreover, home growing is common among various countries of Global North as several studies show (e.g. US, Scotland, Germany, Hungary, Poland, Czechia - see Vávra et al. 2018b; Smith and Jehlička 2013; Schupp and Sharp 2011). Vávra, J., Daněk, P., Jehlička, P. (2018a). What is the contribution of food self-provisioning towards environmental sustainability? A case study of active gardeners. Journal of Cleaner Production 185: 1015–1023. DOI: 10.1016/j.jclepro.2018.02.261. Vávra, J., Megyesi, B., Duží, B., Craig, T., Klufová, R., Lapka, M., Cudlínová, E. (2018b). Food self-provisioning in Europe: An exploration of socio-demographic factors in five regions. Rural Sociology 83 (2): 431–461. DOI: 10.1111/ruso.12180. 19. Smith, J.; Jehlička, P. (2013) Quiet sustainability: Fertile lessons from Europe's productive gardeners. Journal of Rural Studies 32, 148–157. 26. Schupp, J.L.; Sharp, J.S. (2012) Exploring the Social Bases of Home Gardening. Agriculture and Human Values 29, 93–105.	Rejected. Thank you for the suggestion but Alternative Food Networks have not be discussed elsewhere in the chapter and therefore, will not be defined.	Jan Vávra	University of South Bohemia	Czech Republic
14807	61	11	61	13	This definition of CDR is inconsistent with that in the Glossary. CDR should be defined specific to carbon dioxide removal and not equated with GHG removal which many encompass emerging methods to remove methane (consistent with Glossary definition).	Noted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Elizabeth Bush	Environment and Climate Change Canada	Canada
72787	61	11	61	13	This definition for CDR differs to that used in previous reports (e.g. the SR1.5).Is this definition solely for the purposes of this chapter, or has it been adjusted for a specific reasion? E.g. there is no "durable" or "anthropogenic" in this definition.	Noted. Box 7.2 has been removed and readers are referred to the IPCC Glossary for agreed definitions.	Matthew Gidden	Climate Analytics	Germany
83239	61	11	61	13	Please use the glossary definition of CDR (probably skipping reference to GGR, and definetely to NETs - see COGS)	Noted. Box 7.2 has been removed and readers are referred to the IPCC Glossary.	Geden Oliver	German Institute for International and Security Affairs	Germany
21341	61	18	61	18	A good reference for that would be Steenwerth, K.L., Hodson, A.K., Bloom, A.J., Carter, M.R., Cattaneo, A., Chartres, C.J., Hatfield, J.L., Henry, K., Hopmans, J.W., Horwath, W.R., Jenkins, B.M., Kebreab, E., Leemans, R., Lipper, L., Lubell, M.N., Msangi, S., Prabhu, R., Reynolds, M.P., Sandoval Solis, S., Sischo, W.M., Springborn, M., Tittonell, P., Wheeler, S.M., Vermeulen, S.J., Wollenberg, E.K., Jarvis, L.S., Jackson, L.E., 2014. Climate-smart agriculture global research agenda: scientific basis for action. Agriculture & Food Security 3, 11. https://doi.org/10.1186/2048-7010-3-11	Noted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Government of France	Ministère de la Transition écologique et solidaire	France
86293	61	19	61	21	Box 7.2; Where it reads "...Conservation Agriculture: The combined use of minimum tillage, crop rotations (including cover crops) and residue retention (Jia et al. 2019)...soil cover (Mbow et al. 2019; Mirzabaev et al. 2019)..." it should be read as "...Conservation Agriculture: a farming system that can prevent losses of arable land while regenerating degraded lands, keeping permanent soil cover, minimum tillage, and diversification of plant species (FAO, 2016)...".	Noted. Box 7.2 has been removed however, CA is now defined in the Glossary.	Pedro Luiz Oliveira Almeida Machado	Embrapa - Brazilian Agricultural Research Corporation	Brazil
45983	61	22	61	23	Please consider rewording to: A natural part of the digestion process in ruminant animal species (domesticated and wild), such as cattle, buffaloes, sheep, goats, antelopes, etc. thus avoiding scientific jargon which will be difficult to understand for many readers.	Accepted. Box 7.2 has been removed but the metioned definition is now included in the IPCC Glossary and has been modified.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
80555	61	29	61	30	There should be a definition of Land Restoration due to it is also a mitigation measure. Land restoration:The process of assisting the recovery of landfrom a degraded state (McDonald et al., 2016; IPBES, 2018, IPCC Special Report on Climate Change and Land, Glossary, 2019).	Noted. Box 7.2 has been removed but the inclusion of "Land Restoration" in the Glossary, will be considered.	Eray Özdemir	General Directorate of Forestry	Turkey
73509	61	31			The work 'IUCN, 2016' cannot be found in the References.	Noted. Box 7.2 has been removed, but all references will be checked.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21343	61	34	61	34	Organic production has lower emissions per unit of area... but higher emissions per unit of product, as yields are lower (Box 7.7). In the same time organic farming is increasing worldwide for its benefits on biodiversity, health, etc. Of course some technical levers can be mobilized to reduce emissions in OF, but is there compatibility with the food needs of 9 billion people?	Noted. It is hoped that Box 7.7 and associated revisions, sufficiently discusses issues. The ability of organic farming (OF) to contribute to increased food production is debated, nonetheless, it is felt discussion on OF as a farming system regarding mitigation, is warranted.	Government of France	Ministère de la Transition écologique et solidaire	France
19761	61	39	61	39	in box 7. 2 repeat two times reforestation	Noted - thank you. Box 7.2 has been removed.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
43341	61	39	62	6	Box 7.2:defintion of Reforestation appears twice.	Noted - thank you. Box 7.2 has been removed.	jean-christophe domec	Bordeaux Sciences Agro	France
21345	61	41	61	41	The concept of "Ecological Intensification" is missing in this report, i.e. using ecological processes to intensify the provision of food and other ecosystem services. Griffon, M., 2009. Pour des agricultures écologiquement intensives: des territoires à haute valeur environnementale et de nouvelles politiques agricoles. Éditions de l'Aube et Conseil général. and Griffon M. 2017. Éléments théoriques en agroécologie : l'intensivité écologique. OCL 24(3): D302.	Noted. With consideration it was decided not to include specific discussion on ecological intensification. It is hoped that discussion on agroforestry, agricultural system approaches (Box 7.7) and a new box on sustainable intensification may indirectly cover some relevant aspects.	Government of France	Ministère de la Transition écologique et solidaire	France
56037	62	3	62	5	REDD+ definition should indicate that this program is often accompanied by incentives.	Noted. Box 7.2 has been removed and readers are referred to the definition provided in the IPCC Glossary.	Government of United States of America	U.S. Department of State	United States of America
61103	62	3	62	5	Reducing Emissions from Deforestation and Forest Degradation is referred to as REDD+. This definition should be for the term 'REDD+' instead of' Reducing Emissions from Deforestation and Forest Degradation'	Noted. Box 7.2 has been removed and readers are referred to the definition provided in the IPCC Glossary.	LOKESH CHANDRA DUBE	TERI School of Advanced Studies	India
20249	62	6	62	6	in box 7. 2 repeat two times reforestation	Noted - thank you. Box 7.2 has been removed.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
56039	62	6	62	6	Reforestation definition is repeated here. It was first defined on the previous page.	Noted. Box 7.2 has been removed and readers are referred to the IPCC Glossary	Government of United States of America	U.S. Department of State	United States of America
83885	62	6	62	7	Reforestation repeated	Noted - thank you. Box 7.2 has been removed.	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
56041	62	14	62	16	It is important to explain these studies are not finding high levels of leakage. For example, they are global studies so all leakage effects are accounted for, or that there are such low levels of adoption that leakage effects are minimal, etc.	Noted - we provide detail on leakage and permanence for relevant measures in their sub-sections	Government of United States of America	U.S. Department of State	United States of America
77677	62	16	62	32	Defining forest degradation as merely 'over harvesting' or 'poor harvesting practices' ignores the scientific reality that even legal, 'sustainable' logging reduces the average carbon stock (compared to a primary or old growth forest) by 30-70% depending on logging intensities and cycles (Mackey et al. Mitigation and Adaptation Strategies for Global Change https://doi.org/10.1007/s11027-019-09891-4; Keith et al. PLoS ONE 10(10): e0139640. doi:10.1371/journal.pone.0139640 . It also ignores the increasing evidence that logging increases risk of fire and fire severity as noted above. Commercial logging clearly results in initial and ongoing degradation of primary and other natural forests. Failure to distinguish between differences in forest condition along the continuum of primary forests to monoculture tree crops adds to the confusion and needs to rectified.	Thank you, the text was revised, and the activities were mentioned as examples of drivers, not as a definition.	Virginia Young	Australian Rainforest Conservation Society	Australia
77681	62	17	67	24	The role of well designed, well managed and well funded Protected Areas warrants mention in this section as does greater reference to the importance of rights plus resources in indigenous territories (See 'The Nexus Report: Nature Based Solutions to the Climate and Biodiversity Crisis', Barber et al 2020, F20 Foundations, Campaign for Nature and SEE Foundation) A box could be added on 'connectivity conservation' as an important management strategy to enhance mitigation; as could a case study on the mitigation benefit of supporting rights and livelihoods of indigenous people. (The Nexus Report cited above)	Thank you for the reference and suggestion. Unfortunately, due to space limitations, we had to limit the number of boxes and case studies.	Virginia Young	Australian Rainforest Conservation Society	Australia
14745	62	22	62	22	I suggest removing "pest outbreaks" and "extreme wildfires". In boreal forests, with the possible exception of the forests of the Nordic countries, large-scale disturbances by insects and wildfires are part of the natural processes and therefore do not "degrade the forest". The extensive forestry practiced across Canada's boreal forests accounts for these natural disturbances.	Thank you, the text was revised, and the activities were mentioned as examples of drivers, not as a definition.	Pierre Bernier	Natural Resources Canada	Canada
73511	62	24			Please distinguish which source it is among the ones by 'Smith et al.' in 2019.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73513	62	26	62	27	There are two studies conducted by 'Jia et al.' in 2019 (see line 6 and line 9 in page 175).	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
51703	62	27	62	30	The notion that reducing deforestation reduces availability of land for farming is wrong. It reduces the potential for extension of agriculture land, but doesn't reduce current land for farming. "Displacement of emissions" is also not very specific for reducing deforestation, as this is a potential side effect of most mitigation measures	Noted, but the text mentions potential impatcs that are described in the literature.	Florin Vladu	UNFCCC Secretariat	Germany
54335	62	33			Delete SR1.5, as not used for assessment.	Noted, editorial comment. We used the title for all the mitigation options.	Sabine Fuss	MCC Berlin	Germany
54337	63	6	63	7	Generic statement: Either specify which set of countries see decreases and which ones are on the rise or what say what's behind the decreases.	Noted, specific regions are mentioned in the following sentence. Section 7.6 also brings a case study on this topic.	Sabine Fuss	MCC Berlin	Germany
28811	63	10	63	11	The point being made deserves a section that goes deeps into this matter. Particularly as reference levels constitute the cornerstone for performance assessment, and has direct links into what countries are and will include in their NDCs.	Rejected, although important, an extended discussion on this point is not the focus of the subsection.	naikoa aguilar-amuchastegui	WWF-US	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
56043	63	10	63	36	These paragraphs on previous reports and this report omit a large element of concern related to avoided conservation: additionality and measures to ensure additionality of any avoided conservation project. This is a major uncertainty when it comes to this kind of mitigation approach, as in some cases it can be challenging to ascertain what would happen to such lands if not for conservation efforts. This element should be included.	Rejected. Although the point is relevant, the discussion is more related to the policy implementation like in the case of REDD+ (please see section 7.6).	Government of United States of America	U.S. Department of State	United States of America
21347	63	14	63	16	Some economic studies did not found large estimates of leakage in projects that reduce deforestation (Fortmann et al. 2017; Roopsind et al. 2019). However a large body of literature also shows that deforestation is not only determined by local drivers, such as protection, but also by overall demand, including urban centers demand, through agricultural prices and displacement effects (Lambin et al., 2011; DeFries et al., 2010; Busch and Ferretti-Gallon 2017). https://www.pnas.org/content/108/9/3465 https://www.nature.com/articles/ngeo756	Partially accepted. A comment on the limitation of the references will be included. However, the discussion of deforestation drivers is presented in section 7.3.	Government of France	Ministère de la Transition écologique et solidaire	France
51705	63	14	63	16	The statement is not sufficiently substantiated. The Fortmann reference is about a national-level programme, not a project. The distinction is extremely important! How can leakage happen in a national-level programme? The Roopsind reference is interesting, but limited to one project type in Guatemala, and actually concluding that "While there is also evidence of leakage in this group, overall, there is a net reduction in deforestation." However, difficult to generalize from that.	Accepted, a comment on the limitation of the references will be included.	Florin Vladu	UNFCCC Secretariat	Germany
49909	63	17	63	17	The timing of the saturation should be explicitly mentioned, not only prevailing "uncertainty". Because, if the uncertainty is between 100 and 200 years, than it is not too relevant for short-term mitigation.	Rejected. Although it is an important aspect, an extended discussion of saturation uncertainty is not the focus in this subsection. Trends of saturating sink are regionally variable, as studies showed for Europe, for example. The uncertainty in forest biomass sink strength reported by EU member states to the UNFCCC is typically under 20%. However, the uncertainties in the sink trend are significantly decreasing because of the efforts to improve the quality and completeness of the reporting from different regions to the UNFCCC.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
54339	63	17	63	18	Houghton and Nassikas 2017 do not have results on forest carbon saturation. Houghton and Nassikas 2018 mention it in their discussion, so either refer to Houghton and Nassikas 2018 or refer to SRCCL.	Accepted, reference will be corrected.	Sabine Fuss	MCC Berlin	Germany
73515	63	23	63	24	Please distinguish which source it is between the ones by 'Kim et al.' in 2017.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
28813	63	25	63	36	A major issue is that these global assessments do not talk to the assessments countries are making themselves e.g their reference levels. This highlights the level of disconnect between these academic assessments and the political statements of countries themselves. a comparison of methods and values would be of great use.	Noted, this is an important aspect that can be better discussed under Policies, institutions, and governance.	naikoa aguilar-amuchastegui	WWF-US	United States of America
54341	63	25	63	36	The critical assessment misses a bit the bigger picture, i.e. that saving forests may be a necessary requirement for reaching temperature targets well below 2°C, both biophysically speaking and economically (closely related to political feasibility, e.g. https://www.cambridge.org/core/journals/global-sustainability/article/economic-value-of-tropical-forests-in-meeting-global-climate-stabilization-goals/5B4CBE658796B9B97B488CE792EDA946).	Accepted, this point will be considered in the text.	Sabine Fuss	MCC Berlin	Germany
56045	63	29	63	30	Language should clarify that reduced deforestation is a significant component of many NDCs. As written it implies that it is central to all NDCs, which is untrue. Additionally, the use of the word "central" is not useful in the context of assessing NDCs. A potential word that is more appropriate in this context is "significant".	Accepted, the word central will be replaced by significant.	Government of United States of America	U.S. Department of State	United States of America
71819	63	29	63	36	Don't forget agricultural and other development drivers limiting countries' willingness to stop expansion of agricultural lands and, in some countries, deforestation is not co-incidental, but at least partly policy-driven (e.g., to expand extractive industries, secure disputed borders, address demographic pressures).	Noted, these aspects are discussed in section 7.3	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73517	63	30			The work 'Seddon et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73519	63	36			The work 'Gren and Aklilu, 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76823	63	41	63	42	It is not useful to limit the interpretation of "forest restoration" to a subtype of reforestation. Reforestation (as defined in the text) implies land-use change, but restoration need not be limited to that and can be applied to a broad range of forest ecosystems and conditions.	reject, forest restoration is term used a lot in policymaking	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
63709	63	44	63	44	but can also reduce biodiversity associated with open habitats or ecosystems	reject, we mention trade offs few sentences later	Government of Canada	Environment and Climate Change Canada	Canada
19763	63	45	63	45	watershed regulation	reject, we use water also for water cycle	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
54343	63	45	64	4	Add reference to: Cross-Chapter Box 5.1. Interactions between the carbon and water cycles, particularly with drought conditions. in Canadell JG, Moteiro et al. 2021. Global Carbon and other Biogeochemical Cycles and Feedbacks. WGI AR6.	unclear. there is no box 5.1. related to water	Sabine Fuss	MCC Berlin	Germany
1465	63	46	63	47	Add Kongsager 2018 and Kongsager et al. 2016 to the cited references here: "(Ellison et al 2017; Kongsager et al. 2016; Kongsager 2018; Stanturf et al. 2015; Locatelli et al. 2015; Verkerk et al. 2020)." •Kongsager, R., Locatelli, B. & Chazarin, F. (2016). Addressing climate change mitigation and adaptation together: a global assessment of agriculture and forestry projects. Journal: Environmental Management 57 (2), pp 271-282. http://dx.doi.org/10.1007/s00267-015-0605-y• Kongsager, R. (2018). Linking Climate Change Adaptation and Mitigation: A Review with Evidence from the Land-Use Sectors. Journal: Land (7)4, 158. https://doi.org/10.3390/land7040158	reject, we refer to many refs already	RICO KONGSAGER	University College Copenhagen	Denmark
12695	63	46	63	47	A keystone reference on the use of ecological restoration for the purpose of carbon sequestration is: Palmer MA, DA Falk, and JB Zedler (Eds.). 2016. Foundations of Restoration Ecology. Second Edition. Island Press, Washington, DC.	reject, we refer to many refs already	Donald Falk	University of Arizona	United States of America
19765	63	46	63	46	soil erosion protection and conservation	reject, sentence is long already	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
73521	63	46	63	47	The work 'Stanturf et al. 2015' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21349	63	47	63	47	We suggest to add Lacombe et al., 2016 which addresses a very collaborative international work on the topic.	reject, the ref does not add much	Government of France	Ministère de la Transition écologique et solidaire	France
56047	63	47	64	2	Run-on sentence needs correction to help distinguish concepts/points.	accept, sentence improved	Government of United States of America	U.S. Department of State	United States of America
19767	63	48	63	48	soil erosion	accept, sentence improved	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21351	64	2	64	2	We suggest to add after "biodiversity" "and increased erosion (Ribolzi et al., 2017; Neyret et al., 2020)."	reject, the ref does not add much . there are many other refs to trade offs already .every measure in 7.4 has text on trade offs.	Government of France	Ministère de la Transition écologique et solidaire	France
71821	64	2	64	2	also make reference to the BIOECONOMY cross-WG box	reject. we refer to it already at 3 places	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73523	64	2			The work 'Teuling et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1149	64	4	64	4	After the Elllison 2017 citation, add a sentence saying "Adherence to SFM practices and participton in SFM certification schemes can help mitigate some of these potential impacts.	reject, we need to cut txt	Reid Miner	Private Consultant	United States of America
14749	64	4	64	5	The treatment of albedo in this sentence is more in line with current scientific consensus and diverges from the earlier statement in the ES (p. 4 l. 19-20) implying a similar level of uncertainty for albedo and BVOC.	noted, we treat albedo here very short, in 7.4.2. there is section on the bipphysics, albedo, VOCs etc	Pierre Bernier	Natural Resources Canada	Canada
30349	64	4	64	6	Please explain why afforestation and reforestation activities at high lattitudes may produce net warming either here or e.g. in section 7.2.4.	noted, we treat albedo here very short, in 7.4.2. there is section on the bipphysics, albedo, VOCs etc	Government of Norway	Norwegian Environment Agency	Norway
29675	64	6	64	6	The reference ("section 7.4.2") seems misleading, and should probably be "7.2.4")	thanks, accepted	Government of Norway	Norwegian Environment Agency	Norway
73525	64	8			The work 'Smith et al. 2018' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73527	64	8			The work 'Kreidenweis et al. 2016' cannot be found in the Refences.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
80557	64	8	64	9	All of the afforestation, reforestation and forest ecosystem restoration activities sholuld be adaptive for sustainablity.	reject, we reflect the variety of measures that can be taken, with all ins and outs. review comment is personal opinion	Eray Özdemir	General Directorate of Forestry	Turkey
77679	64	14	64	23	The discussion in this section is very important. Clearly not all forms of restoration are equal. Natural regeneration offers superior mitigation benefits in terms of risk, timely scale and longevity, (Mackey et al 2020 cited above, Moomaw et al cited above).	reject, we reflect the variety of measures that can be taken, with all ins and outs.	Virginia Young	Australian Rainforest Conservation Society	Australia
73529	64	19			The work 'Kreidenweis et al. 2016' cannot be found in the Refences.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73531	64	19			The work 'Li et al. 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
73533	64	19			The work 'Huang et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73535	64	25			The work 'Yan et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
49911	64	29	64	40	The study by Strassburg needs a mention here: 10.1038/s41586-020-2784-9	accepted,	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
49993	64	29	65	29	The findings of the study by Camia (Camia, A., J. Giuntoli, R. Jonsson, N. Robert, N.E. Cazzaniga, G. Jasinevicius, V. Avitabile, G. Grassi, J.I. Barredo, und S. Mubareka. The use of woody biomas for energy production in the EU. Bd. EUR 30548 EN. Luxembourg: Publications Office of the European Union, 2021. ISBN 978-92-76-27867-2.) of the GHG effects deserve a mention here, as well as the implications the authors find for biodiversity.	reject, camia is ou tof place here. it is about biomass for bioenergy	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
54345	64	29	65	23	This is a very balanced assessment of the developments since previous reports.	Thank you.	Sabine Fuss	MCC Berlin	Germany
72789	64	29	64	40	Strassburg 2020 ttps://doi.org/10.1038/s41586-020-2784-9 could be a useful reference here	accepted,	Matthew Gidden	Climate Analytics	Germany
56049	64	30	64	40	Need clarity here on the nature of this debate. Are the authors saying that some AF/RF proponents are saying that AF/RF can help achieve the 1.5°C target due to the high potentials in the literature, and thus in retaliation some opponents are saying AF/RF can't take place unless part of natural restoration? Do any of the citations of studies producing potentials estimates (lines 30-31) or the citations for intense debates (lines 36-37) make this claim that only AF/RF is needed? The former studies make appropriate caveats that other programs and policies, such as those on biodiversity and social and cultural aspects, would also need to be implemented to avoid potential negative outcomes. Thus, these statements made in the last sentence seem strong. Be sure that all perspectives are being represented clearly and accurately here.	noted, well reflected by reviewer, sentence kept	Government of United States of America	U.S. Department of State	United States of America
73537	64	30			The work 'Bastin et al. (2019)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73539	64	31			The wrodk 'Doelman et al (2019)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73541	64	31			The work 'Favero et al 2020' cannot be found in the Refernces.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73543	64	36	64	37	The work 'Anderegg et al 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73545	64	37			The work 'Holl et al. 2020' cannot be found in the References. There is a work by 'Holl (with other author)' in 2020 in the References but the authors are only two in it.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73547	64	37			The work 'Heilmayr et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73549	64	37			The work 'Hong et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73551	64	37			The work 'Bond et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
45985	64	38	64	40	Please add source which supports statement or delete sentence. Comment: The source provided (Lewis and Wheeler 2019) does not support the given statement. It's more that the content of this comment by Lewis and Wheeler seems to have provoked the author of this paragraph in Ch7 to diagnose "polarisation". As the source just hints to problems in categorising of what might qualify as "forest restoration" this reaction seems rather emotional and not suited to inform on the state of science.	reject, the source lewis et al. does reflect a more critical view on tree planting	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
56051	64	38	64	40	While the characterization of polarization in the debate over the use of afforestation and reforestation for mitigation is accurate, it does not convey the entirety of the debate or causes for polarization. Language should be inserted to convey that this is but one element contributing to polarization.	reject, the sentence does reflect the debate	Government of United States of America	U.S. Department of State	United States of America
1151	64	40	64	40	should the word "nature" be changed to "natural"?	accept	Reid Miner	Private Consultant	United States of America
21353	64	40	64	40	Importantly, considering A/R mitigations strategies alone leads to increased food prices, a consequence often overlooked in studies on A/R mitigation potentials, which calls for complementary options, such as diet change (Stevanović et al., 2017; Prudhomme et al., 2020). https://pubs.acs.org/doi/abs/10.1021/acs.est.6b04291 https://iopscience.iop.org/article/10.1088/1748-9326/abb10a	reject, we deal with competition for food many times in chapter	Government of France	Ministère de la Transition écologique et solidaire	France
51707	64	41	65	29	It should also be mentioned that not only existing carbon stocks are at serious risk from extreme events, but also the potential to sequester carbon via afforestation/reforestation is at risk throught droughts, firest, pest, diseases, etc. The very important discussion on 'tipping points' and their effects on cc mitigation is completely missing. Compare, for example, https://www.nature.com/articles/d41586-020-00508-4 and K.A. Duffy el al., "How close are we to the temperature tipping point of the terrestrial biosphere?," Science Advances (2020). https://advances.sciencemag.org/content/7/3/eaay1052	noted, reviewer is right, this risk is mentioned several times in whole chapter, and in exe summary	Florin Vladu	UNFCCC Secretariat	Germany
56053	65	2	65	4	Make it clear what type of estimates are included in the Domke 2020 study: technical, economic, or sustainable (whatever narrowest lens category is). It is not clear if costs of mitigation are included here, so presumably this is technical potential.	accept, added. 'technical'	Government of United States of America	U.S. Department of State	United States of America
73553	65	2	65	3	The work 'Romanovskaya et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
14751	65	6	65	8	Another appropriate comment on albedo, in contradition with the treatment of albedo earlier in the text (p. 4 l. 19-20)	reject, here the statement on albedo is correct. teh overal lsection on albedo, treats its uncertainty and ranges all over the world, which is more unceertain and counteracts each other between high and low latitiudes	Pierre Bernier	Natural Resources Canada	Canada
73555	65	6			The work 'Wade et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
48753	65	7		8	However, tropics are less efective places in terms of soil carbon storage asociated to such forest restoration in comparisson to higher latitudes. Soil carbon is as relevant as biomass carbon.	reject, we cannot treat all specific everywhere of all locations	Alfredo Erlwein	Soil Science Institute, Universidad Austral de Chile	Chile
29677	65	8	65	11	This sentence may be confusing because it gives a very specific number without further explanation based on a single study. It could be questioned whether it is appropriate to present such a specific number from only one scientific source. It would be more useful to cite and compare multiple lines of evidence. We also miss Favero et al., (2018), (2017) and (2020) in the reference list. When calculating albedo, it is important to focus not only on cost, but also on benefits and efficiency.	unknown, there s no nr here in this line. maybe they refer to line 10, this nr is based on the study	Government of Norway	Norwegian Environment Agency	Norway
76825	65	10	65	10	"costs may be 46% greater if albedo is considered": Please explain. Afforestation is unlikely to get more expensive form considering albedo. The MAC curve of afforestation may shift, but then there are probably also, more important implications, like certain types of afforestation in certain places may not even mitigate.	reject, costs get higher when the net climate cooling effect becomes lower.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73557	65	11			The work 'Favero et al., 2018' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73559	65	13			The reference of the work 'Romijn et al. 2019' is not clear (see page 190, line 6).	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
56055	65	14	65	14	Make it clear that this statement on uncertainty of carbon sequestration per unit area pertains specifically to restoration.	reject, pertains to many forms of mitigation measures	Government of United States of America	U.S. Department of State	United States of America
61333	65	14	65	23	Nothing is said about the substantive ability of soils to sequester carbon, nor the huge uncertainty in the rates of accumulation of this carbon source. This can easily be greater than the above ground woody component. This remains a huge uncertainty and this should be emphasized. Available rates should be provided.	accept, we added a sentence and a ref.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
72791	65	14	65	23	Cook-Patton 2020 https://doi.org/10.1038/s41586-020-2686-x could be a useful reference here	accept , added on soil uncertainty	Matthew Gidden	Climate Analytics	Germany
73561	65	17			The work 'Wheeler 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1153	65	19	65	19	Wheeler 2016 is not included in the list of references	Thanks, references were revised.	Reid Miner	Private Consultant	United States of America
73563	65	19			The work 'Wheeler 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73565	65	21			The work 'Chazdon 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
45987	65	24	65	29	It would be valuable for the reader to be presented with a broader assessment of A/R. Especially the critical aspects of afforestation activities could be mentioned in this paragraph, as already hinted to on page 63, line 47ff and covered in chapter 12, section 5.	reject, we have treated risks at many places.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
72793	65	24	65	29	Is there a justification for the 100 USD/tonne limit? How sensitive are potentials to this? e.g. is it economics or other barriers / sustainability concerns that prevent more from being achieved?	noted, the 100 dollar limit is a widely accepted limit, always used in studies	Matthew Gidden	Climate Analytics	Germany
56057	65	27	65	29	This is a good point but suggest further clarification: "Not all sectoral studies rely on economic models that account for leakage, which may be > 50% (Murray et al., 2004; Sohngen and Brown, 2004), suggesting that technical potential may be overestimated." Suggest edits to the second part of this sentence, to make it clear that "technical potential, as estimated in studies not including economics, may be overestimated".	accept, imporved senetence	Government of United States of America	U.S. Department of State	United States of America
48757	65	30			Again I consider very necesary a specification on CSF about the fast-growing tree species used, whereas very relevant differences between exotic and native species can be found, as I mentioned before. I understand that in the european case native species are commonly used. Unfortunatelly is not the case of many underdeveloped countries.	reject, thsi refers to CSF box. the csf box explains CSF, and that it is more than fast growing trees.	Alfredo Erlwein	Soil Science Institute, Universidad Austral de Chile	Chile
79095	65	30	67	24	Little mention of the possible effects of climate change (including drought, extreme heat, expansion of pests' ranges, or extreme fire) on forests, but these effects seem poised to reduce potential for mitigation in this sector or reduce the permanence of mitigation in this sector	reject, adaptation is mentioned clearly, furthermore . and table 7.6. gives risks as well.	Edith Juno	National Wildlife Federation	United States of America
20381	65	31	65	41	As the section's title is "Assessment of AFOLU mitigation measures including trade-offs and synergies", it would be good to state from the start that the main, direct mitigation potential of forests lies in the increse of forest carbon stocks. Sustainable forest management does not necessarily add to the carbon stocks at all, but it can help mitigation in other sectors through the production of biomass. The current text is very vague on how forests can actually contribute to mitigation, which is ultimately the focus of the whole WG3 report.	reject, this is increase in C stock in forest is only one measure, and is mostly in 7.4.2.2.	Tommi Ekholm	Finnish Meteorological Institute	Finland
49913	65	31	65	35	This definitions is tautological (improved is what is improved), and, in the light of the existing trade-offs between the target entity, not operational enough.	reject, although we agree that 'improved' can mean a variety of aims and goals, it is stil a much use term	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
1343	65	37	65	41	I miss here a reference to the management of deposited sediments within fluvial systems that can be a significant sink (an partially unexplored) of organic carbon, having deposited sediments a high potential for carbon sequestration	reject, this is part of wetlands	Carolina Boix-Fayos	CEBAS-CSIC	Spain
49915	65	38	65	39	higher carbon stocks than? What is the reference level? Higher than the potential? I am not aware of any study. Higher than with current management and with the same harvest level? Needs to be specific	reject, higher than baselien, or current obviously	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
76827	65	38	65	40	increased carbon stocks are mentioned twice ("higher" and "enhancing"), but no consideration os given to lower carbon stocks. Table 7.6 considers "short rotations" as part of "improved management" and "decreased resilience" as a possible result, which would make lower carbon stocks a distinct possibility.	reject, risks are mentioned in table 7.6. and the HWP section gives also the risk of too hgh harvest resulting in lower C stock s	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
20445	65	40	65	41	One paper to add to this list: Ekholm, T., 2020. Optimal forest rotation under carbon pricing and forest damage risk, Forest Policy and Economics 115, 102131. (https://doi.org/10.1016/j.forpol.2020.102131). The paper looks at optimal rotation when the forest carbon is priced, and when considering the risk of forest disturbances. A modest carbon prices increases carbon stocks without large sacrifices on the harvest volumes, provides more income to the forest owner and also mitigates the financial risk from distrurbances.	accept, inserted	Tommi Ekholm	Finnish Meteorological Institute	Finland
73567	65	40			The work 'Seidl et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73569	65	40	65	41	The work 'Abatzoglou and Williams, 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73571	65	41			The work 'Hashida et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
11261	65	42			It might worth to mention the work of Luyssaert et al. 2018 and Naudts et al 2016 who showed that forest management may increase C storage but biophysical feedbacks may warm the climate Naudts, K., Chen, Y., McGrath, M. J., Ryder, J., Valade, A., Otto, J. and Luyssaert, S.: Europe's forest management did not Mitigate Climate Warming, Science (80-.)., 351(6273), 597–601, doi:10.1126/science.aac9976, 2016.	reject, too many references already	Bertrand Guenet	CNRS	France
20383	65	42	65	42	"Improved management" is very vague. Please provide specific examples of what can be done to improve management,	reject, we agree it is a broad term. but it encompasses many measures, loaly specific. we outline it from L30-48	Tommi Ekholm	Finnish Meteorological Institute	Finland
29651	65	42	66	4	Please consider mentioning BECCS in this paragraph as well. BECCS is currently not covered by the phrases "substitution" and "carbon stock changes in biomass and soils". Please coordinate with the authors of chapter 6 and consider if this can be covered in the report.	reject, we menton bioenergy. BECCS ha a whole section 7.4.4.	Government of Norway	Norwegian Environment Agency	Norway
49999	65	42	65	42	would be helpful if measures and activities that fall under "improved managment" would be explicitly listed (see Box 7.7 pg 92 for agriculture).	reject, we agree it is a broad term. but it encompasses many measures, loaly specific. we outline it from L30-48	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
61369	65	42	65	44	This is strongly relevant in water limited regions with strong water demand. See e.g. Forest thinning impacts on the water balance of Sierra Nevada mixed-conifer headwater basins Saksa, P.C., Conklin, M.H., Battles, J.J., Tague, C.L., Bales, R.C. Water Resources Research, 2017, 53(7), pp. 5364–5381	agree, this is mentioned	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
80661	65	42	65	48	Bioenergy substitution for fossil fuels is not an effective mitigation strategy because burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels. Furthermore, bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways	reject, we have a whole section on bioenergy and BECCS, furthermore ch 12 deals with it as well, and has a bioeconomy box. clearly enough. this section here 7.4.2.3. is about all the various aspects of forest management to improve the climate mitigation effects. active management and provision of products is also part of that	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
80805	65	42	65	48	Bioenergy substitution for fossil fuels is not an effective mitigation strategy because burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels. Furthermore, bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways	reject, we have a whole section on bioenergy and BECCS, furthermore ch 12 deals with it as well, and has a bioeconomy box. clearly enough. this section here 7.4.2.3. is about all the various aspects of forest management to improve the climate mitigation effects. active management and provision of products is also part of that	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
19769	65	43	65	43	regulation of watershed (erosion,sedimentation and floating risk)	accepted, improved	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
8481	65	44			use ; not comma here	Thanks, editorial comment.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10245	65	44	65	44	use ; not comma here	Thanks, editorial comment.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
20391	65	44	65	47	The text states that "often results will be subtle". I disagree strongly. There is a substantial body of literature in forest economics which states that even a modest carbon price (compared e.g. to those discussed in previous sections of the WG3 report) could lead to cessation of harvests in commercial forests. See e.g. van Kooten et al. 1995, Uusivuori and Laturi 2007 (doi:10.1139/X07-071) and Ekholm 2020 (https://doi.org/10.1016/j.forpol.2020.102131). This is far from subtle. This would imply major increases in forest carbon stocks, but these papers also highlight how problematic this would be for the wood product chain. A more modest price would incentivize longer rotations in commercial forests without sacrificing much of the harvested wood volume, but increasing carbon sinks. Nevertheless, this demonstrates the high economic potential that forests have in mitigation, which needs to be stated in this section.	agree, rephrased	Tommi Ekholm	Finnish Meteorological Institute	Finland
56059	65	44	65	47	There are major problems with this overly prescriptive statement concerning the 'only' way to conduct an assessment of mitigation via IFM. This IPCC report should NOT be asserting that there is only one way to assess or estimate the mitigation outcomes from IFM. This is overly prescriptive and should be struck from the document. If not, it should be revised to be more balanced and thoughtful to different national and other circumstances. Though it may be true that "Often, results will be subtle", authors must be clear that mitigation strategies effects can be assessed, when appropriate, in conjunction with the overall forest and wood use system.	accept, rephrased	Government of United States of America	U.S. Department of State	United States of America
56061	65	44	65	47	This report should not be asserting that all IFM mitigation assesssments 'should' include specific elements. It especially should not be prescribing that the 'bioenergy component' be assessed 'with the avoided emissions through substitution'. Not only are the authors saying that IFM outcomes should include bioenergy outcomes but those bioenergy outcomes should include avoided FF emissions, which essentially makes the bioenergy component, and overall the IFM assessment, potentially look more beneficial than it would without those components.	accept, rephrased	Government of United States of America	U.S. Department of State	United States of America
56063	65	44	65	47	There is a potential problem of double counting if this advised assesssment approach is the 'only' way to assess IFM within an economy-wide assessment, as such outcomes could also be accounted for in other sectors. Suggest striking 'should' and 'only', inserting 'can', and striking, at a minimum, the 'with the avoided emissions through substitution' text.	accept, rephrased	Government of United States of America	U.S. Department of State	United States of America
73573	65	44			The work 'Ashton et al. 2012' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
49917	65	46	65	47	I agree, the accounting should be comprehensive and include all components. As an assessment of potential actions, it needs to include the substitution effect, as mentioned, but substition factors are decisive for the outcome (Kalt 10.1111/gcbb.12626) and one cannot assume, biomass always substituting (york 10.1038/nclimate1451) - history shows that biomass often "adds on top", see the example of Austria (10.1111/j.1530-9290.2008.00076.x, 10.1007/s10113-007-0024-6). And, as it is about no-use options as reference value, it also needs to include the oportunity costs, i.e. the sink-forgone effects (Marques 10.1038/s41559-019-0824-3, 10.1038/s41586-018-0757-z, 10.1126/sciadv.aax2546). And they can be substantial and thus need to be mentioned here.	reject, we name bioenergy as part of chain here. more extensive bioenergy issues are dealt with in BECCS box and in ch 12.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
9613	65	47	65	47	I agree that the evaluation of GHG (in particular C) effects must be comprehensive and also include avoided emissions through fossil fuel substitution, but it should also be noted that it is not adequate to automatically assume that each unit of forest bioenergy replaces one unit of fossil fuels such as coal or oil-based products. First, there is strong evidence that just supplying more biomass to markets does not automatically reduce fossil fuel consumption by the same amount. An empirical analysis based on a panel study even suggested that the fossil-fuel savings may be shockingly small (York 2012, Nature Clim Change, doi 10.1038/nclimate1451). Second, as the phase-out of fossil fuels progresses, it may well be that biomass replaces other fuels or forms of energy with much lower GHG emissions, in particular when calculating substitution effects in the more distant future (Werner et al. 2010, Env Sci Policy, 10.1016/j.envsci.2009.10.004)	reject, we name bioenergy as part of chain here. more extensive bioenergy issues are dealt with in BECCS box and in ch 12.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
20385	65	47	65	48	The statement "The net carbon emissions should then be assessed against a baseline." is problematic. "Should" is a normative word, but the text does not provide any justification for why a baseline should be used. On one hand, to evaluate an impact, *any* action should be measured against a baseline, where that action didn not take place. That is, this is not related only to net emissions from forestry. On the other hand, this opens up the fundamental problem that one can never know the counterfactual case, i.e. what would have happened without that certain action. The text will work perfectly even without this problematic statement.	agree, deleted	Tommi Ekholm	Finnish Meteorological Institute	Finland
72657	65	47	65	47	As is noted throughout this chapter, avoided emissions due to substitution is not accounted for in the land sector, but in the respective commodity sectors. It is inconsistent and misleading for it to be included here in the assessment of forest management effects.	reject, we do not include it here in our assessment. note the very small b ioenergy mitigatin potential in our chapter in Table 7.4. this is only the CDR componentn	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
9615	65	48	66	3	In my view, this statement - that even lacks any underpinning by literature - is biased and hence inappropriate in an assessment report. I agree that such effects "may" (as the text says) happen in specific cases, but the opposite is certainly also the case in many instances. From my experience, this statement is very much an expression of the view of experts from forest management sciences, but forest ecologists would strongly object. In an IPCC assessment, I expect that both perspectives need to be reviewed and their relative merits be evaluated against each other, resulting in a balanced statement. In my view, the following sentence does not establish a balanced discussion. It also lacks underpinning in the litature and is very generic, so overall this whole para remains unsatisfactory	reject, we balance all perspective from conservation section 7.4.2.1. to sust management here	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
49919	66	1	66	3	The tone of this text is not balance, it suggests that increasign C-stock strategy negatively affect biodiversity and resilience. But no-use appraoches have shown that forests left without focus increase resilience even better than with management, and build up considerable C-stocks (as used forests have a lower steady-state than the potential, as function of harvest pressure). 10.1016/j.foreco.2019.03.047, 10.5194/bg-15-5699-2018, 10.5194/bg-15-5699-2018, 10.1111/gcb.13506, 10.1088/1748-9326/aa5ef1, 10.1111/brv.12193	reject, we balance all perspective from conservation section 7.4.2.1. to sust management here. sentence has been improved	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
14753	66	3	66	4	This portayal of albedo change over small areas is incorrect. Changes in albedo over any size of surface has a radiative forcing effect that can be quantified easily. However, it is clear that changing the albedo of 1 ha of land will not have a discernable effect on the regional climate, but with forest management, the hectares add up over time!	accept, imporved sentence	Pierre Bernier	Natural Resources Canada	Canada

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
1345	66	4	66	12	In relation to the former comment, I miss a statement on forest management at the integrated scale within hydrological catchmens including the management of not only of vertical flows but also lateral flows (erosion processes and sediment redistribution) and their potential for carbon sequestration. References: Boix-Fayos, C., Nadeu, E., Quiñonero, J.M., Martínez-Mena, M., Almagro, M. and de Vente, J., 2015. Sediment flow paths and associated organic carbon dynamics across a Mediterranean catchment. Hydrol. Earth Syst. Sci., 19(3): 1209-1223. Martínez-Mena, M., Almagro, M., García-Franco, N., de Vente, J., García, E., Boix Fayos, C., 2019. Fluvial sedimentary deposits as carbon sinks: organic carbon pools and stabilization mechanisms across a Mediterranean catchment. Biogeosciences 16, 1035–1051. Doetterl, S., Berhe, A., Nadeu, E., Wang, Z., Sommer, M., and Fiener, P.: Erosion, deposition and soil carbon: A review of process-level controls, experimental tools and models to address C cycling in dynamic landscapes, Earth-Sci. Rev., 154, 102–122 , https://doi.org/10.1016/j.earscirev.2015.12.005, 2016.	accept, emphasised a bit more with a ref.	Carolina Boix-Fayos	CEBAS-CSIC	Spain
20379	66	5	66	12	One illustration of the trade-offs between increasing forest carbon stocks and the amount of harvested carbon is provided by Pingoud et al. 2018 (https://doi.org/10.1016/j.jenvman.2017.12.076).	reject, we have enough refs on thsi	Tommi Ekholm	Finnish Meteorological Institute	Finland
20387	66	5	66	12	The paragraph is very vague and needs to be clarified. Please list examples of actual mitigation options (e.g. longer rotations, less intensive harvests, continuous-cover forestry etc.). This allows then you to specify what trade-offs would result from each option.	accept, done	Tommi Ekholm	Finnish Meteorological Institute	Finland
56065	66	6	66	7	Is this additional value from Austin for China specifically?	comment unclear. no Austin here	Government of United States of America	U.S. Department of State	United States of America
9555	66	7	66	12	The sentence: "Further, there is a trade-off between management in various parts of the forest product value chain, resulting in a wide range of results on the role of managed forests in mitigation (Agostini et al., 2013; Braun et al., 2016, Gustavsson et al. 2017. Erb et al, 2017, Soimakallio et al. 2016, Hurmekoski et al. 2020, Favero et al. 2020) and where managed forests do not necessarily contain less carbon than unmanaged systems, and when the whole value chain is regarded, carbon storage may be quite similar (Schulze et al 2019, DenOuden et al. 2019)." is biased. The first part of the sentence states that there are trade-offs in mitigation but does not provide any reasoning on what these trade-offs are. The second part of the sentence states that there is not necessarily less carbon in managed forests than than in unmanaged systems. Although this might be the case, this is not likely the case on average level (Erb et al. 2017). In addition, at least some of the studies referred in the first part of the sentence (e.g. Soimakallio et al. 2016) and other studies (e.g. Seppälä et al. 2019) conclude clearly that forest harvest reduces forest carbon stocks for decades more than carbon is sequestered in HWP stcoks and avoided in material and energy substitution (Soimakallio et al. 2016, Seppälä et al. 2019). Thus, I suggest the following modifications. "Further, there is a trade-off between management in various parts of the forest product value chain, resulting in a wide range of results on the role of managed forests in mitigation (Agostini et al., 2013; Braun et al., 2016, Gustavsson et al. 2017. Erb et al, 2017, Soimakallio et al. 2016, Hurmekoski et al. 2020, Favero et al. 2020). According to Erb et al. 2017, forest management has reduced carbon stocks in tropical, subtropical and boreal forests from their potential levels. Some studies conclude that reduction in forest carbon stocks due to harvest exceeds for decades the joint sequestration of carbon in harvested wood product stocks and carbon dioxide emissions avoided in material and energy substitution of wood use (Soimakallio et al. 2016, Seppälä et al. 2019). On the other hand, some studies conclude that managed forests do not necessarily contain less carbon than unmanaged systems, and when the whole value chain is regarded, carbon storage may be quite similar (Schulze et al 2019, DenOuden et al. 2019)."	accept, rephrased	Sampo Soimakallio	Finnish Environment Institute	Finland
72659	66	7	66	12	This sentence does not make sense. What is the trade-ff between? How is the last part about similar carbon relevant? Is the point about the varied roles that forest management can play in mitigation? What are these varied roles? Are they varied due to the potential range of practices, or to their efficacy at reducing emissions?	accept, rephrased	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
21355	66	8	66	8	According to Schlesinger (2018), "managed forests store less carbon than their native counterparts, and harvesting of native forests will therefore be a source of, not a sink for, atmospheric CO2"	reject, section rephrased	Government of France	Ministère de la Transition écologique et solidaire	France
73575	66	8			The work 'Agostini et al., 2013' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8543	66	9	66	12	use ; not comma here	Thanks, editorial comment.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73577	66	9	66	10	The work 'Hurmekoski et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1155	66	10	66	10	End sentence after Favero et al. 2020, and begin next sentence, "Where managed forests..."	Thanks, editorial comment.	Reid Miner	Private Consultant	United States of America
20377	66	10	66	11	It is not only a comparison between managed and unmanaged forests that is relevant. Different management practices, such as extended rotations or less-intensive harvests, can lead to significantly higher forest carbon stocks. Economic incentives for this could be provided for example through carbon payment schemes, see e.g. Ekholm 2020 (https://doi.org/10.1016/j.forpol.2020.102131).	accept, rephrased	Tommi Ekholm	Finnish Meteorological Institute	Finland
49921	66	10	66	12	This passage is not really at the state-of-art for an assessment report. It builds upon the Schulze paper 2019 that was heavily critizised for being biased and not referring to an appropriate reference level when compaing old-grown and mananged forests. Assessing the full array of literature is a minimum condition: https://doi.org/10.1111/gcbb.12716, https://doi.org/10.1111/gcbb.12714, https://doi.org/10.1111/gcbb.12796. Furhtermore, there is not much theory that actually used forests would have higher carbon stocks than the potential forests at the same site, see also the result by Erb 10.1038/nature25138, 10.1007/s10021-004-0234-4, Niedertscheider 10.1007/s10021-017-0120-5, see also the "translation" of this fact in the bookkeeping model by Houghton (used forests reach 75% of potential forests). Furthermore, this assertion is in harsh conflict to the IPCC Guideline data and compilations of restoration potentials an the carbon stocks of old-grown foretss. See again also Erb 10.1038/nature25138	accept, rephrased	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
73579	66	10			The work 'Favero et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73581	66	12			The work 'Schulze et al 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73583	66	12			The work 'DenOuden et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
49923	66	13	66	19	The text needs to be explicit if this entails a reduction in wood harvest, and exact qoutes	reject, a wide assessment of various measures was done in Roe et sl. 2019	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
21357	66	14	66	14	We suggest to replace "forest management activities" with "RIL and reduced harvest", this is all what these references are talking about.	reject, griscom is wider than RIL	Government of France	Ministère de la Transition écologique et solidaire	France
56067	66	16	66	17	Another component is costs/investment flows, as well as planning (like implementing BMPs or carbon planning/budgets). Consider adding this.	reject, not relevant here	Government of United States of America	U.S. Department of State	United States of America
48755	66	17			The term "improved plantations" is used but not defined. Does this term address the issue I am pointing (native species plantations)?	reject, roe and griscom analyse a set of measures. a few ar ementioned here.	Alfredo Erlwein	Soil Science Institute, Universidad Austral de Chile	Chile
73585	66	22			The work 'FRA, 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76829	66	22	66	23	"the overall growing stock in the world's forests is increasing." This seems to contradict the statement in the SPM "overall total forest growing stock is reported to be stable". Please reconcile. Also, it would be useful to give an estimate of how much of the increase in the global growing stock may be related to the natural causes.	accept, rephrased ' slightly'	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
49925	66	26	66	30	the 1 bill. ha of degraded forest comes too sudden, and it needs to explicitly lay out how degradation is defined (and how it is different from used forests that are not degraded). Also, how it is formulated, it suggests "management" plans to be positive, and the absence of "management plans" to be negative. But, first, management can also simply mean harvest, and harvest reduces C-stocks stored in forests (in steady-state results in a permanently lower C-stock) - thus explicit, precise terms are needed here. Furthermore, the increase of management plans also means a loss of wilderness and untouched forests - with ensuing C-emisisons. See Venter 10.1038/ncomms12558, Potapov 10.1126/sciadv.1600821. And lastly, the text (by referring to "secondary forests" casually suggests that it would be a question of effort to reconcile the trade-off between harvest and C-stock losses - but it is fundamentally an issue of intrinsic system relation. More details and precision are needed here.	reject, out of scope here. we deal with tarde offs between management and C stocks extensively	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
73587	66	26			The work 'FRA, 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73589	66	30			The work 'Leskinen et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21359	66	31	66	35	These numbers are very surprising, as already commented about table 7.5.	reject, it refers to table 7.5. with refs	Government of France	Ministère de la Transition écologique et solidaire	France
72795	66	31	66	34	Is it clear how much of these potentials are reduced emissions vs. increased removals?	this is imporved management section, i.e. not reduced deforestation	Matthew Gidden	Climate Analytics	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
17813	66	35	66	40	Most part of the planet's boreal forests (about 70%) are located in Russia, mainly in Siberia. The productivity of Siberian forests is significantly lower than that of tropical or broad-leaved forests of the temperate zone. However, the boreal forests of Siberia have a specific carbon cycle, which consists in the fact that dying parts of plants in harsh climatic conditions are poorly decomposed, the work of microorganisms, fungi and insects that destroy phytodetrite slows down, which ensures the preservation of dead organics in the soil for a long time and reduces carbon emissions into the atmosphere.	reject, too much detail	Sergey Chestnoy	UC RUSAL	Russian Federation
19911	66	35	66	40	Most part of the planet's boreal forests (about 70%) are located in Russia, mainly in Siberia. The productivity of Siberian forests is significantly lower than that of tropical or broad-leaved forests of the temperate zone. However, the boreal forests of Siberia have a specific carbon cycle, which consists in the fact that dying parts of plants in harsh climatic conditions are poorly decomposed, the work of microorganisms, fungi and insects that destroy phytodetrite slows down, which ensures the preservation of dead organics in the soil for a long time and reduces carbon emissions into the atmosphere.	reject, too much detail	Yulia Dolinina	UC RUSAL	Russian Federation
8485	66	36			Romanovskaya et al (2019). Always use dot after et al and before brackets. Romanovskaya et al.(2019)	accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10247	66	36	66	36	Romanovskaya et al (2019). Always use dot after et al and before brackets. Romanovskaya et al.(2019)	accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73591	66	36			The work 'Wade et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8487	66	44			(Austin et al., 2020) better to use dot and comma after et al when inside the brakets. But depend upon the IPCC format. Either use this format in the whole document or remove comma for uniformity. Because in most of the cases comma is not used.	accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10249	66	44	66	44	(Austin et al., 2020) better to use dot and comma after et al when inside the brakets. But depend upon the IPCC format. Either use this format in the whole document or remove comma for uniformity. Because in most of the cases comma is not used.	accept	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
49927	67	1	67	2	The paper by Nabuurs et al., (2017) is a back-of-the envellop estimates with many simple and partly bold assumptions and does not a full-fledged assessment that considers trade-offs, non-addibility or double-counting, and does not consider the time-dimension of e.g. productivity increases. Thus, a formulation would be good that expresses the explorativ nature of this study (or, rather, comment in the mdpi-journal "Forests"). It is also very difficult to assess the statement "in line with the regional estimate in Table 7.5.")	reject, the paper is good assessment of literature	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
21361	67	2	67	2	This sentence can be precised and the litterature review for Europe could go beyond the article mentioned. 1) Highlighting that the CSF assessed here boils down to changing tree density and (probably mostly) replacement of slow growing hardwoods by fast growing softwoods. and 2) Pointing out that there is also ample evidence from diverse countries and authors that in temperate managed forests, harvesting more (be it by shortening rotation lengths, harvesting abandonned old stands, intensified thinning, full tree harvest, ...) is detrimental to climate for at least the first 30-40 years (Agostini et al., 2013; Braun et al., 2016; Lecocq et al., 2011; Roux et al., 2017; Valade et al., 2018). The quantified potential of "harvesting less" can be obtained from these publications. Agostini, A., Giuntoli, J., Boulamanti, A., 2013. Carbon accounting of forest bioenergy (JRC Technical Report). European Commission, Joint Research Centre, Ispra, Italy. Braun, M., Fritz, D., Weiss, P., Braschel, N., Büchsenmeister, R., Freudenschuß, A., Gschwantner, T., Jandl, R., Ledermann, T., Neumann, M., Pölz, W., Schadauer, K., Schmid, C., Schwarzbauer, P., Stern, T., 2016. A holistic assessment of greenhouse gas dynamics from forests to the effects of wood products use in Austria. Carbon Management 7, 271–283. https://doi.org/10.1080/17583004.2016.1230990 Valade, A., Luyssaert, S., Vallet, P., Njakou Djomo, S., Jesus Van Der Kellen, I., Bellassen, V., 2018. Carbon costs and benefits of France's biomass energy production targets. Carbon Balance Manage 13, 26. https://doi.org/10.1186/s13021-018-0113-5	reject, for every continent we have a couple of prime studies .	Government of France	Ministère de la Transition écologique et solidaire	France
1157	67	4	67	4	Wade et al 2019 is missing from the list of references	Thanks, references were revised.	Reid Miner	Private Consultant	United States of America
63051	67	4	67	5	The forest ecosystem inventory data, including biomass, dead organic matter, soil organic carbon and wood forest products, in the latest national greenhouse gas two-year update report (2014) should be added after (Fang et al., 2018) to reflect more objectively the current situation and changes of China's forest ecosystem carbon sequestration since 2005.	reject, we do not reflect the NGHGIs here	Changke WANG	National Climate Center, China Meteorological Administration	China
73593	67	4			The work 'Wade et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
63053	67	5	67	6	Add 'afforestation and' after 'project-induced' to reflect the contribution of the key ecological projects to the increase off forest carbon sink.	accept done	Changke WANG	National Climate Center, China Meteorological Administration	China
73595	67	5			The work 'Fang et al., 2018' cannot be found in the References.	Thanks, editorial comment	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8489	67	6			105 Mton yr-1 subscript of -1 needed.	Thanks, editorial comment	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10251	67	6	67	6	105 Mton yr-1 subscript of -1 needed.	Thanks, editorial comment	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73597	67	6			The work 'Lu et al., 2018' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73599	67	12			The work 'Asner et al., 2005' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73601	67	12	67	13	The work 'Blaser and Kuchli 2011' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73603	67	13			The work 'Pearson et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
20389	67	16	67	24	The conclusions need a complete rewrite. The text is very vague and doesn't build on the earlier texts. Where did the consideration of labour and access come from? There was nothing either on leakage earlier in the section. Why raise set-asides here? I thought this was about improved management, which provides many more options than set-asides. Why raise one study that takes leakage into account (and even then only implicitly), and then compare that just generally to "other studies". Last, I have no idea what your judgement for mitigation potential actually means. Also, who is "we"? Is the judgement a personal opinion? The IPCC reports need to be reviews of published literature.	accept, rewritten	Tommi Ekholm	Finnish Meteorological Institute	Finland
28699	67	16	67	17	Labour and access are obvious. The key, however; is having dedicated and trained personel to educate and oversee the implementation of 'good' forest management.	accept, rewritten	Delton Alderman	USFS	United States of America
76831	67	16	67	17	Add "knowledge" and "institutions" to the list of prerequisites. Optimal management requires knowledge of site potentials, growth and yield tables for potential species adequate to the region etc., none of which is attainable locally based on only individual skills.	accept, rewritten	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
45989	67	21	67	24	Please provide stronger evidence for indirect effects or delete. Comment: The hint to indirect effects bears the risk of distracting from the use of the forest mitigation potential. It suggests (but does not specify or reference) a set aside scenario to suspect increased harvest "elsewhere" due to supply shortages somewhere. This doesn't seem to be a strong basis to arrive at medium certainty and confidence for the mitigation potential of better forest management, so this needs stronger evidence. Moreover, it doesn't exactly appear evident that leakage has to be linked to higher costs even though a model might implicitly (?) assume so. The quoted source, however, doesn't seem to support the conclusions drawn here as Austin et al. describe leakage as follows: Investments made in GHG mitigation in one region (e.g., delayed harvests or reduced deforestation) will have market implications and can alter harvest and production patterns in other regions, which can induce positive or negative emissions leakage. The current version of the GTM includes the integration of heterogeneous forest product demand functions for various wood products, which allows policy incentives and carbon sequestration investments to influence multiple markets, and which refine projections of regional responses to global stimuli. Specifically, this differentiation of forest products allows the model to substitute across pulpwood and sawtimber production to balance forest product demand with demand for forest carbon sequestration under an explicit mitigation policy incentive (i.e., a carbon price). For example, a policy that incentivizes short-term expansion in storage of terrestrial carbon could result in avoided deforestation, near-term expansion of fast-growing plantations, and increased harvest levels of lower-valued pulpwood, with each investment activity concentrated in the most productive regions.	reject, the leakage has a good ref.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
49929	67	23	67	24	from the text above, it does not become obvious why the assessment is medium. Also, what is medium certainty, the label reads " evidence" and "agreement" that results in "confidence". Needs to be more precise and traceable, and the conclusion is: low potential, medium confidence (if medium at all, and it should be split, e.g. in medium evidence low agreement)	accept, rewritten	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
54347	67	23	67	24	Please clarify: To which mitigation potential does this confidence statement refer? To all regional estimates above?	accept, rewritten	Sabine Fuss	MCC Berlin	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
45991	67	26	68	20	Please adjust or delete Box 7.3, "Case study: Climate Smart Forestry in Europe". RATIONALE: This box's content so far does not really reflect on evaluated cases of improved forest management. It's about a way to derive expected impacts through modelling. The box rather reflects a case of policy intervention on behalf of the whole supply chain for forest products in the EU while increasing cutting levels and mainly embracing mitigation effects outside the forest stand. We suggest the authors check the wording here because „Climate Smart Forestry" cannot be called a case study: It is just a political concept proposal for the EU.	reject, all boxes are called case studies, although they may not be a specific location with a case. these can also highlight ideas, examples	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
48759	67	26			Idem Previous observatoin	reject, all boxes are called case studies, although they may not be a specific location with a case. these can also highlight ideas, examples	Alfredo Erlwein	Soil Science Institute, Universidad Austral de Chile	Chile
49935	67	26	68	20	The box on climate smart forestry is much of hand-waving without too much substance and, in particular, lacking assessment style. It is partly prescriptive "will have to", "will be needed" and I do not really understand what this box should convey, with so little assessment and with only two rerferences, both papers being either rather conceptual and back-of-the envelope, or a commenatary on what would be needed on generic terms, without much evidence and insights into trade-offs, terms and conditions, etc.)	reject, all boxes are called case studies, although they may not be a specific location with a case. these can also highlight ideas, examples	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
51709	67	26	68	20	What is the definition of 'climate-smart forestry'? Is there also a definition for climate-stupid forestry then?	reject, it is clearly defined	Florin Vladu	UNFCCC Secretariat	Germany
76833	67	26	68	20	Please revise the title of Box 7.3. "Case study" suggests a proven example, but this concept seems to be brand new (proposed in the last two years) and seems not to have been implemented, thus its performance still needs to be demonstrated. It may be prefereable to refer to it as a new concept/proposal. Moreover, the text seems to refer to the European Union, not Europe as such.	accept, rewritten	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76835	67	26	68	20	Please clarify whether the numbers refer to the EU of 28 or 27 Member States. The sources given were published after the Brexit refrendum, but some of the numbers seem to refer to EU-28.	accept. , all boxes are called case studies, although they may not be a specific location with a case. these can also highlight ideas, examples	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
28701	67	28	67	29	Are there other factors affecting the stocks of Norway Spruce? For instance: over-mature stands; over-stocking; were prescribed burns implemented -- or not?: and traditional and pre-commercial thinnings? If so, should they alos not be listed?	accept, added	Delton Alderman	USFS	United States of America
49931	67	28	67	28	"prospering and increasing" is not really "balanced language". Furhermore, who has regarded? And, all forests? There a big trends, but still losses of pristine forests etc. Needs more balance.	reject, see forest europe. many indicators things are devloping well	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
49933	67	29	67	34	it is important to also mention that the wide-spread of Norway spruce that now comes unter CC pressure is the result of long-lasting silvicultural practice and thus not solely "climate-change induced", but a questions of "exposure to thread". It is also important to qoute the ongoing trends in Europe's forests: 10.1038/s41893-020-00609-y and 10.1038/s41586-020-2438-y	accept, added ref	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
19531	67	32	67	34	It is not clear who is behind the strategy and who implements it.	accept, added.	Markku Rummukainen	Lund University	Sweden
10683	67	39	67	41	Forests are hosting a large variety of animal species, sometimes vulnerable; it is disturbing that no concern for the preservation of biodiversity seems to be present in the CSF concept.	accept, added. diverse forest	Philippe Waldteufel	CNRS	France
76837	67	44	67	45	The mitigation effect includes material and energy substitution. These are legitimate benefits, but fall outside of the AFOLU sector as defined in thsi report. It would be useful to give an indication of the relative share of AFOLU proper versus benefits in other sectors.	reject, here in box we can give full scope. in table 7.4. and 7.5. we distinguish	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21363	67	45	67	45	What is the reference for the number 569 Mt?	refernces are clearly higher up in box	Government of France	Ministère de la Transition écologique et solidaire	France
83241	67	45	67	45	Not sure what year as assumed as "current" here, but it seems that 569Mt/13% would refer to 2017 EU28 emissions - please adjust (to more recent values and EU27) and/or make explicit what the calculation refers to	accept, added.	Geden Oliver	German Institute for International and Security Affairs	Germany
21365	68	2	68	3	"Implementation of CSF goals" is very vague. If the reference is Nabuurs et al. 2017, then better specify that "implementation of CSF goals" boils down to changing tree density and (probably mostly) replacement of slow growing hardwoods by fast growing softwoods.	accept, goals deleted	Government of France	Ministère de la Transition écologique et solidaire	France
21367	68	3	68	3	What is the reference for the number 441 Mt?	refernces are clearly higher up in box	Government of France	Ministère de la Transition écologique et solidaire	France
21369	68	4	68	4	Please precise which instrument of the Green deal is concerned her.	accept, added.	Government of France	Ministère de la Transition écologique et solidaire	France
19533	68	6	68	8	Provision of reneweables and other substitution is part of the climate mitigation effort itself, not a co-benefit.	reject, these are co benefits to mitigation	Markku Rummukainen	Lund University	Sweden
19535	68	6	68	8	While these aspects may be co-benefits from a mitigation-centric point of you, for example biodiversity is a goal of its own, and not "under" climate goals. The issue is more about finding solutions that use synergies and avoid goal conflicts. Whether this then calls for integrated management or ascertaining co-benefits on each policy area, may be open for consideration.	reject, these are co benefits to mitigation	Markku Rummukainen	Lund University	Sweden
19537	68	11	68	12	It is not clear where the "will have to be" and "will have to establish… and take care…" come from. Is this specified in the strategy or assessed by the authors here?	reject, this box flags a concept, an idea. which is taking shape in many countries already	Markku Rummukainen	Lund University	Sweden
19539	68	17	68	20	This seems quite prescriptive and the basis for this is not really provided.	accept, changed	Markku Rummukainen	Lund University	Sweden
72661	68	22	70	7	There is a critical piece misssing here regarding how the emissions due to forest fire fuels management may outweigh the associated reductions in wildfire emissions. See: Simmonds, M.B., A.V. Di Vittorio, C. Jahns, et al (2021). Impacts of California's cliamte-relevant land use policy scenarios on terrestrial carbon emissions (CO2 and CH4) and wildfire risk. Environmental Research Letters, 16:014044.	Thank for the reference. It will be verified how it can contribute to the text.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
61335	68	23	68	32	Many grasses are dependent on fire to remove moribund material and remain healthy. Fire management can also affect species contribution of palatable vs unpalatable species, and release nutrients to stimulate new growth.	Noted, but unfortunately we can not add all the details on fire management benefits or trade-offs.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
21371	68	25	68	25	Paradoxically, aggressive and largely successful fire suppression has left frequent fire forests increasingly vulnerable to the negative effects of fire and other tree mortality agents (Stephens et al., 2018, https://academic.oup.com/bioscience/article/68/2/77/4797261).	Noted, but unfortunately we can not add all the details on fire management benefits or trade-offs.	Government of France	Ministère de la Transition écologique et solidaire	France
12697	68	26	68	27	The statement of the benefits of restoring fire to stabilizing biomass and carbon needs support: (1) Hurteau, M. D., M. P. North, G. W. Koch, and B. A. Hungate. 2019. Managing for disturbance stabilizes forest carbon. Proceedings of the National Academy of Sciences 116:10193-10195; (2) Hurteau, M. D., and M. L. Brooks. 2011. Short-and long-term effects of fire on carbon in US dry temperate forest systems. BioScience 61:139-146; and (3) Falk DA. 2017. Restoration ecology, resilience, and the axes of change. Annals of the Missouri Botanical Garden 102:201–216. http://doi:10.3417/2017006 \	Noted, thanks for the references.	Donald Falk	University of Arizona	United States of America
76839	68	29	68	29	Replace "natural reforestation" with "regeneration".	Accepted.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76841	68	30	68	30	Reduced air pollution is a questionable benefit of controlled burning and unacceptable in the context of burning following clear felling. Whilst controlled burning can reduce air pollution compared to much larger, uncontrolled fires that it may help avoid, a clear felling provides multiple alternative opportunities for reducing fuel load. The burning of the site may be a preferable option for other reasons, but clearly the worst for air pollution.	Accepted, the text will be revised to include these conditions.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76843	68	38	68	40	It is unclear how landscape fragmentation associated with increased population density could/would be associated with enhanced carbon uptake. Increased uptake is unlikely to be possible on a decreasing forest (and canopy) area. Net removals may increase due to reduced losses due to increased fire supression, but not due to increased uptake. Also, increased fire supression (often forced by urban sprawl that makes it unacceptable to allow fires to burn out naturally) has long been implicated in the emergence of megafires, which can more than wipe out any marginal benefits from previous suppression. This is why controlled burning is mentioned as beneficial in the previous paragraph, thus sending very mixed messages.	Noted, the text will be revised but this specific point is a reference from the SRCCL.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
61337	68	41	61	42	Are savannas the most fire-prone vegetation? Tropical grasslands or Mediterranean vegetation such as the South African fynboss must also rank high.	Agreed, sentence will be revised.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
11827	68	42	68	44	Is that still so today after the forest fires in Australia and USA etc. in the last three years? New data available?	Information on recent wildfires will be included in section 7.3.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
73605	68	46	69	1	The work 'Lipsett-Moore et al. (2018)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
63713	69	1	69	3	Incomplete sentence: "Implementation of prescribed burning with low intensity fires, principally in the early dry season, to effectively manage the risk of wildfires occurring in the late dry season are associated with reduction in [missing word - emissions?] (Whitehead et al. 2014)."	Thanks, phrase was completed.	Government of Canada	Environment and Climate Change Canada	Canada
5147	69	3	69	3	Reduction in ? (Fires) seems missing	Thanks, phrase was completed.	Dorota Retelska	FIBL Biological Agriculture Research Laboratory	Switzerland
12699	69	3	69	3	Incomplete sentence ("…reduction in…")	Thanks, phrase was completed.	Donald Falk	University of Arizona	United States of America

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73607	69	3			The wrok 'Whitehead et al. 2014' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8491	69	7			(Lipsett-Moore et al. (2018). Correct as (Lipsett-Moore et al., 2018). Just remove one unneseesary bracket (.	Accepted.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10253	69	7	69	7	(Lipsett-Moore et al. (2018). Correct as (Lipsett-Moore et al., 2018). Just remove one unneseesary bracket (.	Accepted.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73609	69	7			The work 'Lipsett-Moore et al. (2018)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
85809	69	7	69	9	The text states - currently…This should be qualified with a date since the data is continually changing. For example, as of March 2021, there are now 78 projects registered rather than the 72 stated in the text.	Accepted, thank you.	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
85811	69	9	69	11	The sentence cites a publication that includes outdated data. Up to date data is: abatement as of March 2021, as derived from credits issued to savanna projects under Australia's Emissions Reduction Fund, exceeds 8.2 MtCO2-eq to date.	Accepted, thank you.	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
12701	69	12	69	12	Opening statement needs reference: (1) Scott, A. C., D. M. J. S. Bowman, W. J. Bond, S. J. Pyne, and M. E. Alexander. 2013. Fire on Earth: An Introduction. John Wiley & Sons, Chichester, UK; (2) Falk DA, EK Heyerdahl, PM Brown, CA Farris, PZ Fulé, D McKenzie, TW Swetnam, AH Taylor, and ML Van Horne. 2011. Multiscale controls of historical fire regimes: New insights from fire-scar networks. Frontiers in Ecology and the Environment 9(8): 446-454. http://doi:10.1890/100052	Thanks for the references. They will be considered if adequate and if section extension allows.	Donald Falk	University of Arizona	United States of America
20393	69	12	69	37	The text discussess only prescribed fires as a way to manage forest fires. More broader context would be good.	The section is part of the mitigation measures, and prescribed burning are presented as a way to reduce emissions.	Tommi Ekholm	Finnish Meteorological Institute	Finland
20395	69	12	69	37	The text is long and would benefit from condensing.	Thanks, editorial comment. The whole section will be condensed.	Tommi Ekholm	Finnish Meteorological Institute	Finland
63711	69	12	69	37	Suggest to add information from wildfires in boreal ecosystems.	More information on wildfires will be added in section 7.3.	Government of Canada	Environment and Climate Change Canada	Canada
73611	69	14			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8553	69	16	69	16	(Kalies and Kent, 2016). Comma after authors and before year is good. However, in this whole document comma is not used. So bring uniformity in whole document. Check my PDF file corrections.	Thanks. Editorial comment.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
12703	69	16	69	16	On prescribed fire benefits and importance: Ryan, K. C., E. E. Knapp, and J. M. Varner. 2013. Prescribed fire in North American forests and woodlands: history, current practice, and challenges. Frontiers in Ecology and the Environment 11.	Thanks for the references. They will be considered if adequate and if section extension allows.	Donald Falk	University of Arizona	United States of America
73613	69	16			The work 'Kalies and Kent, 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
85813	69	16	69	17	The sentence 'The Australian Government has sanctioned greenhouse gas emissions (GHG) abatement methodologies to meet international emissions reduction obligations.' is misleading and we suggest it be deleted. The context of the paragraph suggests Australia has an abatement methodology involving use of prescribed fire in forests, Australia has no methodology along those lines. Also, even out of the context of that paragraph, the line is not correct. Australia does not 'sanction' methodologies (they are legislative instruments) and they are not designed specifically to meet international obligations.	Accepted, the sentence wiil be revised.	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
61343	69	17	69	17	If grasslands store 50% more carbon than forests, why is there an over-emphasis throughout the report on forests and trees, but low emphasis on protection and restoration of grasslands? The numbers, however don't seem to add up if grasslands have only 20% of soil organic carbon. These numbers need to be checked.	Numbers will be checked but the section includes specific sub-items related to grasslands conservation and management.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
12705	69	19	69	20	Regarding loss of resilience in southwestern North American forests: Keeley JE, P van Mantgem, and DA Falk. 2019. Fire, climate and changing forests. Nature Plants 5 (8): 774-775. https://doi.org/10.1038/s41477-019-0485-x ; (3) Friggens M, RA Loehman, AE Thode, W Flatley, A Evans, W Bunn, C Wilcox, S Mueller, L Yocom, and DA Falk. 2019. User guide to the FireCLIME Vulnerability Assessment (VA) tool: A rapid and flexible system for assessing ecosystem vulnerability to climate-fire interactions. Gen. Tech. Rep. RMRS-GTR-395. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 42 p. https://www.fs.usda.gov/treesearch/pubs/59033 ; (4) van Mantgem PJ, DA Falk, EC Williams, AJ Das, and NL Stephenson. 2020. Intermediate- and long-term growth predict post-fire tree mortality for common conifers in western U.S. parks. International Journal of Wildland Fire 29(6) 513-518. https://doi.org/10.1071/WF19020	Thanks for the references. They will be considered if adequate and if section extension allows.	Donald Falk	University of Arizona	United States of America
76845	69	19	69	19	"southern forest landscapes": presumably southern US. Please clarify.	Accepted, the sentence will be revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
61391	69	20	69	20	"…which has experienced drought …" should be "droughts"	Accepted, the sentence will be revised.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
12707	69	21	68	22	Increasingly severe wildfires: Falk DA. 2013. Are Madrean ecosystems approaching tipping points? Anticipating interactions of landscape disturbance and climate change. In Gottfried GJ, Ffolliott PF, Gebow BS, Eskew LG, and Collins LC, Merging science and management in a rapidly changing world: Biodiversity and management of the Madrean Archipelago III. RMRS P-67. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fort Collins, CO. https://www.fs.usda.gov/treesearch/pubs/44410	Thanks for the references. They will be considered if adequate and if section extension allows.	Donald Falk	University of Arizona	United States of America
73615	69	22			The work 'Hurteau et al. 2014' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1159	69	27	69	28	reword sentence	Rejected, no details on what should be revised.	Reid Miner	Private Consultant	United States of America
63715	69	27	69	28	Sentence unclear: "Studies that assume prescribed fire essentially replaces wildfire (i.e., the same total area burned), increases in prescribed fire activity can lead to reductions in total fire emissions."	Sentence will be revised for clarity.	Government of Canada	Environment and Climate Change Canada	Canada
61393	69	30	69	32	"Fuel treatments can reduce …" This sentence is not understandable.	Sentence will be revised for clarity.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
61395	69	30	69	32	"… how ongoing climate change…" should be "…how these ongoing climate changes…"	Accepted, the sentence will be revised.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
73617	69	32	69	33	The work 'Stephens et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73619	69	34			The work 'Krofcheck et al. 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61397	69	35	69	36	"… wildfire and the carbon stores and uptake in these systems…" should be "…wildfires, the carbon stores and uptake in these systems…"	Accepted, the sentence will be revised.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
73621	69	36			Please distinguish which source it is between the ones by 'Bowman et al.' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
56069	69	38	69	43	These sentences focus on savannahs, the subject of the previous subsection. This section is on forests. Suggest moving these sentences to savannahs.	Accepted, the sentence will be revised.	Government of United States of America	U.S. Department of State	United States of America
61339	69	38	69	41	The importance of fire for maintain biodiversity should also be mentioned.	Noted, but the focus is on mitigation.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
73623	69	39	69	40	The work 'Russell- Smith et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
84805	69	39	69	39	Reference to legal and policies issues here (in the context of savanna fire management) is not unique to savanna fire managemeht. Suggest this discussion cross-reference later discussion in the chapter regarding land access and tenure issues in the AFOLU context	Noted and thank you. This has been considered.	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
73625	69	43			The work 'Goldammer 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73627	69	49			The work 'Wotton et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
11829	70	1	70	3	Is that so with climate change? The statements in "Critical assessment and conclusion", are questioned. As most of carbon storage in savannas are belowground while aboveground in forests, fires must affect carbon stores in these systems very differently (see also Dass 2018). Seems that this critical assessment and conclusion needs to be updated. Dass, P., Houlton, B.Z. Wang, Y. & Warlind, D. 2018. Grasslands may be more reliable carbon sinks than forests in California. Environ.Res.Lett. 13 (7): 074027.	Sentence will be revised for clarity.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
63055	70	3	70	4	Replace 'mitigate GHG' with 'GHG mitigation'.	Accepted, the sentence will be revised.	Changke WANG	National Climate Center, China Meteorological Administration	China
1161	70	4	70	7	Change this sentence to "Although prescribed burning is a widely promoted to reduce uncontrolled wildfires in forests, the benefits for the management of carbon stores are unclear, with different studies reporting varying results" I suggest this change because it better summarizes current literature.	Noted. Thank you for the suggestion. This has been considered	Reid Miner	Private Consultant	United States of America
63057	70	4	70	6	Replace 'carbon stores' with 'carbon stocks'.	Accepted, the sentence will be revised.	Changke WANG	National Climate Center, China Meteorological Administration	China
21373	70	5	70	5	A word is missing at the beginning of the line	Accepted, the sentence will be revised.	Government of France	Ministère de la Transition écologique et solidaire	France
76847	70	5	70	5	Delete "a".	Thanks, editorial comment.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73629	70	6	70	7	The work 'Wotton et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
19771	70	7	70	7	prescribed burning schould be evaluated in terms of carbon balance throughout the nutrient cycle in differents soils ecosystems and conditions	Noted, but the focus is on mitigation.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
73631	70	7			Please distinguish which source it is between the ones by 'Bowman et al.' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61341	70	8	70	8	Suggest the heading is changed to "Reduce DEGRADATION and conversion of grasslands and savannas"	Accepted, the title will be revised.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
49937	70	9	70	18	The quotes here are important, but relatively old. Links to the SRCCL data would be important here	Rejected, quotes are related to the general description and distribution of savannas and are still valid. SRCCL was considered for other information.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
11831	70	17	70	48	Stated here is that grasslands hold more carbon than forests. This fact is not taken to any critical analysis in the report and the extensive literature and research publications on grasslands that have been published in the last decade is not finding its way to this report. Why do grasslands store more carbon than forests? Why do grassland soils hold more carbon than forest soils? Why has the main effort for carbon mitigation with focus on forests – not grasslands were, naturally, the main storage is? In the section, the key barrier is identified as cost. Is the cost higher for implementing grasslands than afforestation? Grasslands provide many additional benefits than forests – food to be the main - along with longer lasting carbon storage in soil formation and increased soil thickness. Carbon in wood needs to be preserved for long term storage. A life cycle analysis is needed here. In line 45 it is stated "Unlike most of the measures covered in Section 7.4, there are currently no global, spatially explicit mitigation potential estimates for reduced grassland conversion to generate technical and economic potentials by region". Currently there is much evidence for the important potential of grasslands for carbon mitigation and therefore it must be a priority for IPCC to gather together estimates on this potential. Some data seems though to be available as the first sentence in Critical assessment and conclusion (line 12 p.71) states that "Reduce conversion of grasslands and savannas showed considerable mitigation potential with most of the carbon sequestration in belowground biomass and soil organic matter. " There is however no reference for this statement. The last sentence in the section : "Conversion grasslands and savannas has received less national and international attention, despite growing evidence of concentrated cropland expansion into these areas" – and ….despite growing evidence of the importance of grasslands in the global carbon cycle. IPCC needs to put more focus on grasslands on the agenda.	Noted, but the chapter in many parts recognized and highlighted the role of grasslands carbon stocks.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
63059	70	17	70	18	"Grasslands store 50% more carbon than forests worldwide and represent around 20% of global soil organic carbon" isdifferent from [Grasslands contain a substantial amount of the world's soil organic carbon. Integrating data on grassland areas (FAOSTAT, 2009) and grassland soil carbon stocks (Sombroek, Nachtergaele and Hebel, 1993) results in a global estimate of about 343 billion tonnes of C – nearly 50 percent more than is stored in forests worldwide (FAO, 2007).] please check.	Accepted, the numbers will be checked.	Changke WANG	National Climate Center, China Meteorological Administration	China
8765	70	18	70	29	This section identifies the benefits of reducing conversion of grasslands to cropland but it ignores the impact on soil erosion. Reducing conversion of grassland to cropland has been shown to contribute to reducing soil erosion (cf. Classen et al. 2010) Claassen, R., Carriazo, F., & Ueda, K. (2010). Grassland conversion for crop production in the United States: defining indicators for policy analysis. Economic research service. Washington, DC (US): US. Department of Agriculture.	Accepted, soil erosion will be mentioned.	Billy Jones	Lund University	Sweden
18359	70	20	70	22	Could the authors please consider referring to the fact that the potential for enhanced grassland sequestration is regionally constrained.	Rejected, this is true for all the mitigation measures in the sector.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
73633	70	33			The work 'Lipper et al. 2010' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73635	70	33			The work 'Lipper et al. 2011' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21375	70	37	70	40	The use of Poeplau et al. 2011 numbers should be checked (in SRCCL, chapter 6, a 36% decrease is used for grasslands conversion. However, in Poeplau et al. 2011 is quoted that grasslands conversion yields a loss of 36tC/ha, not 36%. Additionnaly, Poelpau considers temperate grasslands, not global ones. Shouldn't only temperate grasslands be considered instead of all grasslands at the global scale?).	The context of this reference will be specified. The calculation in SRCCL is correct as Poeplau et al. specified a 36% loss and not a loss of 36t/ha.	Government of France	Ministère de la Transition écologique et solidaire	France
72663	71	1	71	2	This is questionable because field studies show that California grasslands are carbon sources to the atmosphere, not sinks. See: Ma, S., D.D. Baldocchi, L. Xu, T. Hehn (2007). Inter-annual variability in carbon dioxide exchange of an oak/grass svanna and open grassland in California. Agricultural and Forest Meterorology, 147:151-171. Also: Ryals, R., W.L. Silver (2013). Effects of organic matter amendments on net primary productvity and greenhouse gas emissions in annual grasslands. Ecological Applications, 23(1):46-59.	The Ma et al. paper indicates the role to precipitation on C storage in savannas. This point was included in the revised version. The Ryals et al. reference, however, reinforces the point the grasslands are C sinks.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
61345	71	12	71	12	Need to add "degradation". It is degradation, and not just conversion that causes carbon loss.	Accepted, the point on degradation will be included.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
21377	71	14	71	15	We recommend to add the following: "Moreover, grasslands and savannas are mostly used to feed ruminants, which are the largest source of emissions from agriculture. Policies aiming at reduced conversions must therefore be carefully designed to avoid supporting livestock rearing. One example is to promote the substitution of maize with grass (Pellerin et al., 2019). Pellerin, S., Bamière, L., Constantin, J., Launay, C., Martin, R., Schiavo, M., Angers, D., Augusto, L., Balesdent, J., Basile Doelsch, I., Bellassen, V., Cardinael, R., Cécillon, L., Ceschia, E., Chenu, C., Daroussin, J., Delacote, P., Delame, N., Gastal, F., Graux, A.-I., Guenet, B., Houot, S., Klumpp, K., Letort, E., Martin, M., Mary, B., Menasseri, S., Meziere, D., Mosnier, C., Morvan, T., Roger-Estrade, J., Saint-André, L., Therond, O., Viaud, V., Rechauchère, O., Richard, G., 2019. A model-based assessment of the soil C storage potential at the national scale: A case study from France. Presented at the Food security and climate change: 4 per 1000 initiative new tangible global challenges for the soil.	Thanks, the reference will be evaluated but it seems that the reference is limited to a study case and maybe not representative for other regions.	Government of France	Ministère de la Transition écologique et solidaire	France
3875	71	16			double "in" at the end of the line, remove one.	Thanks, editorial comment.	Rosa M Poch	ITPS and UdL	Spain
53727	71	16	71	16	"especially in in arid areas" should be "especially in arid areas"	Thanks, editorial comment.	ZHENG XINZHU	China University of Petroleum (Beijing)	China
51711	71	17	71	19	The claims about carbon offsets are unsubstantiated. The Ahlering study is purely about technical potential, and only in a North-American context. The reference to its implications for carbon offsets is pure speculation, and can't be taken over here, and in particular not in a global context, including many regions with different eco-climatic conditions and data availability.	Accepted, the context of this reference will be specified.	Florin Vladu	UNFCCC Secretariat	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
51713	71	19	71	20	The reference to REDD (or REDD+?) is unclear here. What is this supposed to achieve? Requires further explanation.	The point was to highlight that forests were a priority for mitigation programs regarding natural ecosystems. Grasslands and savannas should also be subject to similar attention.	Florin Vladu	UNFCCC Secretariat	Germany
8293	71	20	71	20	conversion of grasslands and savannas	Thanks, editorial comment.	Ceris Jones	National farmers union/ world farmers organisation	United Kingdom (of Great Britain and Northern Ireland)
63717	71	23	74	13	When discussing the preservation and restoration of peatlands in this chapter as an effective mitigation option, it is also important to note that it may not be possible to effectively protect or restore peatlands in some regions in the future. For example, in some regions increased overall negative (dryer) moisture deficits (differences between precipitation and potential evapotranspiration) may make this a significant, if not impossible, challenge and these peatlands may not be carbon sinks, but rather carbon sources due to this scenario. This context is important when considering that what we have historically viewed as carbon sinks, may not necessarily continue to be so in the future.	Noted, this is an important point that we address later in the section (see 'Peatlands are sensitive to climate change and there is low confience about the future peatland sink...'). Word limits prevent further discussion	Government of Canada	Environment and Climate Change Canada	Canada
73637	71	26			The work 'Kauffman et al. 2017' cannot be found in the References.	Thanks, this ref will be added	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73639	71	35			Please distinguish which source it is among the ones from 'Smith et al.' in 2019.	Thanks, editorial comment is addressed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
45993	71	36	71	38	Please provide source and context or delete sentence. Comment: There is no source provided for a statement which would fit on a large number of measures agreed to be in general a means of mitigation (see p. 72, l. 41-46). It appears self-evident that restrictions on the use of certain portions of land can increase pressure on other land provided demand and other factors are assumed constant or rising. Please also reflect that drained peatlands are only a small share of agricultural land, but contribute to nearly 5 % of global CO2-emissions. Hence, reduced conversion of peatlands is a mitigation option with high ratio of emissions per area and less an issue for increasing competition for land (Joosten, H. 2009. The Global Peatland CO2 Picture. Peatland status and emissions in all countries of the World. Ede,Wetlands International.)	Accepted, this sentence has been revised to better include the point that drained peatlands constitute low percentage of agricultural lands but high emissions per area	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
71823	71	36	71	38	The argument is unconvincing as the area of peatland is very small compared to the mitigation (and biodiversity and ES) benefits, so there would be a high incentive given the right policy tools. Competition for land would be comparatively small considering the amount of land needed otherwise to achieve the same amount of mitigation.	Accepted, this sentence has been revised (see prior comment)	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
9915	72	6		8	Reference is made to the statement says: 'The carbon stocks of tropical peatlands ----, 330-1,160MtC ha -1in the Peruvian Amazon --- and 558-5,591 MtC ha-1 in Indonesia --- '. Suggestion. The unit of measurement should be typed consistently for the entire document.	Accepted, units are coverted to CO2eq	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
73641	72	8			The work 'Kauffman et al. 2017' cannot be found in the References.	Thanks, this ref will be added	Raehyun KIM	National Institute of Forest Science	Republic of Korea
3877	72	31		40	The impact of rising sea levels in coastal peatlands - mangroves is not taken into account? (7.4.2.6, 7.4.2.7 and 7.4.2.8)	Noted, we have added more detail on sea level rise impacts (with refs) to 7.4.2.8	Rosa M Poch	ITPS and UdL	Spain
71825	72	46	72	46	Add 'political will'. It should also recognise lock-in due to natural conditions or other "facts on the ground" that make reversals unfeasible or impossible after certain initial changes, like a significant permanent alteration of a hydrological system that preclues the maintenance of peatland.	Noted - 'political will' added here. The barrier of permanent hydrologic changes is mentioned briefly in section 7.4.2.7	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73643	73	9			There is a work by 'Tan (with other author)' in 2021 in the References but the authors are only two in it.	Thanks, the reference is corrected	Raehyun KIM	National Institute of Forest Science	Republic of Korea
71827	73	11	73	15	The "role of global impact" should be clarified. Overcoming local to national pressures is the main challenge. The sentence seems to refer to the mismatch between the mitigation contribution (a global good) and the cost (including opportunity cost) borne locally. Addressing that requires much more than just collaborative and transparent planning processes (which are important too)	Accepted, this sentence has been modified to clarify that global and regional food security will not be affected by peatland restoration. Additional text expands on the need for integrating restoration policies with local community needs	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73645	73	11			Please distinguish which source it is among the ones from 'Smith et al.' in 2019.	Thanks, the reference is corrected	Raehyun KIM	National Institute of Forest Science	Republic of Korea
3879	73	14			Rewetting of peatlands that contained soils with sulfidic material can give rise to strong acidification. 10.1641/0006-3568(2006)56[477:RTGOEA]2.0.CO	Noted, we added a sentence regarding mobilization of salts	Rosa M Poch	ITPS and UdL	Spain
73647	73	15			Please distinguish which source it is among the ones from 'Tanneberger et al.' in 2020.	Thanks, the reference is corrected	Raehyun KIM	National Institute of Forest Science	Republic of Korea
50843	73	29	73	29	"rewetting of drained peatlands increases CH4 emissions", here the CH4 should be CH4	Unclear what this comment refers to	Wen Zhang	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
11833	73	48	74	1	"fertile" should be added in front of the words "drained temperate and boreal peatlands…."	Rejected, this point is made by stating 'drained temperate and boreal peatlands used for agriculture'	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
6063	74	3	74	4	It is not clear why should topsoil be removed or to what depth	Noted, additional details are available in the cited reference (Zak et al. 2018) and not included here due to space constraints	Remigio Paradelo	Universidade de Santiago de Compostela	Spain
73649	74	6			Please distinguish which source it is among the ones from 'Tanneberger et al.' in 2021.	Thanks, the reference is corrected	Raehyun KIM	National Institute of Forest Science	Republic of Korea
24641	74	12	74	13	To the sentence: 'However, large-scale implementation of tropical peatland restoration may be limited by financial costs'. Based on Danish experience with this measure, it would be correct to say 'is'.	Noted, changed to 'will likely be'	Government of Denmark	Danish Meteorological Institute	Denmark
21381	74	14	74	14	This chapter only considers mangroves, marshes and seagrasses suggesting that nothing can been done in other types of coastal ecosystem. Moreover, speaking about aquaculture in addition to the reduction of conversion, less intensive production approach could be promoted	Noted, we qualified aquaculture as 'intensive'. This section explicitly focuses on coastal wetlands; carbon accumluation/mitigation potential of other coastal ecosystems is still underdeveloped - we refer to WGII Ch3 Blue Carbon box which discusses different ecosystems in more detail	Government of France	Ministère de la Transition écologique et solidaire	France
43347	74	15	74	39	in paragraph 7.4.2.8 Reduce conversion of coastal wetlands: Please see and cite this recent study on long term Carbon flux and storage in natural wetlands : Aguilos M., Mitra B., Noormets A., Minick K., Prajapati P., Gavazzi M., Sun G., McNulty S., Li, X., Domec J.-C., Miao G., King J.S. Long-term carbon flux and balance in managed and natural forested wetlands. Agricultural and Forest Meteorology 288-289.https://doi.org/10.1016/j.agrformet.2020.108022	Rejected, this is a valuable regional study but does not address mitigation potentials of wetland protection	jean-christophe domec	Bordeaux Sciences Agro	France
76849	74	20	74	20	Insert "sometimes" to read "ecosystems are sometimes referred to as "blue carbon".	Accepted, this change is made	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
3881	74	23			Add the underlined words: "... wetland conservation is urgent because they are organic soils and these carbon stocks accumulate slowly..." ; or histosols instead of organic soils.	Rejected, due to word limits	Rosa M Poch	ITPS and UdL	Spain
45995	74	26	74	26	Regarding aquaculture, this statement is probably too general. The wording should be more specific by substituting "aquaculture" by "unsustainable aquaculture practices". (Not all coastal aquacultures should be considered negative per se.)	Noted, agreed that not all aquaculture is negative but the development of aquaculture is a major driver of coastal wetland conversion (e.g. mangroves into shrimp ponds). 'Sustainable' aquaculture doesn't necessarily mean there will be no conversion of wetland area. However, we have added 'intensive' to be more specific	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
21383	74	30	74	31	The sentence is unclear	Unclear exactly which sentence was identified but the text has been edited for clarity	Government of France	Ministère de la Transition écologique et solidaire	France
71829	74	34	74	36	This argument should be made for peatlands as well.	Accepted, this argument is now better articulated for peatlands (stating that peatland conservation competes against other land use and that adquate economic reources are needed to maintain livelihoods when peatlands are conserved/restored)	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21385	74	36	74	36	We suggest to add "short term" before "more profitable" . Converting coastal wetlands into more profitable land use can be more profitable at a short-term scale, but the consequences of this conversion can lead to serious threats at both short (e.g.: reduced resilience to natural disasters) and long term (as explained lines 28-30). Thus said, writing "more profitable short-term land use" would be more accurate.	Accepted, this change is made	Government of France	Ministère de la Transition écologique et solidaire	France
21387	74	37	74	37	What would be the purpose of policies and efforts for fisheries ? Clarifying this point would be of great interest.	The idea is that coordination among policy objectives will optimize co-benefits. E.g. coastal wetlands are often fish nurseries for economically important species; considering habitat protection alongside climate mitigation in the policies to conserve wetlands may improve outcomes. Due to space limits, we cannot elaborate in the text but the Herr 2017 reference provides more detail	Government of France	Ministère de la Transition écologique et solidaire	France
8495	74	44		48	put ; instead of comma to separate different ciation. Highlited in PDF file in whole text.	Accepted, this change is made	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10255	74	44	74	48	put ; instead of comma to separate different ciation. Highlited in PDF file in whole text.	Accepted, this change is made	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21379	74	44	74	44	How can the figure be so small? In the EU alone current peatland emissions are 100-200 MtCO2e/yr (eg. FAO 2020c). Peatlands are cheap to restore (cf Smith et al 2014 quoted here): actual costs are negligible (cutting drains, ...) and opportunity costs are limited to current, usually low-yield, agricultural or forestry use. For the EU only, Barthelmes et al (2018) estimate the potential at 109 MtCO2e/yr. Barthelmes, A., 2018. Reporting greenhouse gas emissions from organic soils in the European Union: challenges and opportunities, Proceedings of the Greifswald Mire Centre. Greifswald Mire Centre.	This section focuses strictly on coastal wetlands (mangroves, tidal marshes, and seagrasses). Peatlands are addressed separately in section 7.4.2.6 and 7.4.2.7. The Barthelmes 2018 reference includes all peatlands drained for agriculture and forestry, which is a different scope than the ecosystems considered here	Government of France	Ministère de la Transition écologique et solidaire	France
21389	75	5	75	5	A projection of mangrove loss and its consequences in terms of carbon release would be of great interest. E.g.: Global emissions from mangrove loss are projected to reach 2,397 TgCO2 eq by the end of the century (2020-2100). Including the loss of potential carbon sequestration once mangroves are deforested (considered to have a global mean value of 1.5 MgC ha-1 yr−1; Alongi, 2014)	Noted, we had updated the references for emissions from mangrove deforestation	Government of France	Ministère de la Transition écologique et solidaire	France
51715	75	5	75	20	What is the relevance for a mangroves section here? Doesn't it overlap almost completely with the different forest activities listed above, given that mangroves are considered forests in most countries? Requires further explanation to which degree these estimates are additional, and to which degree they are included already in former estimates.	Accepted, we have restructured the section and include a reference to the prior forestry sections	Florin Vladu	UNFCCC Secretariat	Germany
76851	75	6	75	6	Replace "carbon stocks" with "carbon densities".	Noted - this section no longer includes estimates of stocks (refer instead to WGII, Ch3, Blue Carbon box)	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21391	75	7	75	7	Please remind what TECS means	Accepted, we have eliminated the acronym	Government of France	Ministère de la Transition écologique et solidaire	France
85585	75	12	75	20	Forest carbon stock and emission factor may need to be reviewed later as significant difference in forest carbon assessment was reported by FREL, 2018 developed by Forest Department, MONREC, Myanmar. 1445 Mt C in 33.32 million ha of Myanmar forest was calculated in 2005 and 1378 Mt C in 30.47 million ha. The Emission Factor 125.43 tCO2e/Ha was developed in the revised FREL report representing three carbon pools, for the respective forest districts, including the number of sample plots used for the calculation. A paper of (Win. S, et al. 2018) reported above ground biomass carbon stock of 5.04 t C/ha surved at mangrove in Ayeyarwaddy Delta Coastal Zone in Myanmar.	Noted, however these values in the text refer to the total mangrove ecosystem carbon stock (above + belowground biomass and soil C). Aboveground biomass is a small proportion of the total	San Win	Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation	Myanmar
73651	75	19	75	20	The work 'Kauffman et al. 2017' cannot be found in the References.	Thanks, the reference is corrected	Raehyun KIM	National Institute of Forest Science	Republic of Korea
72665	75	25	75	30	This doesn't seem to add up. If there is 1.9 PgC in the top meter of wetland soils, and more C is below that, then how come including up to 3m results in only 1.94 PgC in mangroves and 0.95 PgC in marshes?	Noted - this section has been restructured and the sentence was eliminated	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
71831	75	34	76	11	What's the carbon density of seagrass meadows, and speed of carbon uptake in restoration projects?	For information on seagrass C densities, we refer to WGII, Ch3, Blue Carbon Box. For the restoration question, we address in the next section	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
9927	75		76		Tropical regions are estimated to have greatest economic mitigation potential because of the lower 25 cost of avoided deforestation and degradation, however there is also considerable potential in 26developed and emerging countries in temperate regions. (this statement should be proven with consideration threat to forest sustainability and the needs of forest convertion especially in developing countries). The incentive system as a REDD mechanism needs to be developed and facilitated so that it attracts the interest of various stakeholders to participate in the REDD program. The assessment needs to convey best practices from various existing REDD + schemes, including the implementation of results based payments for RBP REDD. Land-based mitigation measures have important co-benefits, risks and trade-offs (high 37 confidence). Considering the potential consequences of misguided or inappropriate land 38management, it is critical that AFOLU mitigation is pursued and associated measures are 39 designed and implemented carefully and in such a way that maximises co-benefits, limits risks 40 and avoids trade-offs. (The assessment should provide examples of the co-benefits, risks and costs of land-based mitigation efforts. Best practices of AFOLU mitigation with good design and implementation need to be conveyed to ensure additional benefits, low risks and minimum losses are obtained. Land-based mitigation must also consider implementation costs and the availability of technology that can be implemented by involving the community.)	The REDD mechanism is discussed in detail in Section 7.6	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
21393	76	10	76	10	It is clumsy to introduce a policy term "Developed" when other spaces are regionally defined.	Noted, however these are the regions identified for the infographic and throughout the chapter	Government of France	Ministère de la Transition écologique et solidaire	France
3883	76	12		20	I still miss, in this section and in the following (coastal wetland restoration) more solid statements on the consequences of raising sea levels, besides the uncertainties of whether these lands will remain or not under some CC scenarios. For instance: are these large carbon stocks going to remain if flooded? What is the probable evolution of these stocks under higher influence of sea water? Probably any of the wetland restoration techniques we know will be of little help under the worst scenarios, the same applies to the expected sequestering rates.	Accepted, we have added a stronger statement and references: Sea level strongly influences coastal wetland distribution, productivity, and sediment accretion; therefore, sea level rise will impact carbon accumulation and persistence of existing carbon stocks (Macreadie et al. 2019, WGII, Ch3, Blue Carbon box).	Rosa M Poch	ITPS and UdL	Spain
72797	76	16	76	17	This line says that emissions from converting coastal ecosystems are high compared with upland systems - is that in absolute terms or in per ha terms?	Noted, this sentence was deleted	Matthew Gidden	Climate Analytics	Germany
76853	76	16	76	16	Is there really robust evidence that the greenhouse gas emissions are higher? Carbon stock losses are relatively easy to estimate, but do they necessarily translate to GHG emissions as such in aquatic ecosystems? Most carbon is in the soil (aquatic sediment) and it may be washed away and deposited elsewhere before it would decompose.	Noted, this sentence was deleted	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76855	76	16	76	17	Replace [GHG emissions] "from land conversion of coastal" with "per area from conversion of coastal". The emissions are presumably higher per unit area (not in absolute terms) and these systems are often not referred to as "land".	Noted, this sentence was deleted	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21397	76	21	76	21	We suggest to add "as well as aquaculture opportunities (for example bivalves)" Pogoda B., Brown J., Hancock B. , Preston J., Pouvreau S., Kamermans P., Sanderson w;, H. von Nordheim. The Native Oyster Restoration Alliance (NORA) and the Berlin Oyster Recommendation: bringing back a key ecosystem engineer by developing and supporting best practice in Europe. Aquat. Living Resour., 32 (2019), p. 13, 10	Rejected - this section does not cover all coastal restoration efforts. Carbon sequestration from oyster aquaculture is not (yet) quantified	Government of France	Ministère de la Transition écologique et solidaire	France
21395	76	22	76	22	Including concrete economical benefits would help to support the co-benefits of this restoration. E.g.: Coastal wetlands are some of the most productive ecosystems on Earth. They are crucial for healthy estuaries, which generate approximately half of commercially harvested seafood in the United States. In 2017, U.S. fisheries supported 1.74 million jobs (a 3.3 percent increase from 2016) and contributed $244.1 billion in sales (a 11.1 percent increase from 2016). (NOAA Fisheries, visited 01/27/21)	Noted, but for reasons of space we cannot include this information	Government of France	Ministère de la Transition écologique et solidaire	France
21399	76	40	76	46	Counterbalancing this part with successful examples would be of great interest. (Cadier, C., Bayraktarov, E., Piccolo, R., & Adame, M.F. (2020). Indicators of Coastal Wetlands Restoration Success: A Systematic Review. Frontiers in Marine Science.) (Qingqing Zhao, Junhong Bai, Laibin Huang, Binhe Gu, Qiongqiong Lu, Zhaoqin Gao. (2016). A review of methodologies and success indicators for coastal wetland restoration, Ecological Indicators, Volume 60, Pages 442-452, ISSN 1470-160X, https://doi.org/10.1016 j.ecolind.2015.07.003.)	Accepted, these refs are added to the text	Government of France	Ministère de la Transition écologique et solidaire	France
9923	77	20			add Indonesia (in bold) Recent studies of rehabilitated mangroves in Indonesia also indicate that annual carbon sequestration rates in biomass and soils can return to natural levels within decades of restoration (Cameron et al. 2019, Sidik et al. 2019).	Unclear what this refers to (no countries are referenced in this line)	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
9925	77	27			add in Indonesia(in bold) These rates are substantially lower than potential emissions from mangrove conversion, which recent estimates place at 120 tCO2- eq ha-1 yr-1 for conversion to shrimp ponds in Indonesia (Arifanti et al. 2019).	Unclear what this refers to (no countries are referenced in this line)	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
21401	77	45	77	46	This kind of assessment can be counterproductive. It could be interpreted as "seagrass or salt marsh restoration is not a priority, nor essential", when it is very important among other interest such as biodiversity conservation and other non-climatic benefits.	Accepted, we edited the text to include a sentence higlighting the strong motivation for seagrass and salt marsh restoration	Government of France	Ministère de la Transition écologique et solidaire	France
71833	77	49	77	49	What's passive restoration? It should be defined in the glossary and addressed consistently (not just for mangroves).	Passive restoration is definied in the first paragraph of the section	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
8817	78	1	94	35	Section 7.4.3 Agriculture would benefit by inclusion of a sub-section on rebound effects in terms of absolute GHG emissions from the agriculture system where efficiency based measures are use to reduce emissions intensity. This could consider the contrast between potential for rebound effects in ruminant livestock systems vs. crop systems. I don't think this has been addressed in the chapter in detail but could link to Section 7.3.2.1. which deals with livestock numbers as well as the section on sustainable healthy diets. This issue was dealt with briefly in the SRCCL but I think expanding on the mitigation side of this issue would be very beneficial to this chapter.	Noted, we address in the sustainable intensification box	Eamon Haughey	Galway-Mayo Institute of Technology	Ireland
72799	78	16	78	17	When discussing blue carbon, it is important to note that mitigation is not necessarily the most important driver of protecting or restoring coasal ecosystems (e.g. adaptation may be far more important for vulnerable coastal nations). See https://climateanalytics.org/media/blue_carbon_briefing_dec_2019.pdf and Mukherjee et al 2014 Ecosystem Service Valuations of Mangrove Ecosystems to Inform Decision Making and Future Valuation Exercises	Noted, we emphasize throughout that there are valuable co-benefits, including increasing coastal resilience	Matthew Gidden	Climate Analytics	Germany
49939	78	18	79	33	The link/separation form the grassland passage is not clear. Agriculture encompassess livestock as well was arable and permanent cropland, but the structure followed in the text blurrs this and leads potentially to misunderstandings or blurs the message.	Noted and clarified	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
71835	78	18	94	35	Similar to REDD+, it would be important to dedicate a section to the prtection of natural ecosystems to highlight the enormous benefits of avoided degradation.	We aggregate the protection of natural ecosystems in Table 7.3 and discuss in 7.4.1; the remaining sub-sections provide detail on protection of forests, peatlands, coastal wetlands and grasslands/ savannas	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
71837	78	18	94	35	Rather than presenting the regional mitigation potentials for each of the options in the text, a table would enable you to focus on the bigger picture and shorten the text needed. (Example: page 86 lines 30-35).	We revised, shortened and refer to Figure 7.11	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
1341	78	19	78	40	I miss in this paragraph all agricultural practices in the category of green and natural covers, or green manure, it is a wide category with different managements of green covers. This practice is key and essential in reducing fertilization and reducing the carbon footprint of the application of those, and it is a key practice to increase organic carbon in arid and semiarid areas with poor organic carbon soils but with a high organic carbon sequestration potential, at the same time is a very beneficial practice for improving agroecosystem services (increasing water retention capacity, improvement of soil structure, attraction of pollinators, and regulation of erosion and high incorporation of organic carbon into the soil). M. Almagro, N. Garcia-Franco, M. Martínez-Mena The potential of reducing tillage frequency and incorporating plant residues as a strategy for climate change mitigation in semiarid Mediterranean agroecosystems Agric. Ecosyst. Environ., 246 (2017), pp. 210-220, 10.1016/j.agee.2017.05.016	Accepted. Incuded under nutrient management but this text added to clarify: "including fertilization with organic amendments / green manures "	Carolina Boix-Fayos	CEBAS-CSIC	Spain
18361	78	19	78	40	Could the authors please consider referring to the relevant regional constraints in this analysis.	Rejected. Not enough space to include regional applicability analysis on each option	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
1415	78	20	78	27	It seems that agroforestry practices are not included here which seems surprising. If not included, that would be necessary to explain why. If it is included, that would be necessary to clearly mention it.	Noted. Agroforestry is addressed in its own section (7.4.3.3). Now added cross reference	Julien Demenois	Cirad	France
1417	78	20	78	27	This statement should be documented with references. Indeed, several authors highlighted that social, economic and policy dimensions of SOC management are key factors to boost SOC sequestration (Chabbi et al. 2017; Bradford et al. 2019; Demenois et al. 2020). Chabbi, A., Lehmann, J., Ciais, P., Loescher, H.W., Cotrufo, M.F., Don, A., Sanclements, M., Schipper, L., Six, J., Smith, P., Rumpel, C., 2017. Aligning agriculture and climate policy. Nat. Clim. Chang. 7, 307–309. doi:10.1038/nclimate3286 Bradford, M.A., Carey, C.J., Atwood, L., Bossio, D., Fenichel, E.P., Gennet, S., Fargione, J., Fisher, J.R.B., Fuller, E., Kane, D.A., Lehmann, J., Oldfield, E.E., Ordway, E.M., Rudek, J., Sanderman, J., Wood, S.A., 2019. Soil carbon science for policy and practice. Nat. Sustain. 2, 1070–1072. doi:10.1038/s41893-019-0431-y Demenois J, Torquebiau E, Arnoult MH, Eglin T, Masse D, Assouma MH, Blanfort V, Chenu C, Chapuis-Lardy L, Medoc J-M, Sall SN (2020) Barriers and Strategies to Boost Soil Carbon Sequestration in Agriculture. Frontiers in Sustainable Food Systems 4. doi: 10.3389/fsufs.2020.00037.	Noted. References are given (Smith et al., 2014; Smith et al., 2019)	Julien Demenois	Cirad	France
11835	78	20	78	40	In this important section there are a very few references – and all to Smith et. al. – that is Smith et al. 2014: 2019 and 2020. Looking up these references, there are several 2019 and 2020 references and not to be seen in the section what is being referred to (a,b,c.. etc. is missing). Further, non of these Smith references (2014 and all the ones 2019 and 2020) seem to be on grasslands specifically – they are all general references mostly on GHG removal – not on grasslands. This section must be rewritten with appropriate references.	Noted. The Smith et al. 2014: 2019 and 2020 references cover a wide range of studies - that include both croplands and grazing lands	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
21403	78	20	78	27	It seems that agroforestry practices are not included here which seems surprising. If not included, that would be necessary to explain why. If it is included, that would be necessary to clearly mention it.	Noted. Agroforestry is addressed in its own section (7.4.3.3). Now added cross reference	Government of France	Ministère de la Transition écologique et solidaire	France
21405	78	20	78	27	Recent research showed that C3-type crops such as rice, wheat and soybean have a large potential for increased carbon gain via genetically improved adaptation to increasing atmospheric CO2 levels (Dingkuhn et al., 2020). This may in part be channeled into soil OM via root residues (sequestration), while the improved yields may reduce pressure on marginal land cultivation. Dingkuhn M, Luquet D, Fabre D, Muller M, Yin X, Paul M. 2020. The case for improving crop carbon sink strength or plasticity for a CO2-rich future. Curr. Op. Plant Biol., https://doi.org/10.1016/j.pbi.2020.05.012	Noted. Already included under "agricultural biotechnology" under crop management	Government of France	Ministère de la Transition écologique et solidaire	France
76857	78	20	78	40	The list of activities is inconsistent with the interpretation of "mitigation" in 7.4. A deviation from BaU should be a prerequisite, but it is not indicated for all actions. Insert "improved" as follows: "improved crop management", "improved nutrient management" and "improved management of vegetation" and "improved animal management".	Rejected. The interventions to increase soil organic carbon are described here. The invterventions that improve the practices are listed. Adding "improved" before each practice would take additional space but would not improve understanding	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21407	78	23	78	24	It might be interesting to the reader to know which agricultural biotechnologies could be preferentially be used (and are ready to be used) in order to increase carbon inputs	Rejected. Too specific to be included	Government of France	Ministère de la Transition écologique et solidaire	France
21409	78	23	78	23	We recommend to mention here agroforestry. Somehow different from perennial cropping systems and crop diversification	Noted. Agroforestry is addressed in its own section (7.4.3.3). Now added cross reference	Government of France	Ministère de la Transition écologique et solidaire	France
5149	78	24	78	24	add Agrofrestery, (7.4.3.3) organic farming	Noted. Agroforestry is addressed in its own section (7.4.3.3). Now added cross reference. Organic farming not added as it is a farming system, not a practice	Dorota Retelska	FIBL Biological Agriculture Research Laboratory	Switzerland
18363	78	24	78	24	Could the authors please note the literature on minimum tillage which has fairly comprehensively demonstrated its inneffectiveness as a mitigation measure. Min till concentrates carbon in the upper levels of the soil profile - measured changes relate to changing distribution of carbon not total content (on an equivalent mass basis). As such the measure has adaptation benefits in terms of water and nutrient retention in the rooting zone, but little meaningful mitigation relevance. See for example the comprehensive meta-analysis from Meurer et al https://doi.org/10.1016/j.earscirev.2017.12.015	Rejected. For every practice there are papers showing limitations in some circumstances. Climate zone is important (see Sun, W., Canadell, J.G., Yu, L., Yu, L., Zhang, W., Smith, P., Fischer, A. & Huang, Y. 2020. Climate drives global soil carbon sequestration and crop yield changes under conservation agriculture. Global Change Biology 26, 3325–3335. doi: 10.1111/gcb.15001.)	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
21411	78	24	78	25	We recommend to delete the mention of reduced tillage which has been shown to have no impact on soil C when the entire soil profile (down to 1 metre depth) is accounted for (Haddaway et al., 2017). Haddaway, N.R., Hedlund, K., Jackson, L.E., Kätterer, T., Lugato, E., Thomsen, I.K., Jørgensen, H.B., Isberg, P.-E., 2017. How does tillage intensity affect soil organic carbon? A systematic review. Environ Evid 6, 30. https://doi.org/10.1186/s13750-017-0108-9	Rejected. This is not true. Some studies have suggested that - others not. Climate zone is important (see Sun, W., Canadell, J.G., Yu, L., Yu, L., Zhang, W., Smith, P., Fischer, A. & Huang, Y. 2020. Climate drives global soil carbon sequestration and crop yield changes under conservation agriculture. Global Change Biology 26, 3325–3335. doi: 10.1111/gcb.15001.)	Government of France	Ministère de la Transition écologique et solidaire	France
21413	78	24	78	24	residue retention can be seen as contributing to high input carbon practices and as such should be move in category (1)	Rejected. tillage and residue management are not part of how crops are managed - they are interventions on how the soil is managed	Government of France	Ministère de la Transition écologique et solidaire	France
21425	78	24	78	24	What is the precise nature of these difficulties in order to understand precisely what hinders the use of this option (soil carbon management)?	Rejected. No difficulties are listed here (page 78, line 24) - only descriptions of the interventions are included here	Government of France	Ministère de la Transition écologique et solidaire	France
19773	78	25	78	25	soil and water management	Rejected. Some soil management practices are included elsewhere so this would be a misleading catergory - water management only deals with interventions in management of water (e.g. irrigation, drainage)	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
76859	78	27	78	27	Delete "(6) biochar application". It has its own section, there is no reason to link it to crops or even soil application (as the char can be better sequestered elsewhere).	Rejected. It is included as it was included in SRCCL - a cross-reference to the biochar section is given	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21415	78	28	78	29	The following article should be cited in this section as it suggests that breeding can enhance crop C sequestration by boosting C plant sink growth, further taking advantage of atmospheric CO2 elevation; this should make plants able to combine higher grain yield with deeper and larger rooting systems that benefit to C sequestration C, access to soil resources and soil fertility. Dingkuhn, M., D. Luquet, D. Fabre, B. Muller, X. Yin and M. J. Paul (2020). "The case for improving crop carbon sink strength or plasticity for a CO2-rich future." Current Opinion In Plant Biology.	Rejected. Too specific to be included	Government of France	Ministère de la Transition écologique et solidaire	France
21417	78	30	78	30	We recommend to replace animal with livestock practices	Accepted. "Animal" changed to "Livestock"	Government of France	Ministère de la Transition écologique et solidaire	France
3885	78	32		33	Add the following sentence between the two lines: All these measures are recognized as Sustainable Soil Management Practices by FAO (Baritz et al., 2017): https://doi.org/10.1007/978-3-319-68885-5_3	Accepted. Sentence added	Rosa M Poch	ITPS and UdL	Spain
19775	78	32	78	32	add (4) the management of crops and harvest residues by chipping ,grinding and forming mulching that is homogeoulsy distributed mantein soil organic carbon ,reduced emissions and air pollution.	Rejected. A form of residue management - already included	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
47871	78	33	78	37	...and impacts on leakage, indirect land-use change and foregone sequestration do not apply,...' the meaning of this sentence clause is not clear.	Accepted: "(since production in not displaced)" was added to clarify	Aidan Farrell	The University of the West Indies	Trinidad and Tobago
3887	78	34			The statement in this line is not completely true, for instance irrigation in arid lands involves emissions due to the implementation of pipes, channels, water pumping,... Also for making and applying biochar; draining of waterlogged soils (in contradiction with previous sections). It could be corrected saying that "...and impacts on leakage, indirect land-use change and foregone sequestration are reduced for most of the practices,"	Partly accepted: There are emissions associated with some practices, but the intent of the clause is to emphasise that production is not displaced. "(since production in not displaced)" was added to clarify	Rosa M Poch	ITPS and UdL	Spain
21419	78	35	78	36	A very relevant and useful reference for this sentence here: Guenet, B., Gabrielle, B., Chenu, C., Arrouays, D., Balesdent, J., Bernoux, M., Bruni, E., Caliman, J.-P., Cardinael, R., Chen, S., Ciais, P., Desbois, D., Fouche, J., Frank, S., Henault, C., Lugato, E., Naipal, V., Nesme, T., Obersteiner, M., Pellerin, S., Powlson, D.S., Rasse, D., Rees, F., Soussana, J.-F., Su, Y., Tian, H., Valin, H., Zhou, F., 2021. Can N2O emissions offset the benefits from soil organic carbon storage? Glob. Chang. Biol. 27, 237–256. doi:10.1111/gcb.15342	Accepted. Thank you. Reference added.	Government of France	Ministère de la Transition écologique et solidaire	France
81719	78	36	78	40	For 7.4.3.1 line 40, page 7-78: One citation is provided for MRV challenges in relation to soil carbon. As MRV is a particular challenge for the realisation of schemes encouraging increases in soil carbon storage in practise, it would be useful for the chapter to provide a more extensive coverage of literature around this (including for evaluations of policies that have targeted soil carbon). For example, there are some useful citations here https://www.agmatters.nz/assets/On-farm-soil-carbon-benchmarking-and-monitoring-approach_final-report_June2019-v2.pdf. These may be NZ-specific, though may have useful information that could apply more widely	Noted. The Smith et al. (2020) is peer reviewed and covers these aspects fully	Government of New Zealand	Ministry for the Environment	New Zealand

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
5151	78	37	78	38	Gattinger (PNAS 2012, PMID 23071312) reported that organic farming increases soil carbon content, in addition to suppressing the need for N2O and subsequent emissions.	Noted. But not relevant here	Dorota Retelska	FIBL Biological Agriculture Research Laboratory	Switzerland
21421	78	38	78	38	In French Amazonia (French Guiana), the long-term dynamics of C in deep soil has been studied in established tropical pastures after deforestation in 1970. Indeed, little is known about the long-term capacity of tropical pastures to sequester C after deforestation and most studies on soil organic carbon (SOC) sequestration in the world, including in grassland areas, only consider the topsoil (i.e., down to a depth of 0.3 m, Budiman and al., 2017). Stahl et al. (2017) set up a unique combination of a large chronosequence study (C stock at a depth of 1 m) and eddy covariance measurements (flux tower). Results showed that pastures stored at least 1.27 ± 0.37 tC ha-1 yr-1 while the nearby native forest stored 3.23 ± 0.65 tC ha-1 yr-1. Efforts to curb deforestation should therefore continue to be a priority to preserve C stocks and forest biodiversity, but need to be accompanied by sustainable management of areas that have already been converted into pastures, including strategies for the mitigation of GHG emissions. These results suggest that the use of appropriate practices (no fire and no overgrazing, with a mixture of grasses and legumes and a grazing rotation plan in French Amazonia old permanent tropical pastures (≥ 24 years old) can restore part of the C storage observed in native forest. These practices allows farmers to maintain these pastures in the long- term with no loss of soil fertility as often observed in cultivated soils. Conservation of soil fertility should help limit the conversion of new fertile areas and consequently, should limit deforestation. (Stahl and al., 2017). Stahl, C., Fontaine, S., Klumpp, K., Picon-Cochard, C., Grise, M.M., Dezecache, C., Ponchant, L., et al. 2017. Continuous soil carbon storage of old permanent pastures in Amazonia. Global Change Biology, 23(8): 3382–3392 [online]. https://doi.org/10.1111/gcb.13573	Rejected. Not relevant in the sentence	Government of France	Ministère de la Transition écologique et solidaire	France
21423	78	39	78	40	When considering implementation barriers, soil carbon management in croplands and grasslands is a low-cost option at a high level of technology readiness (it is already widely deployed) with low socio-cultural and institutional barriers, but with difficulty in monitoring and verification proving a barrier to implementation (Smith et al. 2020).	Noted: Nothing to respond to. This is what is already written	Government of France	Ministère de la Transition écologique et solidaire	France
21427	78	39	78	39	This statement should be documented with references. Indeed, several authors highlighted that social, economic and policy dimensions of SOC management are key factors to boost SOC sequestration (Chabbi et al. 2017; Bradford et al. 2019; Demenois et al. 2020). Chabbi, A., Lehmann, J., Ciais, P., Loescher, H.W., Cotrufo, M.F., Don, A., Sanclements, M., Schipper, L., Six, J., Smith, P., Rumpel, C., 2017. Aligning agriculture and climate policy. Nat. Clim. Chang. 7, 307–309. doi:10.1038/nclimate3286 Bradford, M.A., Carey, C.J., Atwood, L., Bossio, D., Fenichel, E.P., Gennet, S., Fargione, J., Fisher, J.R.B., Fuller, E., Kane, D.A., Lehmann, J., Oldfield, E.E., Ordway, E.M., Rudek, J., Sanderman, J., Wood, S.A., 2019. Soil carbon science for policy and practice. Nat. Sustain. 2, 1070–1072. doi:10.1038/s41893-019-0431-y Demenois J, Torquebiau E, Arnoult MH, Eglin T, Masse D, Assouma MH, Blanfort V, Chenu C, Chapuis-Lardy L, Medoc J-M, Sall SN (2020) Barriers and Strategies to Boost Soil Carbon Sequestration in Agriculture. Frontiers in Sustainable Food Systems 4. doi: 10.3389/fsufs.2020.00037.	Noted. This already has a reference	Government of France	Ministère de la Transition écologique et solidaire	France
21429	78	39	78	39	This is not true for all regions. There are quite some litterature on the low adoption of technologies (because it's not context-specific), especially in SSA. here a few references: Bouwman, T.I., Andersson, J.A., Giller, K.E., 2021. Adapting yet not adopting? Conservation agriculture in Central Malawi. Agriculture, Ecosystems & Environment 307, 107224. https://doi.org/10.1016/j.agee.2020.107224 Descheemaeker, K., Ronner, E., Ollenburger, M., Franke, A.C., Klapwijk, C.J., Falconnier, G.N., Wichern, J., Giller, K.E., 2019. WHICH OPTIONS FIT BEST? OPERATIONALIZING THE SOCIO-ECOLOGICAL NICHE CONCEPT. Experimental Agriculture 55, 169–190. https://doi.org/10.1017/S001447971600048X Falconnier, G.N., Descheemaeker, K., Traore, B., Bayoko, A., Giller, K.E., 2018. Agricultural intensification and policy interventions: Exploring plausible futures for smallholder farmers in Southern Mali. Land Use Policy 70, 623–634. https://doi.org/10.1016/j.landusepol.2017.10.044	Accepted. Word "globally" added so as not to imply that i is equally adopted everywhere.	Government of France	Ministère de la Transition écologique et solidaire	France
21431	78	44	78	44	Forgotten unit: GtCO2-eq yr-1	Accepted. Thank you. Units added.	Government of France	Ministère de la Transition écologique et solidaire	France
19777	78	47	78	47	soil organic carbon	Accepted. Word "organic" added	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
6065	78		81		This section would need a separate subsection about the use of organic amendments, including reuse of organic wastes from different industries, as a way of increasing C contents in agricultural soils. It is the main and easier to implement agricultural practice in the world to reach this objective and it is difficult to understand why it has not been considered in the report.	Partly accepted. Already included under nutrient management. Now expanded to: "nutrient management including fertilization with organic amendments / green manures"	Remigio Paradelo	Universidade de Santiago de Compostela	Spain
21433	79	2	79	2	In french Amazonie (French Guiana), sStable systems (no more deforestation) are characterised by a yearly C sequestration of grasslands (>24 years old) which, in 2013, compensated for up to 80% of the farm's GHG emissions. Dallaporta B., Bochu JL, Vigne M, Ouliac B, Zoogones L, Lecomte P, Blanfort V. 2016. Taking into account carbon sequestration of pasture in carbon balance of cattle ranching systems established after deforestation in Amazonia. In Proceedings of the 10th International Rangeland Congress. Saskatoon : IRC, 399-401. Saskatoon, Canada, 16/22/2016.	Rejected. Not relevant in the sentence	Government of France	Ministère de la Transition écologique et solidaire	France
21435	79	12	79	12	Please consider adding Chang et al (2021). Climate warming from managed grasslands cancels the cooling effect of carbon sinks in sparsely grazed and natural grasslands. https://doi.org/10.1038/s41467-020-20406-7	Rejected. Chang et al. does not estimate mitigation potentials, but past GHG balances of global grasslands	Government of France	Ministère de la Transition écologique et solidaire	France
5153	79	17	79	17	s grasslands should be ' n grasslands	Accepted. Thank you. Changed	Dorota Retelska	FIBL Biological Agriculture Research Laboratory	Switzerland
11837	79	17	79	20	The statement "For soil carbon management in grasslands, the feasibility is greatest in areas where grasslands have been degraded (e.g. by overgrazing) and soil organic carbon is depleted. For well managed grasslands, soil carbon stocks are already high and the potential for additional carbon storage is low" has no references. This statement is highly questionable and accumulating evidence is for the contrary. The same is repeated in concluding remarks in the section were grasslands and croplands are put under one hat – and concerns over saturation and permanence is put forward – stated without any references - . What is the difference in regional capacity for monitoring and verifying carbon mitigation in grasslands vs. forests?	Partially accepted. Reference has been added.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
50845	79	17	79	17	"For soil carbon management is grasslands the feasibility is greatest" should be "For soil carbon management in grasslands the feasibility is greatest"	Accepted. Thank you. Changed	Wen Zhang	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
21437	79	28	79	31	Corbeels et al. 2020 mentioned that "Roughly, as a first approximation we estimate the potential at 10.8 Tg C yr-1 assuming an average per-area rate of 0.45 Mg C ha-1 yr-1 and that 20% of the current soil C-depleted (annual) croplands (estimated at 120 Mha) are cultivated with CA. It is, however, important to note that SOC stocks do not increase forever, and that annual sequestration rates decline as the soil approaches a new equilibrium, which can take from 20 to +50 years depending on climate and soil type. "Corbeels, M., Cardinael, R., Powlson, D., Chikowo, R., Gerard, B., 2020. Carbon sequestration potential through conservation agriculture in Africa has been largely overestimated. Soil and Tillage Research 196, 104300. https://doi.org/10.1016/j.still.2019.104300	Noted. Thank you	Government of France	Ministère de la Transition écologique et solidaire	France
1419	79	31	79	33	Barriers should not be limited to technical iand biophysical issues as several authors highlighted that social, economic and policy dimensions of SOC management are key factors to boost SOC sequestration (Chabbi et al. 2017; Bradford et al. 2019; Demenois et al. 2020). Chabbi, A., Lehmann, J., Ciais, P., Loescher, H.W., Cotrufo, M.F., Don, A., Sanclements, M., Schipper, L., Six, J., Smith, P., Rumpel, C., 2017. Aligning agriculture and climate policy. Nat. Clim. Chang. 7, 307–309. doi:10.1038/nclimate3286 Bradford, M.A., Carey, C.J., Atwood, L., Bossio, D., Fenichel, E.P., Gennet, S., Fargione, J., Fisher, J.R.B., Fuller, E., Kane, D.A., Lehmann, J., Oldfield, E.E., Ordway, E.M., Rudek, J., Sanderman, J., Wood, S.A., 2019. Soil carbon science for policy and practice. Nat. Sustain. 2, 1070–1072. doi:10.1038/s41893-019-0431-y Demenois J, Torquebiau E, Arnoult MH, Eglin T, Masse D, Assouma MH, Blanfort V, Chenu C, Chapuis-Lardy L, Medoc J-M, Sall SN (2020) Barriers and Strategies to Boost Soil Carbon Sequestration in Agriculture. Frontiers in Sustainable Food Systems 4. doi: 10.3389/fsufs.2020.00037.	Noted. Main barriers listed	Julien Demenois	Cirad	France
21439	79	31	79	33	Barriers should not be limited to technical iand biophysical issues as several authors highlighted that social, economic and policy dimensions of SOC management are key factors to boost SOC sequestration (Chabbi et al. 2017; Bradford et al. 2019; Demenois et al. 2020). Chabbi, A., Lehmann, J., Ciais, P., Loescher, H.W., Cotrufo, M.F., Don, A., Sanclements, M., Schipper, L., Six, J., Smith, P., Rumpel, C., 2017. Aligning agriculture and climate policy. Nat. Clim. Chang. 7, 307–309. doi:10.1038/nclimate3286 Bradford, M.A., Carey, C.J., Atwood, L., Bossio, D., Fenichel, E.P., Gennet, S., Fargione, J., Fisher, J.R.B., Fuller, E., Kane, D.A., Lehmann, J., Oldfield, E.E., Ordway, E.M., Rudek, J., Sanderman, J., Wood, S.A., 2019. Soil carbon science for policy and practice. Nat. Sustain. 2, 1070–1072. doi:10.1038/s41893-019-0431-y Demenois J, Torquebiau E, Arnoult MH, Eglin T, Masse D, Assouma MH, Blanfort V, Chenu C, Chapuis-Lardy L, Medoc J-M, Sall SN (2020) Barriers and Strategies to Boost Soil Carbon Sequestration in Agriculture. Frontiers in Sustainable Food Systems 4. doi: 10.3389/fsufs.2020.00037.	Noted. Main barriers listed	Government of France	Ministère de la Transition écologique et solidaire	France
21441	79	31	79	31	We suggest to add after "overgrazing" " ..and erosion leading to bare soil and poor vegetation cover"	Rejected. Not added due to space constraints	Government of France	Ministère de la Transition écologique et solidaire	France
21443	79	31	79	31	We suggest to add "limited" before "regional"	Rejected. Not necessary	Government of France	Ministère de la Transition écologique et solidaire	France
21445	79	32	79	33	It is unclear how these concerns (about soli chemistry apparently) are "barriers to implementation". More precision in the expression would be needed.	Rejected. Text is clear	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
12035	79	34	81	32	It would be useful to add some comments on the need for governance. The MRV of the take up and use of biochar can be difficult, both at the state and international level. How, for example, might small scale remote rural community biochar production be monitored? Improved accounting will, though, be important in the future for carbon accounting purposes and it is possible that biochar will, in the longer term, become subject to international governance mechanisms such as the CBD and UNFCCC. However, currently, the main regulatory frameworks that apply are state and customary law. Were transboundary trade in biochar to become common, certification schemes, like those associated with other bio-based products, such as forestry products, bioenergy, or palm oil might be required.	Accepted. Lack of agreed approach to MRV now mentioned.	Paul Rouse	Carnegie Climate Governance Initiative (C2G) - The Carnegie Council for Ethics and International Affairs	United Kingdom (of Great Britain and Northern Ireland)
21447	79	34	79	34	Why is the emphasis put on biochar compared to other organic waste also recycled in agriculture (e.g. composts, sludges) ? It clearly appears in tables (e.g. 7.7) and chapter (7.4.3.2) that the potential of biochar to mitigate climate change at global scale is still to be explored and submitted to the nature of the feedstock. Whereas nothing is indicated for the recycling of other organic wastes as composts (except for manure). Instead of a chapter on biochar it could have been made a chapter on waste recycling that includes biochar.	Rejected. Use of organic amendments in nutrient management is covered in 7.4.3.6. Biochar is addressed specifically because biochar systems can provide net CDR.	Government of France	Ministère de la Transition écologique et solidaire	France
31317	79	34	81	32	This section on biochar provides a reasonable balance except it omits the practical issues of application and integration in the soil. Also for biochar and the sections on soil carbon, the challenging issue of how to measure an increase in soil C in order for there to be C credits awarded needs to be addressed. Farmers will respond to increasing C contents of their land if they can see benefits in terms of increased crop yields and/or revenue from absorbing C. So the science of measuring soil C should be addressed.	Noted. MRV for biochar is based on the properties of the biochar, rather than requiring measurements of the soil. The challenges of MRV for SOC are mentioned in 7.4.3.1	Ralph Sims	Massey University	New Zealand
45997	79	34	81	32	[Chapter 7.4.3.2 Biochar] Even though mentioned in the first headline of this chapter, risks and potential negative impacts of biochar application are not explained further in the text. Please add here further details for a balanced understanding of the potentials and risks of biochar application as can be found in e. g. Verheijen et al. 2010: Biochar Application to Soils - A Critical Scientific Review of Effects on Soil Properties, Processes and Functions, available at: https://publications.jrc.ec.europa.eu/repository/bitstream/111111111/13558/1/jrc_biochar_soils.pdf or Tisserant & Cherubini 2019: Potentials, limitations, co-benefits, and trade-offs of biochar applications to soils for climate change mitigation. Land 8, available at: https://www.mdpi.com/2073-445X/8/12/179/htm. These risks include: mitigation deterrence; additional emissions from biomass production, biochar processing and transport to the fields; potential contamination of the biomass used (heavy metals, dioxin); increasing competition of different uses of biomass and biogenic residues and competition for land (which could lead to losses of carbon-rich natural ecosystems); potential negative impacts on biodiversity and ecosystem functions; permanence of stored carbon; influence on surface albedo among others. Please also consider possible side-effects from biochar-application on soil biodiversity, e.g. changes in microbial community composition and earthworms, should be mentioned here as well (see e.g. Lehmann et al. 2011; https://www.sciencedirect.com/science/article/abs/pii/S0038071711001805; Briones et al. 2020: https://www.sciencedirect.com/science/article/abs/pii/S0038071720301000; see also chapter 12, p.35, line 29ff: Fuss et al. 2018). It would also be helpful to deepen the discussion on the feedstock for the biomass used to produce biochar (see chapter 12, section 12.5, p.68ff).	Partly accepted.Risks are now mentioned and reference provided to Tisserant and Cherubini. Impacts on soil biology vary widely between biochars, application rates and soil organisms; it is not possible to summarise here due to space constraints.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
56071	79	34	79	48	In Section 7.4.3.2 (Biochar), there is no mention of the negative effects from the accumulation of heavy metals in the production of biochar or the high cost and manufacturing issues. Every production location has different raw materials so that the effects of use on large scales has not been well investigated including what happens in the unsaturated zone. In the U.S., this mitigation method is not encouraged. The negatives far outweigh the positives, and it isn't until page 81, lines 28-32, that this is even suggested. Far too much space is allotted to this method.	Noted. High cost is already mentioned as a barrier. Risks are now mentioned, with relevant citation added. Heavy metals are an issue of feedstock quality control. Lack of standardisation and quality control is mentioned as a barrier.	Government of United States of America	U.S. Department of State	United States of America
76861	79	34	81	32	Section 7.4.3.2 Needs a thorough revision and rebalancing. It is rather biased in its abbroach and evidence base, over-emphasizing benefits and ignoring costs and risks.	Accepted. High cost is already mentioned as a barrier. Risks are now mentioned, with relevant citation added. Lack of standardisation and quality control is mentioned as a barrier.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81907	79	34	81	32	Section 7.4.3.2: There is a considerable amount of scientific literature questioning the positive and long-term sequestration effects of biochar addition and this section lacks a balanced scientific discussion of knowledge gaps and different scientific views, The assessment omits a thorough discussion of the potentials for waste biomass that can be used as feedstocks to produce biochar/ charcoal. The production of biofuels has already shown that the availability of waste biomass is limited. Removal of crop residues for use as a feedstock for biochar production can forego incorporation of the crop residue into the soil, potentially leading to multiple negative effects on soils. These residues will no longer be available as nutrient inputs to soils in agro-ecosystems that maintain nutrient cycles. Biochar additions have also been found to catalyse decomposition of existing soil organic carbon (Wardle DA, Nilsson M-C, Zackrisson O (2008) Fire-Derived Charcoal Causes Loss of Forest Humus. Science 320: 629) which seems a logical effect of the addition of inert organic materials to soils that microorganisms consume more of the less inert organic substances present in the soils. The use of biomass to produce biochar which are not waste sources can produce indirect land use change similar to the situation with biofuels. Roberts et al. (Roberts KG (2010) Life Cycle Assessment of Biochar Systems: Estimating the Energetic, Economic, and Climate Change Potential. Environmental Science & Technology 44: 827–833.) showed that ILUC can reduce or even reverse the climate mitigation potential of biochar systems. The pyrolysis process produces air pollutants such as particulate matter, soot, VOCs with negative health effects which is also not considered. Many authors reported negative effects of biochar on soil microorganisms and mycrorrhizae (see review in Ding, Y., Liu, Y., Liu, S. et al. Biochar to improve soil fertility. A review. Agron. Sustain. Dev. 36, 36 (2016). https://doi.org/10.1007/s13593-016-0372-z). The same author concludes in the review that the exact service life of biochar is still rarely understood and that long-term field trials need to be conducted to test whether soil properties can be influenced permanently through biochar application. The current promotion of biochar is still not based on such long-term field trials. A more balanced evaluation of biochars's potential adverse environmental impacts in this section would be essential.	Accepted. Availability of feedstock is already mentioned as a barrier. Risks are now mentioned, with relevnat citation added. Lack of standardisation and quality control is mentioned as a barrier.	Anke Herold	Oeko-Institut e.V.	Germany
76863	79	35	80	12	The presentation of the measure should explain the carbon benefits and costs in a balanced manner. All the biomass feedstocks indicated as suitable for biochar would be suitable also for other uses, such as biogas, direct energy use (combustion), soil improvement (as compost/mulch) or even as industrial raw mateiral, therefore they involve opportunity costs (foregone benefits). Conversion to char involves GHG emissions and losses (of energy and carbon).	noted, we give a more balanced overview of biochar with risks and co benefits now	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76865	79	35	80	12	It shoudl be explained why the char should be applied to soils at all. Assuming that it is reasonable to convert biomass to char for long-term storage, it does not follow that it should be stored in the soil, exposed to a harsh environement, where it is difficult to apply and monitor. It could be more easily stored in a concentrated deposit (e.g., landfill) where it is likely to be more stable, cheaper to apply and easier to monitor its permanence (eventual loss). Application to soil only makes sense if its agronomic benefits outweight the risks to soils, cost of application and the reduced stability of carbon	Noted. The use of biomass for biochar can give greater life cycle mitigation benefit than alternative applications of biochar (eg in road base or depositing in landfill) when agronomic benefits and effects on soil GHG emissions and priming are included, or compared with alternative uses of biomass eg for soil carbon management (where biomass decomposes) or bioenergy (unless displacing highly GHG-intensive energy systems) or BECCS (where CDR is new and expensive technology) (Lehmann et al 2021 Nature Geoscience). Sentence added to briefly explain this.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
16423	79		80		A study by Korea on reduction of methane emissions through application of biochar was requested to be added in the bibliography and this request is reflected.	Noted. No change required.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
76867	80	1	80	3	The presentation of energy "co-benefits" of pyrorilsis gases seems contradictory to how "mitigation benefits" should be assessed. 7.4.1.1 states that benefits should be assessed against a counterfactual scenario without mitigation. The substitution benefits of pyrolysis oil can be real only to the extent that biochar itself is justified for mitigation. However, that must include the assessment of the benefits foregone. The counterfactual of biochar is no biochar, which would allow all the feedstock considered for biochar to be used for bioenergy, not just the pyrolysis oil. This means that the production of biochar involves a very significant opportunity cost, but these foregone benefits of energy substitution are not even mentioned, let alone evaluated. In fact, the assessment should also consider the use of biochar itself (which is essentially charcoal) for energy as an option. As long as there is fossil fuel in use in the area concerned, the use of charcoal for energy substitution should be considered as it may be prefreable to burying the charcoal and continuing to extract and use the fossil fuel. Both charcoal and biomass proper are easier to use for energy than pyrolisis gas, although some qualitative differences may favour the latter.	Accepted. Statement comparing biomass use for biochar vs bioenergy added.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
11497	80	2	80	7	Improved Nitro effeincy and reduce GHG emission	Noted. This is discussed.	Nkuba Michael	University of Botswana	Botswana
11505	80	2	80	7	Effects of biochar and sewage sludge on spinach (Spinacia oleracea L.) yield and soil NO3- content in texturally different soils in Glen Valley, Botswana	Noted. Such studies are reviewed in the cited literature.	Nkuba Michael	University of Botswana	Botswana
11507	80	2	80	7	Ugele Majaule , Oagile Dikinya, Baleseng Moseki, Bruno Glaser	See above	Nkuba Michael	University of Botswana	Botswana
11509	80	2	80	7	Vol.19(5), pp. 287-300 , May 2020 African Journal of Biotechnology https://doi.org/10.5897/AJB2020.17146	See above	Nkuba Michael	University of Botswana	Botswana
11263	80	13		17	exact but as a consequences farmers using biochar and pesticides have to add more pesticides for the same effect because a part is adsorbed by the biochar. Moreover the interactions between biohar and pesticides is still not fully understood see Liu, Y., Lonappan, L., Brar, S. K. and Yang, S.: Impact of biochar amendment in agricultural soils on the sorption, desorption, and degradation of pesticides: A review, Sci. Total Environ., 645, 60–70, doi:10.1016/j.scitotenv.2018.07.099, 2018.	Noted. This is an important issue but cannot be inlcuded due to space constraints. It is disucssed in the cited literature (Tisserant and Cherubini)	Bertrand Guenet	CNRS	France
11839	80	13	81	44	The effect of biochar application on yield increase variates depending on soil type and region from high increases on tropical soils, but no effect in temperate climate regions (Jeffery et al., 2017). There are also indication that biochar can reduce yields by adsorption of nutrients, the same mechanism that, correctly, can adsorb organic pollutants, heavy metals and ions in soil of which the biochar can't tell the good ones from the bad Laxmar (2017). References: Laxmar E., 2017. The effect of biochar addition and fertilization on yield levels in two field experiments. Master thesis Report 2017:03, Department of soil and environment, SLU. Jeffery, S., Abalos, D., Prodana, M., Bastos, A.C., van Groenigen, J.W., Bruce, A., Hungate, B.A., Verheijen, F., 2017. Biochar boosts tropical but not temperate crop yields. Environ. Res. Lett. 12: 053001.	Noted. Jeffery et al is cited.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
18365	80	13	80	29	This paragraph needs to recognise and reflect upon concerns relating to potential soil contamination from biochars - significant applications to large areas of agricultural land could represent a significant risk. Risks will vary depending on feedstocks, pyrolysis temperatures and management and at present these do not appear to be adequately understood.	Noted. Soil contamination risk is an issue of feedstock quality control. These issues are discussed in the cited literature.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
76869	80	15	80	17	Along with the benefits to the nutrient cycle, it would be essential to reflect on adverse effects, like the immobilisation of certain nutrients that may require additional fertiliser application.	Rejected. Immobilisation of nutrients is not a recognised risk. Biochar reduces leaching and volatilisation, enhances cation echange capacity and thereby increases nutrient availability.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76871	80	17	80	17	The adsorption of these pollutants is rightly mentioned, but their significance is unclear. It can have the short-term benefit of reduced uptake by plants, but it cannot make heavy metals disappear from the soil and may make their residence longer. Threre is also no reflextion on the risk of contaminating soils with biochar, which is a distinct possibility depending on the likely origin of feedstock that may have no alternative uses.	Noted. Soil contamination risk is an issue of feedstock quality control. These issues are discussed in the cited literature.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76873	80	19	80	19	Reduction of fuel loads can be a good source of biomass in general, but it is suitable for many applications including direct bioenergy use or production of conventional charcoal for multiple purposes. Biochar is certainly an option, but the trade-off with the other uses (which are well-established and may not be less beneficial) should be addressed, especially that this source of biomass is often counted in the mitigation potentials.	noted, we give a more balanced overview of biochar with risks and co benefits now	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
3889	80	23		24	Not all positive effects reported above are clear and significant in all soils, since the benefits (type and amount) are site- and soil specific.So, if the only benefit is carbon sequestration, the farmer will not apply it. So, it is not only lack of confidence, but also lack of short-term benefits for the farmer income.	Noted. We have discussed the site- and biochar-specific results, and need to select sutiable biocar to maximise mitigation and agronomic benefits.	Rosa M Poch	ITPS and UdL	Spain
21449	80	23	80	23	Several studies suggested the albedo effect is highly significant: Bozzi, E., Genesio, L., Toscano, P., Pieri, M., Miglietta, F., 2015. Mimicking biochar-albedo feedback in complex Mediterranean agricultural landscapes. Environ. Res. Lett. 10. doi:10.1088/1748-9326/10/8/084014 Genesio, L., Miglietta, F., Lugato, E., Baronti, S., Pieri, M., Vaccari, F.P., 2012. Surface albedo following biochar application in durum wheat. Environ. Res. Lett. 7, 014025. doi:10.1088/1748-9326/7/1/014025 Verheijen, F.G.A., Jeffery, S., Velde, M. Van Der, 2013. Reductions in soil surface albedo as a function of biochar application rate: implications for global radiative forcing. Environ. Res. Lett. 8, 1–7. doi:10.1088/1748-9326/8/4/044008	Noted. These studies consider high rates and surface application. As stated, at recommended rates and applcaition methods the albedo effect is not likely to be significant.	Government of France	Ministère de la Transition écologique et solidaire	France
76875	80	24	80	24	It is unclear why the lack of large-scale production facilities is limiting and whether there is a sufficiency of small-scale, perhaps mobile installations. The latter have often been mentioned as preferable for the rural economy and to reduce transport distances.	Noted. As stated, high production cost at small scale is a barrier. Limited large scale facilities restricts the volume of biochar available at lower cost.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
53381	80	25	80	35	If biochar was a byproduct of widespread biofuel production the cost could be much reduced.	Noted. Agreed.	Donald Smith	McGill University	Canada
76877	81	20	81	21	"the key contributor to mitigation is the long term persistence of biochar carbon in soils": Persistence is likely to be better if not applied to the soil, but sequestered.	Noted. Assuming "sequestered" means buried, such as in landfill as the reviewer suggested above, this could be true for some soil types. However, interaction with minerals stabilises biochar. Most importantly soil applciation can provide additional climate and agronomic benefits that would be missed by landfilling biochar. For biochars that are unsutiable for land applcaition, preferable uses are as additive in roadbase or concrete, where biochar has beneficial effects to these products.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76879	81	20	81	21	"greatest uncertainty is the availability of biomass for biochar production". This comes as an afterthought, although it is a critical issue. It should be greatly expanded, including alternative uses of potential biomass sources.	noted, we give a more balanced overview of biochar with risks and co benefits now	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
53383	81	21	81	21	The much longer persistence of biochar than crop residues could allow a greater amount of crop residues to be harvested for production of biofuels (and some byproduct biochar) for production of biofuels, leading to less use of fossil fuels.	Noted. We agree that use of biochar could increase biomass proudction to support co-production of bioenergy and biochar. This is discussed in the cited reference Lehmann et al., 2021.	Donald Smith	McGill University	Canada
76881	81	25	81	32	The "critical assessement" is not sufficiently critical. The overwhelmingly positive assessement seems inconsistent with the statement above regarding "a wide range of results, with positive to nil and occasionally negative impacts". A case study could help.	Noted. The wide range of results is discussed and the needs for careful selection of sutiable biochar for each application is stressed. A paper discussing risks is now cited.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
6067	81	30	81	30	It would be important to remind here again the barriers to upscaling biochar including the limited large-scale production facilities and high production costs as stated above in page 80 lines 24-26	Noted. The informaiton cannot be repeated due to space constraints.	Remigio Paradelo	Universidade de Santiago de Compostela	Spain
49941	81	33	83	15	I wonder if not silvopastoral systems should not be mentioned here? Introducing tress in cropland has quite some trade-offs with mechanization, for instance, but co-benefits of introducing trees on pastures are well-described (e.g. http://www.tropicalgrasslands.info/index.php/tgft/article/view/80)	Silvopastural systems are mentioned 2x in text.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
76883	81	35	81	35	Replace "woody biomass" with "woody plants".	Accepted	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73653	81	37			The work 'Nair et al., 2010' cannot be found in the References.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21451	81	38	81	38	improved water quality is also very important: (Zhu et al., 2020) Zhu, X., Liu, W., Chen, J., Bruijnzeel, L.A., Mao, Z., Yang, X., Cardinael, R., Meng, F.-R., Sidle, R.C., Seitz, S., Nair, V.D., Nanko, K., Zou, X., Chen, C., Jiang, X.J., 2020. Reductions in water, soil and nutrient losses and pesticide pollution in agroforestry practices: a review of evidence and processes. Plant Soil 453, 45–86. doi:10.1007/s11104-019-04377-3	Accepted. Text and reference added.	Government of France	Ministère de la Transition écologique et solidaire	France
76885	81	38	81	38	Insert "increased" before "sequestration". It is the increase that constitutes mitigation.	Noted. This phrase has been clarified by replacing 'sequesters' with 'accumulates'	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76887	81	38	81	38	It would be useful to expalin in more concrete terms the sequestration and productivity benefits. Namely, agroforestry achieves a higher average carbon stock than agriculture without the woody elements. The overall productivity can be higher even if agricultural yield as such may not be. I.e., agroforestry may need less land for a certain amount of agricultural and woody biomass production than producing the same quantities separately in "pure" systems.	Noted. The authors thank the reviewer for the comment. With consideration of the general narrative and word count restrictions, it was decided not to include it.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
8497	81	40	83	3	Ellison et al., 2017; Kuyah et al., 2019; Mbow et al., 2020).remove italic from all et al in the whole text	Accepted	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10257	81	40	82	48	Ellison et al., 2017; Kuyah et al., 2019; Mbow et al., 2020).remove italic from all et al in the whole text	Accepted	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
21453	81	40	81	40	Please add Zhu, X., Liu, W., Chen, J., Bruijnzeel, L.A., Mao, Z., Yang, X., Cardinael, R., Meng, F.-R., Sidle, R.C., Seitz, S., Nair, V.D., Nanko, K., Zou, X., Chen, C., Jiang, X.J., 2020. Reductions in water, soil and nutrient losses and pesticide pollution in agroforestry practices: a review of evidence and processes. Plant Soil 453, 45–86. doi:10.1007/s11104-019-04377-3	Accepted. Reference added.	Government of France	Ministère de la Transition écologique et solidaire	France
21455	81	41	81	41	It can be mentioned here the same risks cited just below (for "Management of organic waste....MSW)" = "Can contain contaminants (heavy metals, organics, pathogens)", because these risks exist with manure management too.	Noted. The authors thank the reviewer for the comment. With consideration of the general narrative and word count restrictions, it was decided not to include it.	Government of France	Ministère de la Transition écologique et solidaire	France
76889	81	41	81	45	It is important to highlight the need for institutional support and knowledge, in particular with new types of agroforestry and/or in areas with no tradition/experience. However, emphasizing the institutional arrangements and advising against "haphazard" application can be counterproductive as most existing agroforestry systems developed informally over time and based on traditional knowledge. Spontaneity and bottom-up initiatives should not be discouraged as practice is often ahead of institutions.	Thank you. The word haphazard has been deleted. This sentence now outlines the potential for trade-offs and reflects a counter argument to the sentence prior listing potential co-benefits. Discussion of specific actions to support under various production environments is not possible given the constraints in words available to this section.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70013	81	42	81	42	In parenthesis, add the following reference: "Cordova et al. 2018"	Noted. The authors thank the reviewer for their suggested reference. Following consideration, it was not included due to word count limits.	Markku Kanninen	University of Helsinki	Finland
21457	81	44	81	47	What is the reason for considering "Management of organic waste (food waste....MSW) solely under this sub-section (Options that don't occupy land used for food production) although the management of such organic waste is already widely practiced on land used for food production?	This comment seems to refer to another section	Government of France	Ministère de la Transition écologique et solidaire	France
21459	81	45	81	45	Depending on the raw material and process used, there might be substantial nitrogen losses during pyrolysis so that making a direct linkage between pyrolysis and "return of nutrients to farmland" seems adequate for some nutrients (for P, and micro-nutrients for example) but partly true for nitrogen.	This comment seems to refer to another section	Government of France	Ministère de la Transition écologique et solidaire	France
21461	81	46	81	47	It may be added to "....return of nutrients to farmland" "depending on process and spreading techniques", because nitrogen in the NH4 form (major form of N in digestate) is particularly sensitive to loss by volatilization when not properly spread.	This comment seems to refer to another section	Government of France	Ministère de la Transition écologique et solidaire	France
73655	81	46			Please distinguish which source it is between the ones by 'Sendzimir et al.' in 2011.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73657	81	46			Please distinguish which source it is among the ones from 'Smith et al.' in 2019.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73659	82	2			Please distinguish which source it is among the ones from 'Miller et al.' in 2020.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
3891	82	5		6	Add land tenure systems. Agroforestry cannot be applied in monocultures by definition.4	Accepted. Modified text to read, 'land policies and tenure systems'	Rosa M Poch	ITPS and UdL	Spain
73661	82	10			Please distinguish which source it is among the ones from 'Dickie et al.' in 2014.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73663	82	10			There is a work by 'Hawken' in 2017 in the References but the work was conducted by ONLY one author.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
53385	82	11	82	11	Biochar application to soil can enhance food production and also lead to more production of crop residues for potential bio-energy production.	This comment seems to refer to another section	Donald Smith	McGill University	Canada
73665	82	22			There is a work by 'Hawken' in 2017 in the References but the work was conducted by ONLY one author.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
76891	82	26	82	28	The potential only mentions sequestration. Is there an estimate taking into account productivity gainst (land savings)? The discussion on organic farming (p. 95) includes extensive considerations for implications of potentially lower yields. Agroforestry can have a significantly higher overall productivity than the systems it replaces, which would need to be similarly analysed for its extended benefits.	Rejected. A discussion of changes in land productivity was not included due to diversity and context specificity of impacts and the strict word counts.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76893	82	31	82	31	The mentioned tropical systems are important, but not necessarily appropriate examples for mitigation. E.g., mixed systems (like coffee that is generally prodced under trees) are well-established for agronomic and other reasons and do not represent "mitigation" as such unless they are improved or (re-)introduced to replace less favourable systems (in which case they should be presented against the counterfactual).	Rejected. The comment illustrates situations where these systems are appropriate examples. Given the distribution of these systems and transitions across the regions and previous land use or management are not implied in the text, we have retained the text as written.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21463	82	33	82	33	We suggest to mention "hedgerows" too. Rigueiro-Rodriguez, A., McAdam, J., Mosquera-Losada, M.R., 2009. Agroforestry in Europe - Current Status and Future Prospects, in: Rigueiro-Rodriguez, A., McAdam, J., Mosquera-Losada, M.R. (Eds.), Advances in Agroforestry. Springer, p. 462. doi:10.1007/978-1-4020-8272-6	Accepted. System and reference added	Government of France	Ministère de la Transition écologique et solidaire	France
21465	82	33	82	33	Actually, the largest agroforestry system in Europe is the Dehesa (an agro-silvo-pastoral system), several millions hectares. Joffre, R., Vacher, J., de los Llanos, C., Long, G., 1988. The dehesa: an agrosilvopastoral system of the Mediterranean region with special reference to the Sierra Morena area of Spain. Agrofor. Syst. 6, 71–96. doi:10.1007/bf02220110 "The dehesas cover approximately 5,000,000 hectares in South Western Spain and more than 500,000 ha in Portugal where they are called "montados".	Accepted. System and reference added	Government of France	Ministère de la Transition écologique et solidaire	France
21467	82	34	82	34	The number 6.24 should be checked. This corresponds approximately to 24 m3 of wood/ha/yr and even a eucalypt plantation (forest) in perfect growing conditions may struggle to reach this level of above ground accumulation.	Noted. Reported as 6.24 t C/ha/a for Asian silvoarable systems in Cardinael et al. 2018 synthesis	Government of France	Ministère de la Transition écologique et solidaire	France
73667	82	36			The work 'De Stefano and Jacobson, 2017' cannot be found in the References.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21469	82	45	82	45	Results from Sida et al 2018 about heat stress and crop yields are highly speculative, only assessed by "Model-based sensitivity analysis". On the opposite, the paper of Arenas-Corraliza et al 2018 provides field measurements during several growing seasons. Sida is an example from Africa (Ethiopia), Arenas-Corraliza is another one from Europe (Spain)	Accepted. Reference added.	Government of France	Ministère de la Transition écologique et solidaire	France
73669	82	46			The work 'Bargués-Tobella et al., 2019' cannot be found in the References.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73671	82	46	82	47	The work 'Reppin et al., 2019' cannot be found in the References.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73673	83	3			The work 'Arslan et al., 2020' cannot be found in the References.	Thank you. The references have been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
53387	83	4	83	4	One could also use N fixing forestry plants, such as alder (Frankia association) in the temperate zones and legume trees in the tropics, so that the forestry bioimass production would not require any addition of nitrogen fertilizer, removing a potential source of GHG production.	This comment seems to refer to another section	Donald Smith	McGill University	Canada
76895	83	8	83	8	"high confidence in agroforestry's mitigation potential at the field scale". The data quoted above seem to suggest consideration for only carbon stocks, whith hardly any estimate of productivity changes and "land savings". Afforestation could offer even higher "mitigation potential" at the field scale, but would stop food production. It would be important to frame the option primarily in the broader mitigation context, including overall benefits beyond carbon stock on the directly affected fields.	Noted. The primary goal is to illustrate agroforestry's mitigation potential. Potential co-benefits and trade-off are mentioned in multiple places. Nuanced discussion of myriad impacts (positive and negative) agroforestry has on food production, hydrology, biodiversity, zoonotic disease spillover, among other is highly context specific and subject to management, species, and environment and thus is beyond the scope of what is possible given the word limits.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76897	83	8	83	9	"Crucially, the field scale is where land management decisions are made." This should be elaborated or deleted. Many key factors are decided at the policy level. Also, the text above (p.81) argues against "haphazard" implementation and in favour of institutional involvement. Many farmers are in a situation where they can ill afford to introduce agoforestry.	Accepted. We agree that policy exerts significant leverage. The word limits constrain the ability to add greater explanations so we have deleted the sentence.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21471	83	11	83	12	We suggest to cite this reference: Rosenstock, T.S., Wilkes, A., Jallo, C., Namoi, N., Bulusu, M., Suber, M., Mboi, D., Mulia, R., Simelton, E., Richards, M., Gurwick, N., Wollenberg, E., 2019. Making trees count: measurement and reporting of agroforestry in UNFCCC national communications of non-Annex I countries. Agric. Ecosyst. Environ. 284, 106569. doi:10.1016/j.agee.2019.106569 . This is a very timely and important study. The authors have examined national communications (NCs) and Nationally Determined Contributions (NDCs) of 147 countries, REDD+strategies and plans of 73 countries, and 283 Nationally Appropriate Mitigation Actions (NAMAs), as well as conducted interviews with representatives of 12 countries in Africa, Asia and Latin America. They concluded that agroforestry was not visible in many measurement, reporting and verification (MRV) systems, and they listed the different challenges: institutional, technical and financial. Actually, this is such an important paper htat Nature Climate Change published a highlight about it!: Yeeles, A., 2019. Counting tree contributions. Nat. Clim. Chang. 9, 577. doi:10.1038/s41558-019-0549-y	Noted. The sentence referred to is no longer included in the current version due to word limits.	Government of France	Ministère de la Transition écologique et solidaire	France
71839	83	11	83	12	add: capacity	Noted. The sentence referred to is no longer included in the current version due to word limits.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21473	83	22	83	22	Please develop CANOPIES (Co-existence of Agriculture and Nature: Optimisation and Planning of Integrated Ecosystem Services, Coord. J Steinfeld, WUR, NL)	accepted , name explained in text box	Government of France	Ministère de la Transition écologique et solidaire	France
73675	83	22			Please clarify then reference and the publication year of 'Steinfeld et al'.	accepted	Raehyun KIM	National Institute of Forest Science	Republic of Korea
79817	83	22	83	22	... project (Steinfeld et al) - year???	reject,	Lucia Helena ANJOS	UFRRJ	Brazil
70063	83	25	83	31	The original text says: "The climate change mitigation potential of agroforestry systems is widely recognised (FAO 2017; 26 Zomer et al. 2016) and Brazilian farmers and researchers are pioneering diverse ways of integrating trees into croplands, from planting rows of eucalyptus trees in pastures up to highly complex agroforests consisting of >30 crop and tree species. The degree of complexity influences the multiple functions that farmers and societies can attain from agroforestry: the more complex it is, the more it resembles a natural forest with associated benefits for its C storage capacity and its habitat quality for biodiversity (Santos et al. 2019)." It is important to consider that eucalyptus is not a native tree in Brazil. Although the planting of lines of eucalyptus can remove carbon from the atmosphere, in Brazil this kind of tree does not provide the same type of environmental service as native species. Therefore, I suggest that the section "resembles a natural forest" may be revised in the case of the use of eucalyptus.	reject, we portray the variety of management systems	PEDRO CORTES	University of Sao Paulo - USP	Brazil
73677	83	31			The wrok 'Santos et al. 2019' cannot be found in the References.	accepted	Raehyun KIM	National Institute of Forest Science	Republic of Korea
19779	83	39	83	39	soil and X management? A noun or word is missing in the sentence	reject soil and management data is proper way to describe.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
79819	83	42	83	45	This box doesn´t describe adequately the relevance of projects with iLCF in Brazil, there is a national network (https://www.redeilpf.org.br/) with participants from most states fo Brazil and cases of usage of the system in every biome of Brazil. The information presented in the box is very limited compared to the relevance of the agroforests systems in Brazil.	reject, we portray a box here, which is (almost always) a case desription	Lucia Helena ANJOS	UFRRJ	Brazil
73679	84	3			Please distinguish which work it is among the ones conducted by Smith et al. in 2020.	accepted, refs completed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
43285	84	12	85	10	The local breed of sheep on the island of North Ronaldsay in the Orkneys show no signs of toxicity living off just seaweed: see e.g., https://en.wikipedia.org/wiki/North_Ronaldsay	Noted. Within current literature, toxicity is identified as a general concern and mentioned here accordingly.	David Hendry	Nuffiled College, Oxford University	United Kingdom (of Great Britain and Northern Ireland)
43287	84	12	85	10	Fumeric acid should be noted as reducing methane emissions by ruminals: see https://www.sciencedirect.com/science/article/pii/S0377840109000893	Rejected. We have considered generic approaches and those flagged in previous reports within the first paragraph. Fumeric acid is included in these. The rest of the subsection deals with recent developments and therefore, specific discussion on Fumeric acid was deemed unnecessary.	David Hendry	Nuffiled College, Oxford University	United Kingdom (of Great Britain and Northern Ireland)
11495	84	14	84	19	browse leaves which is an antimethanogenic feed can be processed and used to mitigate methane emissions and at the same time improve weight gain through out the year.	Noted. It is felt that the measure categories outlined within the first paragraph cover browse leaves and therefore, no changes were made.	Nkuba Michael	University of Botswana	Botswana
11499	84	14	84	19	1. Sarkwa, F.O., Adogla-Bessa, T., Mphinyane, W. N., Madibela, O. R., Perkins, J.S. and Timpong-Jones, E.C (2020). Effort to Reduce Methane Emission in Sheep Production by Feeding Dried Browse Species as Sole Diet. Special Edition of Bulletin of Animal Health and Production in Africa. Volume 68 No.2, 123-132.	Noted. Thank you for the suggested reference. With consideration it was decided not to include it.	Nkuba Michael	University of Botswana	Botswana
11501	84	14	84	19	Sarkwa, F.O., Madibela, O. R., Adogla-Bessa, T., Mphinyane, W. N., Perkins, J.S. and Timpong-Jones, E.C (2020).Chemical Composition, in vitro dry matter digestibility and gas production of four browse species and their combinations used as feed for small ruminants. West African Journal of Applied Ecology, vol 28(2):106-117.	Noted. The authors thank the reviewer for the suggested reference. With consideration of the general narrative and word count restrictions, it was decided not to include it.	Nkuba Michael	University of Botswana	Botswana
11503	84	14	84	19	Sarkwa, F.O., Adogla-Bessa, T., Mphinyane, W. N., Madibela, O. R., Perkins, J.S. and Timpong Jones, E.C (2020). The Effects of Season and Drying on Chemical Composition and Condensed Tannins Levels of Four Browse Species. Special Edition of Bulletin of Animal Health and Production in Africa. Volume 68 No.2, 133-143.	Noted. The authors thank the reviewer for their suggested reference. Following consideration, it was not included.	Nkuba Michael	University of Botswana	Botswana
71841	84	25	84	38	Reference to the benefits of early mitigation due to the higher short-term GWP of CH4 should also be made	Rejected. As the objective was to discuss mitigation measures, while also considering strict word count limitations, it was felt that reference to benefits of early CH4 mitigation in the context of climate pathways was not warranted in this subsection.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
71843	84	39	85	10	The greatest mitigation potential per unit product is certainly through better management and feed and animal health in developing countries. Please also expand a bit on why CH4 vaccines would not change anything in that regard.	Rejected. Having reviewed the subsection it was felt that the narrative and information conveyed was sufficient. The text does not suggest that increasing efficiency in developing countries is not important, nor that vaccines would negate the need to do so.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
45999	84	42	85	1	This paragraph suggests that feed additives are a promising way to mitigate CH4-emissions from enteric fermentation. This is despite the fact that there is critical literature pointing to potential health problems and doubting the practicability of such additives on large scale. One possible literature source is here: Knapp et.al, 2014, Invited review: Enteric methane in dairy cattle production: Quantifying the opportunities and impact of reducing emissions, https://www.sciencedirect.com/science/article/pii/S0022030214002896#sec0115. Another critical review of the possible measures with English summary and extensive literature can be found here: Brade /Wimmers, Methan-Minderungspotenziale bei Wiederkäuern, https://buel.bmel.de/index.php/buel/article/view/104/Brade_Methanmin.html Please add these publications and check the positive evaluation. There is also only a low probability that such feed additives will be allowed in the EU, which will clearly negatively effect its mitigation potential. Please add this information to the report.	Noted – partly accepted. The information sources outlined by the reviewer were explored. No changes have been made for two reasons; (1) it was felt that more recent reviews of mitigation options (referred to in the subsection) identify inhibitors/additives as promising and that the text sufficiently summarises current thinking (2) discussion is already provided on potential barriers or shortcomings regarding additives/inhibitors. However, reference to regulatory approval has been added.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
56073	85	41	85	42	There may be value in additional focus on residue management. Beach et al. (2015), for instance, examined the potential for net reductions in GHG associated with increased incorporation of rice residues into the soil (to the extent that additional residues increased soil carbon more than they increased methane), but there may actually be greater potential net GHG mitigation associated with reducing the amount of rice residue left in the field to lower methane emissions (even if soil carbon sequestration is reduced), especially in locations where the fields would remain flooded after harvest and if residues were used to make biochar that would be reincorporated into agricultural soils. An important consideration in the event more rice residues were removed would be the disposition of those residues, whether piled and burned (resulting in GHG emissions and negative air quality impacts) or used to make biochar or used in other agricultural uses. Further exploration of rice residue management would likely be valuable.	Accepted. Reference is added in the section	Government of United States of America	U.S. Department of State	United States of America
3893	86	7			Poustian is wrong, the correct name is Paustian.	Accepted	Rosa M Poch	ITPS and UdL	Spain
56075	86	7	86	7	"Poustain" should be "Paustian et al. (2016)"	Accepted	Government of United States of America	U.S. Department of State	United States of America
71845	86	13	86	13	... dependent on site-specific ...	Accepted	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
71847	86	43	88	19	The box can probably be shortened and could focus on the Viet Nam case as the background of AWD can be described in the text. What about other options for mitigation in rice, such as SRI?	Accepted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
61399	86	46	86	46	"...efficiency can ..." there are two blanks between the word "efficiency" and word "can"	Accepted . Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
21475	86	48	86	48	The limited potential to switch from anaerobic to aerobic rice cultivation while maintaining current yields may in the long term, to avoid methanogenesis, call for the engineering of new crops producing rice-like grain on a fully dryland-adapted, possibly C4-type plant.	Noted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Government of France	Ministère de la Transition écologique et solidaire	France
53389	87	23	87	23	Change "the diffusion rate increases to 52%," to "the uptake rate increased to 52%,".	Accepted.Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Donald Smith	McGill University	Canada
53391	87	32	87	33	Change "rice field, different type of soil, conflict on benefits between farmers and pumping stations etc." to "rice fields, different types of soil, conflict regarding benefits between farmers and pumping stations, etc.".	Accepted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Donald Smith	McGill University	Canada
53393	87	36	87	37	Change "by 29% to 30% and 26% to 27% respectively" to "by 29 to 30% and 26 to 27% respectively".	Accepted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Donald Smith	McGill University	Canada
53395	87	42	87	42	Change "vary" to "varied".	Accepted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Donald Smith	McGill University	Canada
3895	87	45			compared	Accepted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Rosa M Poch	ITPS and UdL	Spain
53397	87	45	87	45	Change "8 % and 20 %" to "8 and 20 %".	Accepted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Donald Smith	McGill University	Canada
53399	88	11	88	12	Change "mitigation is therefore a potential limitation. Lack of appropriate irrigation system, the small" to "mitigation are therefore a potential limitation. Lack of appropriate irrigation systems, the small".	Accepted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Donald Smith	McGill University	Canada
21477	88	16	88	18	Potentially, among the most effective incentives to change land and crop management (e.g., away from methanogenic anaerobic rice cultivation) would be to breed/engineer crops that provide the desired product (e.g., rice grain) in the most sustainable agro-ecosystem from an GHG emission perspective (e.g., aerobic). The engineering of new crops is becoming increasingly possible, not necessarily involving GMOs (Paul et al., 2017; Zaidi et al., 2020). Paul M, Oszvald M, Jesus C, Rajulu C, Griffiths CA. 2017. Increasing crop yield and resilience with trehalose 6-phosphate: targeting a feast-famine mechanism in cereals for better source-sink optimization. J. Exp. Bot. 68, 4455-4462. doi: 10.1093/jxb/erx083. Zaidi SS, Mahas A, Vanderschuren H, Mahfouz MM. 2020. Engineering crops of the future: CRISPR	Accepted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Government of France	Ministère de la Transition écologique et solidaire	France
53401	88	16	88	16	Change "term" to "terms"	Accepted. Due to page limitations, we decided to remove the box and merge relevant information to Section 7.4.3.5.	Donald Smith	McGill University	Canada
3897	88	21			This section 7.4.3.6. Crop nutrient management is only dealing with nitrogen fertilisation. No mention to deficient P or micronutrient fertilisation which generate problems in some regions. So, reference to them is needed.	Accept. Good point	Rosa M Poch	ITPS and UdL	Spain
3899	88	21			Section 7.4.3.6. Crop nutrient management: Refer to the FAO Code of Conduct for the sustainable use and management of fertilizers: ttp://www.fao.org/3/ca5253en/CA5253EN.pdf	Accept. FAO reference will be used	Rosa M Poch	ITPS and UdL	Spain
9485	88	21	88	21	Change the title to "Crop nutrient and soil properties management"	Agree	Catherine Henault	INRAE - AGROECOLOGIE	France
9487	88	22	88	41	Please add that "liming acidic soil to the target soil pH at ~ 6.8 can also mitigate soil N2O emission (Bakken and Frostegaard, 2020 ; Hénault et al., 2019 ; Shaaban et al., 2015), with co-benefits for numerous ecosystemic services (Holland et al., 2018). Due to the pluriannual effect of liming product on soil pH, avoided N2O emission exceed CO2 emission from applied carbonate products (Hénault et al., 2019)"	Accept. Thanks for additional references	Catherine Henault	INRAE - AGROECOLOGIE	France
79821	88	22	88	41	In no part of the list of practices the management of nutrients using Biological Fixation of N is mentioned. This is extremely relevant for the production of soybean in Brazil, the top country in the word in production of this grain. See: Dietrich WernerWilliam E. Newton. Nitrogen Fixation in Agriculture, Forestry, Ecology, and the Environment pp 25-42. Springer, 2005 (The Importance of Nitrogen Fixation to Soybean Cropping in South America)	Agreed. NBF will further developed in the section	Lucia Helena ANJOS	UFRRJ	Brazil
11841	88	24	88	28	The management practices mentioned are of incremental art and of no real significance if not combined with improved with the implementation of decision support systems and cropping system strategies through farm management information systems.	comment will be taken in consideration in rewriting the section	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
21479	88	27	88	27	intercropping (cereals/legumes) Jensen et al. 2020 said: 'We estimated that the increased N use efficiency in intercropping can reduce the requirements for fossil-based fertilizer N by about 26% on a global scale.' And Natmatsheve mentioned that We conclude that cereal-cowpea intercropping is a pathway for intensification for the low nutrient input systems of smallholder farmers in sub-Saharan Africa. Jensen, E.S., Carlsson, G., Hauggaard-Nielsen, H., 2020. Intercropping of grain legumes and cereals improves the use of soil N resources and reduces the requirement for synthetic fertilizer N: A global-scale analysis. Agron. Sustain. Dev. 40, 5. https://doi.org/10.1007/s13593-020-0607-x Namatsheve, T., Cardinael, R., Corbeels, M., Chikowo, R., 2020. Productivity and biological N2-fixation in cereal-cowpea intercropping systems in sub-Saharan Africa. A review. Agron. Sustain. Dev. 40, 30. https://doi.org/10.1007/s13593-020-00629-0	Agreed. intercropping in relation to nutrient efficiency will be added to text	Government of France	Ministère de la Transition écologique et solidaire	France
21481	88	27	88	29	Should cereal-legume intercropping also not be incorporated here? For example see Namatsheve, T., Chikowo, R., Corbeels, M., Mouquet-Rivier, C., Icard-Vernière, C., Cardinael, R., 2021. Maize-cowpea intercropping as an ecological intensification option for low input systems in sub-humid Zimbabwe: Productivity, biological N2-fixation and grain mineral content. F. Crop. Res. 263, 108052. doi:10.1016/j.fcr.2020.108052	references will be used	Government of France	Ministère de la Transition écologique et solidaire	France
53403	88	28	88	28	Change "management plan, is suggested" to "management planning, are suggested"	accept and will be corrected	Donald Smith	McGill University	Canada
21483	88	37	88	38	The sentence hard to understand: please rephrase	Accept to rephrase	Government of France	Ministère de la Transition écologique et solidaire	France
53405	89	10	89	11	Change "and developing" to "and are developing".	Rejected. The words "and developing' are used as part of an official regional classification.	Donald Smith	McGill University	Canada
19781	89	20	89	20	carbon sequestration may have an antagonistic effect in relation to the ecossystem service of water suplly ,especially in arid zones	Noted. It could	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21485	89	20	89	20	It seems important to add to this paragraph that there is a risk with better nutrient manangement (in certain regions; i.e. SSA) that the effect of climate change on crop productivity will increase (even if intensification is needed, this intensification will lead to higher effect of CC on cereals yield at least) . Falconnier et al. 2020 and Adam et al. 2020 . Adam, M., MacCarthy, D.S., Traoré, P.C.S., Nenkam, A., Freduah, B.S., Ly, M., Adiku, S.G.K., 2020. Which is more important to sorghum production systems in the Sudano-Sahelian zone of West Africa: Climate change or improved management practices? Agricultural Systems 185, 102920. https://doi.org/10.1016/j.agsy.2020.102920 . Falconnier, G., Corbeels, M., Boote, K., Affholder, F., Adam, M., MacCarthy, D., Ruane, A., Nendel, C., Whitbread, A., Justes, E., Ahuja, L., Akinseye, F.M., Alou, I., Amouzou, K., Anapalli, S.S., Baron, C., Basso, B., Baudron, F., Bertuzzi, P., Challinor, A., Chen, Y., Deryng, D., Elsayed, M., Faye, B., Gaiser, T., Galdos, M., Gayler, S., Gerardeaux, E., Giner, M., Grant, B., Hoogenboom, G., Ibrahim, E., Kamali, B., Kersebaum, K., Kim, S., van der Laan, M., Leroux, L., Lizaso, J., Maestrini, B., Meier, E., Mequanint, F., Ndoli, A., Porter, C., Priesack, E., Ripoche, D., Sida, T., Singh, U., Smith, W., Srivastava, A., Sinha, S., Tao, F., Thorburn, P., Timlin, D., Traore, B., Twine, T., Webber, H., 2020. Modelling climate change impacts on maize yields under low nitrogen input conditions in sub-Saharan Africa. Glob Change Biol gcb.15261. https://doi.org/10.1111/gcb.15261	References will be used	Government of France	Ministère de la Transition écologique et solidaire	France
21487	89	20	89	20	Good examples are West-African climate-smart village lanscape designed by communities integrating both livestock and crop activities: Vayssières J., Assouma M.H., Lecomte P., Hiernaux P., Bourgoin J., Jankowski F., Corniaux C., Vigne M., Torquebiau E., Ickowicz A., 2017. Livestock at the heart of "climate-smart" landscapes in West Africa. In: Caron P., Valette E., Wassenaar T., Coppens D'Eeckenbrugge G., Papazian V. (Eds.), Living territories to transform the world. Ed. Quae, Versailles, France, p 111-117.	Thank you for the reference. The box is presenting a particular example and unfortunately, due to space limitations we could not include more examples.	Government of France	Ministère de la Transition écologique et solidaire	France
43289	89	20	90	18	Food insecurity also relates to countries that import most of their food as in the Middle East where vertical and underground farms could play a valuable role: https://www.bbc.co.uk/news/av/science-environment-49411645	Thank you for the reference. The box is presenting a particular example and unfortunately, due to space limitations we could not include more examples.	David Hendry	Nuffiled College, Oxford University	United Kingdom (of Great Britain and Northern Ireland)
43291	89	20	90	18	Huge increases in crop productivity are feasible from best practice (see https://doi.org/10.1038/s41893-020-0505-x) and vertical farms: see https://www.pnas.org/content/117/32/19131	Thank you for the reference. The box is presenting a particular example and unfortunately, due to space limitations we could not include more examples.	David Hendry	Nuffiled College, Oxford University	United Kingdom (of Great Britain and Northern Ireland)
53407	89	28	89	28	Change "would" to "will".	Accepted, text was revised.	Donald Smith	McGill University	Canada
71849	89	39	89	40	better just explain what all these smart measure actually mean	Rejected. The concept behing climate-smart villages is explained in the text.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
16425	89		89		A study on increase in nitrous oxide emissions from rice paddy fields had been reqested to be added in the bibliography and this request is reflected.	Noted. The authors hope that revisions since the FOD have satisfied the reviewer's request.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
71851	90	2	90	3	also mention scalability concerns	Scalability is considered in the item about Lessons from case study.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
53411	90	8	90	8	Change "though warrants" to "though this warrants".	Accepted. "This" has been added (it was assumed the reviewer refers to page 91).	Donald Smith	McGill University	Canada
76901	90	20	90	20	Consider moving 7.4.3.7 (manure management) to just after 7.4.3.4. (enteric fermentation)	Rejected - The topics are ordered according to mitigation potential.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
46001	90	24	90	25	The long term impact of inhibitors on the environment and human health is still not sufficiently researched. There is a publication on fertilizing additives which shows that such inhibitors can negatively impact aquatic animals: Kösler et.al. 2019, Environmental Science Europe, Evaluating the ecotoxicity of nitrification inhibitors using terrestrial and aquatic test organisms, https://enveurope.springeropen.com/articles/10.1186/s12302-019-0272-3. There is also literature which looks at the effects of N-Inhibitors and shows that while N2O-emissions decrease, NH3 emissions increase: Lam, S., Suter, H., Mosier, A. & Chen, D. (2016). Using nitrification inhibitors to mitigate agricultural N2O emission: a double-edged sword? Global Change Biology. DOI: https://doi.org/10.1111/gcb.13338. Please also integrate this critical literature on inhibitors and revaluate.	Accepted. A good point. Specific reference has been made within the text and the work by Kösler et al. has been cited.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
53409	90	25	89	25	Exploain "urine patches".	Rejected. Relevant literature indicates that the term 'urine patches' is widely used. Explanation was deemed unnecessary.	Donald Smith	McGill University	Canada
21489	90	33	90	33	Add this paper which shows very high N2O emissions in the sahelian pastoral ecosystems due to faeces deposition on the soil (Assouma et al., 2019) Assouma, M.H., Hiernaux, P., Lecomte, P., Ickowicz, A., Bernoux, M., Vayssières, J., 2019. Contrasted seasonal balances in a Sahelian pastoral ecosystem result in a neutral annual carbon balance. Journal of Arid Environments 162, 62-73.	Rejected. It was decided not to include the suggested reference as the paragraph in question aims to outlined findings of previous IPCC reports.	Government of France	Ministère de la Transition écologique et solidaire	France
79861	91	4	91	5	Nitrification inhibitors are also found an effective measure to reduce N2O emissions from mineral fertilizer. See, e.g., Himics et al. (2020). Setting climate action as the priority for the Common Agricultural Policy: a simulation experiment. Journal of Agricultural Economics 71 (1): 50-69 doi:10.1111/1477-9552.12339; Fellmann et al. (2018). Major challenges of integrating agriculture into climate change mitigation policy frameworks. Mitigation and Adaptation Strategies for Global Change 23 (3): 451-468. doi:10.1007/s11027-017-9743-2; Himics et al. (2018). Does the current trade liberalization agenda contribute to greenhouse gas emission mitigation in agriculture? Food Policy 76: 120-129. doi:10.1016/j.foodpol.2018.01.011; Pérez Domínguez et al. (2016). An economic assessment of GHG mitigation policy options for EU agriculture (EcAMPA2). JRC Science for Policy Report, European Commission, Luxembourg: Publications Office of the European Union. doi:10.2791/843461. Note: all four references draw an the same assumptions.	Noted. The reviewer makes a valid point. However, this particular subsection only considers manure management. Discussion on fertilizers and inhibitors is presented in Section 7.4.3.6. The reviewer's comment has been passed on to the relevant author.	Thomas Fellmann	European Commission, Joint Research Centre	Spain
79859	91	14	91	19	For developed countries, you should also point out feed additives as promising measures to reduce methane emissions from enteric fermentation. See, e.g., in the following publications that show feed additives as promising mitigation option within a set of other options that you already refer to: Himics et al. (2020). Setting climate action as the priority for the Common Agricultural Policy: a simulation experiment. Journal of Agricultural Economics 71 (1): 50-69 doi:10.1111/1477-9552.12339; Fellmann et al. (2018). Major challenges of integrating agriculture into climate change mitigation policy frameworks. Mitigation and Adaptation Strategies for Global Change 23 (3): 451-468. doi:10.1007/s11027-017-9743-2; Himics et al. (2018). Does the current trade liberalization agenda contribute to greenhouse gas emission mitigation in agriculture? Food Policy 76: 120-129. doi:10.1016/j.foodpol.2018.01.011; Pérez Domínguez et al. (2016). An economic assessment of GHG mitigation policy options for EU agriculture (EcAMPA2). JRC Science for Policy Report, European Commission, Luxembourg: Publications Office of the European Union. doi:10.2791/843461. Note: all four references draw an the same assumptions.	Noted. Discussion on the use of inhibitors in reducing enteric CH4 emissions is covered in Section 7.4.3.4.	Thomas Fellmann	European Commission, Joint Research Centre	Spain
3901	91	25		30	This section on manure management gives the impression that manure management can be done in all regions. In reality, there is a limitation of manure production in semiarid and arid areas, where its use as fertilizer competes with its use as fuel. Some tuning indicating these regional differences should be included.	Accepted. The authors wished to indicate that theoretically, there are measures that can be applied in all regions, though mitigation potential may differ. However, changes have been made.	Rosa M Poch	ITPS and UdL	Spain
11843	91	32	93	38	Göte Bertilsson Agr.Dr has made the following calculations based on the Swedish agriculture which show a great potential in a changed cultivation concept such as Conservation Agriculture. (Under publication)Soil C build-up, 0 in the reporting. Should actually have been 1.8 as a carbon sink according to SLU. Improved cultivation systems with catch / intermediate crops can provide an additional 300 kg C per year and hectares. A decent but realistic development according to the table below would result in the binding of 0.4 million tonnes of carbon dioxide. If this comes up to today's trend, the sum would be 2.2 million tonnes of carbon dioxide. Bioenergy. If agriculture's main crops go to bioenergy, agriculture should not be credited. Then the more arable land may be needed in, for example, the Amazon. But it should be different if agriculture, in addition to the main crop, produces biomass or by-products. One such by-product is straw. Agriculture has the alternative of using it down for soil management or arranging the soil management with an improved cultivation system. The straw can be said to be a side production that should be able to be credited to agriculture in this context, because without agriculture there will be nothing. Denmark has a current production of 4 Twh from straw. There is an opportunity to strongly propagate this with partly manure and partly biomass production as a second crop in the autumn. A table that summarizes different possibilities. Starting points: grain cultivation of about 1 million hectares. Number of cows 500,000, fattening pigs 800,000. 3 tonnes of straw per hectare can be stored for direct energy production. One, medium crop can give 3 tons of dry matter per hectare, and can be harvested for biogas. For greenhouse gases, oil replacement has been calculated, a rough estimate. What is hereinafter referred to as the "Total resource" for intermediate crops is an assessed practical adjustment. This possibility that Bertilsson describes is missing in the report. It is mentioned that bioenergy effects from agricultural production benefits other sectors in the report. To give agriculture realistic goals for mitigation some kind cross-reference should be introduced. A rough estimate for Swedish conditions is that agriculture can give for about 5 TWH of bioenergy from side products and replacing fossil emissions of about 2 million tons GHG. (30% farm adoption) This is not very substantial on the total land budge, but quite substantial for the sector Agriculture. And a very important factor: this would strengthen the soils, sustainability and diversity. The discussion here is supported by the following references: Bolinder M.A., Crotty F., Elsen A., Frac M., Kismanyoky T., Lipiec J., Tits M., Toth Z., Kätterer T. 2020. The effect of crop residues, cover crops, manures and nitrogen fertilization on soil organic carbon changes in agroecosystems: A synthesis of reviews. Mitigation and Adaptation Strategies for Global Change 25: 929–952; Kätterer T., Bolinder M.A., Berglund K., Kirchmann H. 2012. Strategies for carbon sequestration in agricultural soils in northern Europe. Acta Agr. Scand. Section A. 62: 181-198.	Noted. The authors thank the reviewer for their points. (1) Regarding Conservation Agriculture (CA), Bertilsson's work is noted. Unfortunately, this specific paper could not be found. It is hoped that the text as it stands (indicating that CA has context specific potential) satisfies the reviewer's point. (2) Regarding the use of agricultural residues / by-products (straw) for energy production, this should be covered in Bioenergy Section (7.4.4.) Agricultural 'by-flows' are indeed mentioned there.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21491	91	32	91	32	This Box does not really define or distinguish the different approaches, and shows clearly a preference for "Integrated Production System", with still too vague outlines (embracing everything…). And approaches like "regenerative agriculture", "permaculture" or "natural farming" are not included. All this is not without consequences, particularly in terms of plant and economic modelling, which will continue to make such approaches invisible (Dorin and Joly 2020), and will remain stuck and and parameterized on the approach of "industrial agriculture" (specialization on some mass productions produced with public/private laboratory techniques: seeds, chemical fertilizers, pesticides, mechanization/robotization…), hence "business as usual" scenarios. Ref biblio of "Dorin and Joly 2020"Dorin Bruno, Joly Pierre-Benoît, 2020. "Modelling world agriculture as a learning machine? From mainstream models to Agribiom 1.0", Land Use Policy, 96:July, pp. 103624.	Noted & partly agree. The authors can confirm no preference for any system discussed. IPS were discussed first, simply as the other systems may form examples of IPS. However, the systems have been reordered alphabetically to hopefully avoid such issues. Regarding, distinction between systems, it is outlined in the introduction that the systems are not necessarily mutually exclusive (this is now also noted in the figure). Unfortunately, proper definitions and wider discussion on the systems was not possible due to a strict word limit for the box (800 words), with focus having to be on mitigation potential. It was felt that the inclusion of discussion on these 'alternative' Ag. systems was important, even if regrettably brief and constrained, rather than no mention at all within the chapter. Regarding the exclusion of some approaches, Regenerative Ag. is mentioned under Agroecology - though admittedly all too briefly. The word limit restricts the inclusion of additional systems such as permaculture or natural farming. The word 'some' regarding the selection of systems discussed has been added, along with reference to several systems being identified within in the SRCCL. It is hoped that these edits sufficiently emphasise that multiple approaches/systems exist, other than those discussed, yet also indicate the reasoning behind the selection here.	Government of France	Ministère de la Transition écologique et solidaire	France
53415	91	32	93	38	It might be useful to add something in this section related to exploitation of the phytomicrobiome and signal compounds produced by phytomicrobiome members as ways to help crop plants, including biomass crops for bio-energy production, to aid plants in dealing with abiotic stress, including climate change related stress, making crop production systems more climate change resilient and, in the case of bio-energy production, reducing greenhouse gas emissions. It is still early days for this area, but it is now developing quickly and there are now products being used more extensively in crop production.	Noted. The authors thank the reviewer for their suggestion. Though relevant, following consideration it was decided not to include discussion on the phytomicrobiome in Box 7.7. This was for two main reasons (1) there is a strict word limit for the box, constraining new additions and (2) it was felt that exploitation of the phytomicrobiome and 'rhizosphere engineering' does not constitute as a specific farming system.	Donald Smith	McGill University	Canada
21493	91	34	91	34	Figure 3 of the following article clearly shows how different individual managmeent practices can be used within a farm and their potentiel for mitigation or adaptation. Descheemaeker, K., Oosting, S.J., Homann-Kee Tui, S., Masikati, P., Falconnier, G.N., Giller, K.E., 2016. Climate change adaptation and mitigation in smallholder crop–livestock systems in sub-Saharan Africa: a call for integrated impact assessments. Regional Environmental Change 16, 2331–2343. https://doi.org/10.1007/s10113-016-0957-8	Noted. The authors agree but are unsure as to what it is suggested regarding edits to the specific sentence indicated. It is hoped that the re-wording of the introduction satisfies the comment. However, the mentioned paper is now cited in the IPS sections, as it was felt is it was a useful addition there.	Government of France	Ministère de la Transition écologique et solidaire	France
70195	92	1	92	1	Please change black background in box 7.7.	Accepted. The background has been changed.	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain
11845	92	3	92	3	Box 7.7. Sustainable intensification mentioned as part of IPS, see above. The reduced emissions and carbon sequestration advantages listed for organic farming are on reasonable grounds questioned on page 7-93 rows 11-23, why it is difficult to understand why the management system is mentioned at all.	Noted. Organic farming is often perceived as more sustainable (as suggested in the SRCCL). The mitigation potential of the system is of course debated, and its discussion here, and assessment of associated literature, was deemed policy relevant and useful. Some authors consider OF to be an important means of contributing to sustainable intensification.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
21499	92	9	92	11	The following work at farm level (for dairy farms) in a tropical island can be cited: Vayssières J., Vigne M., Alary V., Lecomte P., 2011. Integrated participatory modelling of actual farms to support policy making on sustainable intensification. Agricultural Systems 104, 146–161.	Rejected. The authors thank to reviewer for the suggested reference. Though relevant, it was decided not to include it considering the strict word limit.	Government of France	Ministère de la Transition écologique et solidaire	France
24643	92	9	92	10	To the sentence: 'There is evidence that CA can contribute to mitigation, but its contribution is depended on multiple factors including climate and residue returns'. Based on the this report: https://dcapub.au.dk/djfpdf/DCA_rapport_nr177_web.pdf. there is only a very limited mitigation effect of CA.	Noted. The authors thank the reviewer for highlighting this report. Following consultation, it was felt that the report did not contradict the cited sentence, considering the global perspective and as outlined, that mitigation depends on multiple factors. It was felt that the report (e.g. Table 9.1) confirms findings of the SRCCL (positive and inconclusive results re: C sequestration with emphasis on residue returns) and is cited accordingly.	Government of Denmark	Danish Meteorological Institute	Denmark
12489	92	15	92	19	Add following clarification after the sentence: "However, the risk of leakage of GHGs from different sources on biogas plants could in some cases outnumber the positive climate effects for the biogas systems (Daniel-Gromke et al., 2015), especially on small scale plants (Scheutz & Fredenslund, 2019). Storage of digestate has been identified as the main source of GHGs on digestion plants (Liebetrau et al., 2013), as well as the combined heat and power (CHP) unit (Fredenslund et al., 2018). This means that measures like collecting biogas from storages, CPU leakage control of reactors must be mandory when introducing such technique." Daniel-Gromke J., Liebetrau J., Denysenko V. and Krebs C., 2015. Digestion of bio-waste – GHG emissions and mitigation potential. Energy, Sustainability and Society 5:3, DOI 10.11186/s13705-014-0032-6. Fredenslund A. M, Hinge J., Holmgren M. A., Rasmussen S. G., Scheutz C.,2018. On-site and ground-based remote sensing measurements of methane emissions from four biogas plants: A comparison study. Bioresource Technology 270, 88-95. Liebetrau J., Reinelt T., Clemens J., Hafermann C., Friehe J., Weiland P., 2013. Analysis of greenhouse gas emissions from 10 biogas plants within the agricultural sector. Water Science Technology 67(6), 1370-9. doi: 10.2166/wst.2013.005….Scheutz C., Fredenslund A. M., 2019. Total methane emission rates and losses from 23 biogas plants. Waste Management 97, 38-46.	Accepted. Good point. The lines that the reviewer identified were assumed to be incorrect and that the comments concern Section 7.4.3.7. The risk of fugitive emissions is now mentioned in the manure management section with reference to Fredenslund et al. 2018.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
21495	92		92		Some livestock systems are not truly dedicated to meat or milk production, and rearing animals serves broader purposes. For instance in the Sahel, cows which are African Zebus are not high milk or meat producers, and are reared because of their specific adaptation to heat and drought. Cows are kept during a long time in the herds, and during this long career one of their main role is to produce calves. The size of the herd is quite important because it enables the herders to exchange animals between relatives, and because animals are available for sale if needed. In this situation it could be more suitable to consider the GHG print of cows not only by unit of milk/meat, but by the number of calves produced during the whole career. For example a Zebu cow of 11 years, starting to reproduce at 4, calving every two years and with an annual emission of 48 kg of CH4/animal/year (Tier1 IPCC 2019), would produce 132 kg CH4/calf. The same calculus could be applied to Western cows, considering roughly that their life span is in average 8 years, that they reach maturity at 2 years and have a calf per year. With an annual methane coefficient of 126 kg of CH4/animal/year (Tier1 IPCC 2019), the production would be 144 kg of CH4/calf. This approximate approach is a small aside, aiming at taking into account another view of local production.	Noted. The reviewer(s) make(s) valid points. However, it is unclear what changes are suggested to the figure. Accordingly, no specific changes have been made.	Government of France	Ministère de la Transition écologique et solidaire	France
21497	92		92		We suggest to have the background grey or white	Accepted. The background has been changed.	Government of France	Ministère de la Transition écologique et solidaire	France
21501	93	4	93	4	This reference is missing in the reference list. Corbeels, M., Cardinael, R., Powlson, D., Chikowo, R., Gerard, B., 2020. Carbon sequestration potential through conservation agriculture in Africa has been largely overestimated: Comment on: "Meta-analysis on carbon sequestration through conservation agriculture in Africa." Soil Tillage Res. 196, 104300. doi:10.1016/j.still.2019.104300	Noted. The reference list will be checked	Government of France	Ministère de la Transition écologique et solidaire	France
21503	93	5	93	5	The cited reference not provided in reference list	Noted – thank you. The reference list will be checked.	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21505	93	11	93	11	This section is a partial and reductive account of the climate merit of organic farming. 1) Evidence suggests more than a "tendency" for OF to have lower emissions per unit of area (2) Per unit of product, the evidence is mixed, without a clear tendency for higher emissions for OF: Mondelaers et al. (2009) finds that the carbon footprint of organic products is worse than conventional ones, whereas Meier et al. (2015), Tuomisto et al. (2012) and Clark and Tilman (2017) are inconclusive, arguing that the result may depend on product types. Most interestingly, Meier et al. (2015) concludes that it is not yet possible to draw a conclusive picture on the topic, because detailed calculation methods and parameters – often not fully transparent in published articles – likely overlook important differences between organic and conventional production. Bellassen et al. (2021), using a consistent methodology over various products, finds that organic animal products are not significantly different from their conventional counterparts while organic vegetal products have a median 16% lower carbon footprint. 3) Biomass and soil carbon changes have also not been considered in these studies. These changes are indeed negligible when land use and management is kept constant over long time periods (IPCC, 2006; Pellerin et al., 2019). This is not true however in the first decades following change. Thus, organic farming has been shown to increase soil carbon stocks by an average 0.07-0.27 tC ha-1 year-1, although this is likely an indirect consequence of higher manure inputs and crop rotations than a direct efifect of the technical specifications (Gattinger et al., 2012). In addition, conversions from conventional systems to FQS would, in many cases, involve sowing grasslands over cropland which would increase soil carbon stocks (Lambotte et al., 2020). To the contrary however, such conversions would often result in decreasing yields, which in turn are predicted to have a negative effect on biomass and soil carbon stocks through indirect land-use changes (Bellora and Bureau, 2016; Searchinger et al., 2018). Therefore, there is no obvious prediction as to how including biomass and soil carbon changes would impact these results. 4) Finally, the diet of consumers eating a higher share of organic products has been shown to contain fewer animal-based products, incidentally leading to a lower carbon footprint of the diet as a whole (Baudry et al., 2019; Lacour et al., 2018). References for the previous comment: Baudry, J., Pointereau, P., Seconda, L., Vidal, R., Taupier-Letage, B., Langevin, B., Allès, B., Galan, P., Hercberg, S., Amiot, M.-J., Boizot-Szantai, C., Hamza, O., Cravedi, J.-P., Debrauwer, L., Soler, L.-G., Lairon, D., Kesse-Guyot, E., 2019. Improvement of diet sustainability with increased level of organic food in the diet: findings from the BioNutriNet cohort. The American Journal of Clinical Nutrition 109, 1173–1188. https://doi.org/10.1093/ajcn/nqy361 . Valentin Bellassen, Marion Drut, Federico Antonioli, Ružica Brečić, Abdoul Diallo, Michele Donati, Hugo Ferrer-López, Lisa Gauvrit, Viet Hoang, Kamilla Knutsen Steinnes, Apichaya Lilavanichakul, Edward Majewski, Agata Malak-Rawlikowska, Konstadinos Mattas, An Nguyen, Ioannis Papadopoulos, Jack Peerlings, Bojan Ristic, Marina Tomić Maksan, Áron Török, Gunnar Vittersø (2021). The carbon and land footprint of certified food products. Journal of Agriculture and Food Industrial Organization. Bellora, C., Bureau, C., 2016. How green is organic ? Indirect effects of making EU agriculture greener (Presented at the 19th Annual Conference on Global Economic Analysis, Washington DC, USA). Global Trade Analysis Project (GTAP), Department of Agricultural Economics, Purdue University, West Lafayette, IN. Clark, M., Tilman, D., 2017. Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice. Environ. Res. Lett. 12, 064016. https://doi.org/10.1088/1748-9326/aa6cd5 . Gattinger, A., Muller, A., Haeni, M., Skinner, C., Fliessbach, A., Buchmann, N., Mäder, P., Stolze, M., Smith, P., Scialabba, N.E.-H., Niggli, U., 2012. Enhanced top soil carbon stocks under organic farming. PNAS 109, 18226–18231. https://doi.org/10.1073/pnas.1209429109 . IPCC, 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Chapter 4: Agriculture, Forestry and Other Land Uses (AFOLU). IGES, Hayama, Japan. Lacour, C., Seconda, L., Allès, B., Hercberg, S., Langevin, B., Pointereau, P., Lairon, D., Baudry, J., Kesse-Guyot, E., 2018. Environmental Impacts of Plant-Based Diets: How Does Organic Food Consumption Contribute to Environmental Sustainability? Front. Nutr. 5. https://doi.org/10.3389/fnut.2018.00008 . Lambotte, M., De Cara, S., Brocas, C., Bellassen, V., 2021. Carbon footprint and economic performance of dairy farms: The case of protected designation of origin farms in France. Agricultural Systems 186, 102979. https://doi.org/10.1016/j.agsy.2020.102979 . Meier, M.S., Stoessel, F., Jungbluth, N., Juraske, R., Schader, C., Stolze, M., 2015. Environmental impacts of organic and conventional	Noted. It is important to mention that there was/is a strict word limit for information boxes, included this box, greatly constraining discussion. The text does indeed aim to provide a reductive account or synopsis, though it certainly should not be partial. Regarding Point 1: Accepted. The text has been modified. Point 2: Accepted. It was intended that the words "context specific" as originally written, implied this. However, the text has been changed to clarify. Point 3: Noted. The strict word limit regrettably restricts in-depth discussion. However, a sentence (admittedly all too brief and simplistic) has been added to hopefully convey this. It was decided not to cover impacts of increased grass leys in arable systems, due to the reasons the reviewer outlines - regarding potentially resulting LUC (the impacts of which are more broadly discussed within the box). Point 4: Rejected. Mitigation via dietary preferences typical of those who consume higher levels of organic produce is deemed indirect and beyond the scope of this review.	Government of France	Ministère de la Transition écologique et solidaire	France
76907	93	11	93	23	For organic farming, it is useful to discuss the implications of lower yields, which can translate into higher land requirements. However, it should be done consistently. E.g., for agroforestry, the land savings from higher overall productivity (food and wood combined) is not analysed, let alone the limited discussion on the land impacts of dedicated energy crops. Also, the analysis of organic agriculture could also consider aspects such as: - The reduced input requirements (such as fertilizers and PPPs) and related emissions. - Organic products are often qualitatively different and can have higher nutritional value. There is evidence that some consumers who favour organic food trade quantity for quality, which can at least partially compensate for a lower yield.	Noted. Point 1: The suggestion regarding implications of reduced yields was forwarded to the authors of the subsection on agroforestry. Point 2: Due to a strict word limit, an overall synopsis of literature on mitigation potential can only be provided. Discussion on inputs is not possible, though is indirectly considered within LCAs and evaluating carbon/emission footprints. A note within the figure indicates that mitigation via reduced input production is not included. The nutritional value of organic food was deemed beyond the scope of this box (which assesses GHG mitigation only). As consumer preference for quality over quantity is not universal and the potential impact unclear, it is not specially discussed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
49943	93	14	93	23	The pivotal role of diets, and the increasing-lowering of GHG emissions of organic agriculture is also explored here: Theurl 10.1016/j.scitotenv.2020.139353	Noted – thank you. The suggested reference has been included.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
21507	93	19	93	19	We suggest to add after "... production": organic farming is increasing worldwide for its benefits on biodiversity, health, etc."	Noted. The suggested words have not been included, but reference to potential 'co-benefits' of organic production is now included.	Government of France	Ministère de la Transition écologique et solidaire	France
3903	93	24		38	Besides Regenerative Agriculture it would be necessary to include/name here other types of equally important integrated land management approaches as Climate-smart agriculture and Permaculture. These three approaches will be listed in the technical manual of SOC (soil organic carbon) management that will be issued by FAO during the first semester of 2021. Although they contain some phylosophical background, and are not applicable everywhere, some of the practices they promote have been proved beneficial for SOC storage.	Noted. Regrettably, due to a strict word limit, discussion on other approaches is not possible. However, the wording of the introduction has been changed to indicate that other approaches exist and that those discussed are only a selection.	Rosa M Poch	ITPS and UdL	Spain
21509	93	24	93	24	there is no obvious difference between IPS and AE, except may be that AE covers a wider range of practices than IPS. Similarly, OF is one specific kind of AE. At the very least, the authors should specify the definition of AE and how it differs from IPS and OF.	Noted. It is emphasised within the text that the approaches are not mutually exclusive and may share practices. It was deemed important and policy relevant to discuss these specific approaches, despite potential crossovers. Reference is now made to OF being a form of AE and the reasoning behind its separation. Unfortunately, a strict word limit does not allow definitions to be included within this box. However, definitions (including that of AE) have been added to the Glossary (Annex A)	Government of France	Ministère de la Transition écologique et solidaire	France
49945	93	24	93	24	a succinct definition of AE (and separation from organic farming, which can be part of AE) is required	Noted. Definitions are now provided in the Glossary (Annex A). The reasoning behind separation of organic farming from AE is now emphasised.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
21511	93	42	93	43	Sapkota et al. is quite possibly the best academic reference today on mitigation options and costs in Indian agriculture. However there might be 2 limits : a) exaggerated potential from "Laser Land levelling" of rice plots (a capital intensive technology which might also be redundant with already accounted potential from "Improved water management in rice"); b) agroecological pproaches/technologies such as natural farming are not referenced here (and elsewhere in the report) whereas natural farming (http://apzbnf.in) is now practised by 700,000 farmers in Andhra Pradesh (State of South India) since 2016 only, and has enormous potential, unfortunately not yet referenced by the scientific community	Noted. The authors thank the reviewer for pointing this out. While it is acknowledged that there may be limitations to the research, this informations box is intended to provide a brief synopsis of the study and not a critical assessment. Accordingly, these points were not included.	Government of France	Ministère de la Transition écologique et solidaire	France
56077	94	2	94	4	One of the main benefits of using modern biomass is that the feedstocks are generally renewable, versus the timescale of fossil fuels. It is essential to incorporate this element into this statement, as it is the basis for the perceived benefit of avoiding fossil fuels.	Accepted. The revised text states that renewable biomass may reduce net GHG emissions by displacing the use of coal, oil and natural gas in the production of heat, electricity, and fuels.	Government of United States of America	U.S. Department of State	United States of America
56079	94	3	94	3	Not sure what 'carriers' means here. Delete it.	Noted. "energy carrier" was deleted in the revision of this section	Government of United States of America	U.S. Department of State	United States of America
56081	94	11	94	12	This definition of biomass is inherently biased. Biomass used for energy is not only from waste stream materials or byproducts/by-flows from agriculture and forestry. It can include any form of biomass, including merchantable trees if markets for other products have low prices. Broaden the definition used here to provide a more balanced and useful definition.	Accepted. Text changed to "Bioenergy refers to energy products (solid, liquid and gaseous fuels, electricity, heat) derived from a range of biomass sources including organic waste, harvest residues and by-flows in the agriculture and forestry sectors, and biomass from tree plantations, agroforestry systems, lignocellulosic crops, and conventional food/feed crops."	Government of United States of America	U.S. Department of State	United States of America
56083	94	13	94	14	This text should be caveated -- that is, "... can, in some instances, reduce GHGs by replacing fossil fuels". This very cut and dry apporach to biomass is in stark contrast to the very balanced and measured presentation of biochar above that is very careful to highlight how its benefits largely depend on circumstances. This is the same for biomass, as seen throughout the literature. Take the same conscientious and accurate approach here with biomass.	Accepted. The text now reads "...may reduce net GHG emissions by displacing the use of coal, oil and natural gas with renewable biomass in the production of heat, electricity, and fuels" The Section has been revised to be more clear on the level of mitigation attainable.	Government of United States of America	U.S. Department of State	United States of America
1163	95	1	95	1	Somewhere in the material on bioenergy, there should be discussion of the methane emissions that are avoided if bioenergy is a substitute for disposal. If the mitigation benefits associated with methane reductions from WTE are not included in this chapter, they should be included in Chapter 6.	Accepted. We included the example of avoied emissions from raw manure management in Box 7.7	Reid Miner	Private Consultant	United States of America
46003	95	1	99	29	In order to provide a balanced assessment, the problems around the feedstock of the biomass used for BECCS (e.g. energy crops) should be placed more prominently in the beginning of chapter 7.4.4 to convey the potential problems associated with this approach.	Partially Accepted. The section follows a strict structure in order to be consistent with the rest of the chapter. However, early on it is stated that bioenergy is "associated with a range of co-benefits and adverse side-effects", with relevant citations. Due to strict word limits, listing and anlysing all co-benefits and adverse side-effects is unfortunately not possible. Section 12.5 and Section 17. 3.3 contains complementary information	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
48017	95	1	95	34	The framing of Bioenergy and BECCS in Box 7.9 underestimates its real potentialities as a mitigation strategy. Significant literature recognizes the importance of bioenergy to be a carbon sink when dedicated crops are used, with beneficial increase in SOC (Gelfand et al, 2020, Liu et al, 2020, Pavlenko, 2018; Gelfand et al 2020). Bioenergy from double cropping/sequential cropping (one additional crop produced in the same year) does not require additional land for its production, increases terrestrial carbon stocks and displaces the need to produce other products (feed) (Moreira 2020). Taking into account the literature presented below, the excerpt in lines 16-19 should be updated as follows: "Bioenergy systems can also provide carbon dioxide removal (CDR) when the biogenic CO2 emitted from bioenergy use is captured and deposited in geological storages (bioenergy with carbon capture and storage, BECCS), increasing terrestrial carbon pools (particularly increasing SOC and, in the case of perennial or cover crops, by additional carbon stored in vegetation). Additionally, when produced as a second crop, bioenergy co-product (i.e. DDG) can also reduce emissions without displacing food and other agricultural production." Complete references to this growing literature is presented below: Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Pavlenko, N., & Searle, S. (2018). A comparison of induced land use change emissions estimates from energy crops. International Council on Clean Transportation (ICCT): Washington, DC, USA. Gelfand, I., Hamilton, S. K., Kravchenko, A. N., Jackson, R. D., Thelen, K. D., & Robertson, G. P. (2020). Empirical evidence for the potential climate benefits of decarbonizing light vehicle transport in the US with bioenergy from purpose-grown biomass with and without BECCS. Environmental science & technology, 54(5), 2961-2974. Valencia et al. 2019. Techno-Economic Assessment of Bio-Energy with Carbon Capture and Storage Systems in a Typical Sugarcane Mill in Brazil. Energies. MDPI. doi:10.3390/en12061129 Langholtz et al. 2020. The Economic Accessibility of CO2 Sequestration through Bioenergy with Carbon Capture and Storage (BECCS) in the US. Land. MDPI. doi:10.3390/land9090299 Moreover, as mentioned in a previous comment, in the quantitative summation in this chapter (Table 7.4) only the CDR component of BECCS is considered. The substitution effects of bioenergy use in the energy sector are covered in the chapters covering Energy, Industry and Transport. The role of bioenergy substituting products in other sectors is missing. The role of Bioenergy enhancing carbon stocks is in SOC or increasing terrestrial biomass is also missing". These gaps should be carefully revisited by the authors in a reassessment of the mitigation potential of BECCS. Bioenergy	Partly accepted. Double cropping and the possible benefits of bioenergy systems increasing land carbon stocks are acknowledged in the revised text, but also risks that bioenergy deployment cause land carbon losses. We now clarify in the begining of the section that we here only consider mitigation via the CDR contribution from BECCS, and the possible LUC emissions associated with biomass supply. The text informs that sectoral emissions reduction from the substitution of fossil fuels is treated in the relevant sectoral Chapters. Section 12.3 includes information about the contribution from bioenergy and BECCS in mitigation pathways (both CDR and avoided GHG emissions due to substitution)	Marcelo moreira	UNICAMP - Agroicone	Brazil
50937	95	1	95	34	The framing of Bioenergy and BECCS in Box 7.9 underestimates its real potentialities as a mitigation strategy. Significant literature recognizes the importance of bioenergy to be a carbon sink when dedicated crops are used, with beneficial increase in SOC (Gelfand et al, 2020, Liu et al, 2020, Pavlenko, 2018; Gelfand et al 2020). Bioenergy from double cropping/sequential cropping (one additional crop produced in the same year) does not require additional land for its production, increases terrestrial carbon stocks and displaces the need to produce other products (feed) (Moreira 2020). Taking into account the literature presented below, the excerpt in lines 16-19 should be updated as follows: "Bioenergy systems can also provide carbon dioxide removal (CDR) when the biogenic CO2 emitted from bioenergy use is captured and deposited in geological storages (bioenergy with carbon capture and storage, BECCS), increasing terrestrial carbon pools (particularly increasing SOC and, in the case of perennial or cover crops, by additional carbon stored in vegetation). Additionally, when produced as a second crop, bioenergy co-product (i.e. DDG) can also reduce emissions without displacing food and other agricultural production." Complete references to this growing literature is presented below: Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Pavlenko, N., & Searle, S. (2018). A comparison of induced land use change emissions estimates from energy crops. International Council on Clean Transportation (ICCT): Washington, DC, USA. Gelfand, I., Hamilton, S. K., Kravchenko, A. N., Jackson, R. D., Thelen, K. D., & Robertson, G. P. (2020). Empirical evidence for the potential climate benefits of decarbonizing light vehicle transport in the US with bioenergy from purpose-grown biomass with and without BECCS. Environmental science & technology, 54(5), 2961-2974. Valencia et al. 2019. Techno-Economic Assessment of Bio-Energy with Carbon Capture and Storage Systems in a Typical Sugarcane Mill in Brazil. Energies. MDPI. doi:10.3390/en12061129 Langholtz et al. 2020. The Economic Accessibility of CO2 Sequestration through Bioenergy with Carbon Capture and Storage (BECCS) in the US. Land. MDPI. doi:10.3390/land9090299 Moreover, as mentioned in a previous comment, in the quantitative summation in this chapter (Table 7.4) only the CDR component of BECCS is considered. The substitution effects of bioenergy use in the energy sector are covered in the chapters covering Energy, Industry and Transport. The role of bioenergy substituting products in other sectors is missing. The role of Bioenergy enhancing carbon stocks is in SOC or increasing terrestrial biomass is also missing". These gaps should be carefully revisited by the authors in a reassessment of the mitigation potential of BECCS. Bioenergy	Duplicate comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
54349	95	1	100	29	This is a good assessment, yet it is not logical that it is placed in the AFOLU chapter. Especially BECCS seems to be a much better fit for e.g. chapter 12, energy or industry.	Noted. After careful consideration, the BECCS assessment has been kept in this section to enable comparison of this CDR option with other land-based CDR options covered in Ch7. However it is also covered in Chapter 12.	Sabine Fuss	MCC Berlin	Germany
61383	95	1	95	46	we may add some description about leakage risks of geologic CO2 storage.	Rejected. Potential CO2 leakage from geological reservoirs is out of scope for Ch7 and covered in Ch6	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
76915	95	1	100	29	Section 7.4.4 combines "Bioenergy and BECCS", but mostly focusses on BECCS and does not sufficiently differentiate between bioenergy with and without BECCS. Crucially, a discussion on the AFOLU impact of typial current bioenergy systems (biofuels, biogas, bioelectricity) is missing, although they are likely to remain dominant for many years to come.	Taken into account. The section consistently refers to "bioenergy and BECCS", and thus all of the text (unless specifically about BECCS mitigation potentials) covers bioenergy with and without BECCS. Section 12.5 is complementary to 7.4.4 and covers land related impacts, risks and opportunities associated with mitigation options	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81289	95	1	96	26	This presentation on bioenergy differs in some places from the SRCCL in terms of nuance, but without being clear whether this is because of assessment of new knowledge, or simply different (less careful?) wording. E.g. Page 4, line 4, the SRCCL made clear that this is not just uncertain but critically depends on local implementation - this is missing here. And Page 96, line 9, "It is indisputable" is rather stronger than the conclusion the SRCCL arrived yet - suggest more nuanced wording; or be clear that you disagree with and depart from the SRCCL. Also Page 95 lines 44/5, please cite SRCCL here given that this contained an extensive assessment.	Accepted. The text has been revised keeping the need for nuance in mind. The importance of local application, as well as the drivers of differences in assessments of bioenergy and BECCS potentials have been included.	Andy Reisinger	Ministry for the Environment	New Zealand

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
80663	95	2	95	8	Burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels. BECCS is further complicated by the fact that it is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways	Noted. Expressions such as "burning forest biomass for power generation" is vague (what part of forest biomass?) and therefore difficult to respond to. We stress that the potentials of bioenergy and BECCS in the cited literature includes the use of forest residues for energy but not large scale forest cutting solely for bioenergy use. Furthermore, we have explicitly presented bioenergy potentials, dissagregated between "purpose grown biomass" and "residues", in order to provide some indication of the potential which can be supplied without dedicated land use. Similarly, we have also assessed studies of the potential which may come from marginal land, with relatively lower risk for displacement of food production. The importance of land-use change emissions and counterfactual land use is stressed in Box 7.7. This comment refers to a selection out of a large number of studies and box 7.7 presents an overview of reasons why studies arrive at contrasting conclusions concerning the climate change mitigation value of bioenergy and BECCS, including differences in methodology approaches. Due to the very context specific nature of carbon sequestration and emissions (both size and timing) associated with bioenergy systems (aspects which affect this are included in the text), we have for box 7.7 opted to display the sequestration/emission trade-offs of bioenergy supply via "emission-supply cruves", which provides a basis for evaluating the bioenergy and BECCS supply in relation to alternative land use, in this case either to maintain surplus cropland in idle condition or to promote carbon sequestration via natural revegetation. Concerning Box 7.7, note that the modeling protocol used for the scenarios in the AR6 database accounts for the land-use change and all other GHG emissions along a given transformation trajectory, enabling assessments of the warming level incurred. The results labeled "EMF33" and "partial models with constant land cover" are obtained with modeling approaches compatible with this protocol. The results in the category "partial models with natural regrowth" attribute additional CO2 emissions to the bioenergy system, corresponding to estimated uptake of CO2 in a counterfactual scenario where land is not used for bioenergy but instead subject to natural vegetation regrowth. While such analysis provides insights into implications of alternative land-use strategies, it does not identify the actual emissions due to	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80807	95	2	95	8	Burning forest biomass for power generation emits more CO2 per unit of final energy than burning fossil fuels. BECCS is further complicated by the fact that it is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways	Duplicate comment	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
76921	95	5	95	6	"durably storing (part of) the biogenic carbon in geological, terrestrial, or ocean reservoirs": delete "terrestrial or ocean" or explain what terrestrial and ocen reservoirs are considered that are not already covered under "geological".	Rejected. terrestrial and ocean reservoirs are not part of geological reservoir, so need to include all three reservoirs where C storage can take place	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
9617	95	13	95	14	This statement is not generally correct and it is misleading. There are many examples of bioenergy options that bear GHG emissions as high or higher than fossil fuels, while there are also C negative bioenergy options, see Haberl 2013, GCBB, doi 10.1111/gcbb.12071, Kalt et al. 2020, Env Res Lett, doi 10.1088/1748-9326/ab6c2e. I propose to at least ad a disclaimer such as "under certain conditions". Also it should be noted that the origin of the C in biomass "from a cycle of CO2" is not sufficient to ensure C neutrality vis-a-vis the atmosphere because it ignores the fate of the C absorbed by the plant during photosynthesis that would ensue in case the plants were not harvested (Searchinger 2010, Env Res Lett). Hence I propose to fundamentally revise this sentence based on the current understanding of the C balances of biota and soils with or without human use.	Noted. Box 7.9 was deleted in the revision	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
21513	95	13	95	14	The sentence is questionable. There are plenty of examples of bioenergy production that increase GHG emissions compared to fossil references. (See, e.g., Valin, H., Peters, D., Berg, M. van den, Frank, S., Havlik, P., Forsell, N., Hamelinck, C., 2015. The land use change impact of biofuels consumed in the EU: Quantification of area and greenhouse gas impacts. Ecofys, IIASA and E4tech.)	Noted. Box 7.9 was deleted in the revision	Government of France	Ministère de la Transition écologique et solidaire	France
46005	95	13	95	14	Please enhance definition to meet the state of knowledge. Add [...] provided the cycle can be closed by regrowing biomass at the place of origin and over time scales suitable for effective and permanent provision of ecosystem services. Comment: It's an incomplete definition neglecting vast parts of the discussion on preconditions for this assumption, i.e. sustainability of biomass extraction. REFERENCES: Brack, D., 2017, Woody Biomass for Power and Heat-Impacts on the Global Climate; Brack, D. and King, R., 2020, Net Zero and Beyond-What Role for Bioenergy with Carbon Capture and Storage?; EASAC (2018), Statement on carbon neutrality	Noted. Box 7.9 was deleted in the revision	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
49947	95	13	95	14	This statement is potentially misleading. The C-cylce is more complex, and land-use impacts as well, timing is key here. Thus, the time-dimension must not be ignored and time-agnostic statements like this are not helpful. Reformulation required, e.g. that makes explicit that this is a principle statement, and more elaboration is required to avoid a reading "bioenergy is carbon neutral". See also Searchinger: 10.1126/science.1178797, Holtsmark 10.1111/gcbb.12015, Booth https://doi.org/10.1111/gcbb.12716 and many more	Noted. Box 7.9 was deleted in the revision	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
76927	95	13	95	14	"Because bioenergy originates from a cycle of CO2": do fossil fuels, which were removed by the same processes. Please strengthen the argument.	Noted. Box 7.9 was deleted in the revision	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
46007	95	16	95	18	Please adjust the definition to include the need for sustainability: Bioenergy from sustainably sourced biomass could provide carbon dioxide removal (CDR) where the biogenic CO2 emitted from bioenergy use can be captured and safely be deposited in geological storages with demonstrable long term storage capacity (bioenergy with carbon capture and storage, BECCS). Please amend the glossary accordingly.	Partly accepted. Box 7.9 was deleted in the revision but the revised text states that BECCS may provide CDR and that increased biomass demand for energy may complicate other mitigation measures such as reduced deforestation and degradation. We have not made judgments about geological storage since this is not specific to BECCS.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
76935	95	16	95	18	"Bioenergy systems can also provide carbon dioxide removal": It should be recognised that only the land component provides the removal (from the atmosphere).	Noted. Box 7.9 was deleted in the revision	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
9619	95	24	95	27	Very confusing statement, please revise for clarity	Noted. Box 7.9 was deleted in the revision	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
49949	95	24	94	27	the timing of the net-C-effekt is key. Hanssen et al 10.1038/s41558-020-0885-y show that short term effects are small, and the implications of massive BECCS are discussed in the SRCCL and also here: https://doi.org/10.1111/gcbb.12798	Noted. Box 7.9 was deleted in the revision	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
49951	95	29	95	34	This paragraph is unclear and overly complex for a simple statement.	Accepted. Box 7.9 was deleted in the revision. Some text in the para remains in the section, but revised and hopefully more clear now.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
71853	95	36	95	43	The chapter should also look at traditional heating with wood fuels (mainly charcoal for urban consumption) as there is important mitigation potential (eg Iiyama et al, 2014) and it will not be addressed in the energy chapters nor from a land perspective where this is causing severe forest degradation, primarily in Africa and parts of SE Asia. It is particularly important as the section on "biochar" unconditionally promotes charcoal production without reservation.	Noted. Charcoal is a specific type of bioenergy and due to word count limits we cannot dwell on it. The discussion in the capter concerning biomass supply, its potential and sensitivities also apply to charcoal.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
48019	95	38	95	38	It is not clear the meaning of "(though with clear limits on maximum volumes)". Please clarify.	Accepted. Text removed.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50939	95	38	95	38	It is not clear the meaning of "(though with clear limits on maximum volumes)". Please clarify.	Duplicate comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
48021	95	41	95	43	Why is the information restricted to heat in industry? It would be important to include the share of biofuels used in road transport as well. Data is available at the IEA database.	Accepted. Now present modern bioenergy as a % of total renewable primary energy supply	Marcelo moreira	UNICAMP - Agroicone	Brazil
50941	95	41	95	43	Why is the information restricted to heat in industry? It would be important to include the share of biofuels used in road transport as well. Data is available at the IEA database.	Duplicate comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
80331	95	41	95	43	Opening up possibilities about eventual biomass production with disposal of the grains, or even an equivalence of energy production through biomass and biofuels.	Unclear comment	JUAN DIAZ	Association	United States of America
80665	95	41	96	8	Even using forest residue for bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.").	Noted. This comment refers to a selection out of a large number of studies and box 7.7 presents an overview of reasons why studies arrive at contrasting conclusions concerning the climate change mitigation value of bioenergy and BECCS. Due to the very context specific nature of carbon sequestration and emissions (both size and timing) associated with bioenergy systems (aspects which affect this are included in the text), we have opted to display the sequestration/emission trade-offs of bioenergy supply via "emission-supply cruves", which provides a basis for evaluating the bioenergy and BECCS supply in relation to the alternative to promote carbon sequestration via natural revegetation. Furthermore, we have explicitly presented bioenergy potentials, dissagregated between "purpose grown biomass" and "residues", in order to provide some indication of the potential which can be supplied without dedicated land use. Similarly, we have also assessed studies of the potential which may come from marginal land, not used for food production.	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80809	95	41	96	8	Even using forest residue for bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.").	Duplicate comment	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
9621	95	44	95	45	I can't believe that there is only one relevant publication for this statement. For such a statement, it would be useful to cite a few selected current refs, judged by the writing team as being particularly solid and useful for readers who want to learn more; I guess the SRCCL would also qualify here	Accepted. Added extra literature reviewing the main controversies around biomass, bioenergy, and BECCS. The single citation provided in the SOD was to SRCCL so reflecting the previous assessment. Also added cross-ref to 12.5	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
50829	95	44	96	3	This text addresses one of the most politically sensitive issues on bioenergy, i.e. the amount that can be used sustainably. Box 7.10 explains the various factors that play a role. Nowhere however can policy makers find a clear explanation of how to address this issue. There is great need to provide such a clear set of recommendations. This chapter/ section is the place to include such a set of recommendations, for instance in the form of "safe" uses of bioenergy and "no-go" applications, plus a method to evaluate cases that are in-between. This point should also feature in the SPM.	Noted. We added text about options that are associated with synergies an having lower risk to cause adverse side-effects. We refer to Section 12.5 that covers land related impacts, risks and opportunities associated with bioenergy and other mitigation options. This sections also covers mitigation approaches that provide co-benefits. But it remains that general recommendation on "safe uses" and "no-no" is difficult to provide since the attractiveness of mitigation options depends on preferences and priorities concerning different sustainability criteria. This is not unique for bioenergy.	Bert Metz	European Climate Foundation	Netherlands
63719	95	44	96	16	A summary of the discourse surrounding biomass carbon neutrality may be valuable here, see Booth, M.S. 2018. Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy. Environmental Research Letters. https://doi.org/10.1088/1748-9326/aaac88 and Reid et al. 2019. The future of bioenergy. Global Change Biology. https://doi.org/10.1111/gcb.14883.	Noted. Box 7.7 gives a compact summary of the issues surrounding carbon balances and why studies arrive at contrasting conclusions, including differences in methodology approaches. Space constraints prevent comprehensive coverage of this issue, but cited literature provides more information. Box 7.7 Figure 1 provides a graphical relationship between biomass supply and the GHG impacts of that supply, thus accounting for the large range in GHG impacts across multiple supply sources. The literature cited in the comment applies one specific methodology approach to study pecific supply chains, thus not providing an appropriate overview of the overall GHG profile of biomass and bioenergy systems.	Government of Canada	Environment and Climate Change Canada	Canada
9623	95	45	96	8	Very convoluted text. While I agree with what is being said (as far as I could disentangle the various levels of caveats, which are all very relevant), this sentence needs to be broken down in 3-4 clear and succinct sentences to be readable. Perhaps one important point that should come out more clearly, and is currently only indirectly alluded to, is that the GHG emissions of sourcing bioenergy rise with the amount of bioenergy to be produced, as shown by Kalt et al. (2020, cited here). In my view this is a very policy-relevant insight that should formulated more clearly than is the case here	Accepted. Text has been reworked and we hope it is easier to follow. We also refer to Box 7.7 Figure 1. We did not add a statement that "GHG emissions of sourcing bioenergy rise with the amount of bioenergy to be produced": depending on character and location of deployment, GHG emissions can as well be high at low level of deployment (e.g., tropical deforestation making room for energy crops) and decrease as deployment increases (e.g., if tropical forest protection is increasingly effective and biomass supply capacity is increasingly built up via A/R, agroforestry and ligno crops moving in where food/feed crop cultivation ceases in a scenario with improved land productivity and diet shifts towards more plant-based food).	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
76939	96	4	96	8	The factors listed shoudl include the rebound effect, rate of substitution, energy penalty, best use of CCS storage.	Noted. This text has been reworked, and the term "future energy systems" has been added which covers these elements	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
50003	96	6	96	6	"very" needs to be substantiated	Noted. Text has been completely reworked.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
8499	96	7	97	30	use ; not comma here	Notes. The text with this mistake has been completely reworked	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73681	96	7			The work 'Robledo-Abad et al. 2017' cannot be found in the References.	Amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73683	96	7	96	8	The work 'Calvin et al' is under submission.	Amended. Paper has since been published and reference updated .	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
1165	96	8	96	8	An additional sentence is needed highlighting a key aspect not covered in the other sentences, i.e., timing. I suggest the following: "The estimation of benefits is also complicated by the fact that these benefits can vary dramatically depending on the time horizon of interest" - references follow Helin T, Sokka L, Soimakallio S, et al.2013. Approaches for inclusion of forest carbon in life cycle assessment – a review. GCB Bioenergy 5: 475–86. Marland G, Buchholz T, and Kowalczyk T. 2013. Accounting for carbon dioxide emissions. J Ind Ecol 17: 340–42. Buchholz T, Prisley S, Marland G, et al.2014. Uncertainty in projecting GHG emissions from bioenergy. Nat Climate Change 4: 1045–47.	Accepted. Added "timing" as one of the aspects as this is also included in some of the cited references.	Reid Miner	Private Consultant	United States of America
21515	96	9	96	9	It is possible, however, to systematically compare the GHG mitigation efficiency of bioenergy with other land uses, by separating supply from demand effects. In such a setting, dedicated bioenergy systematically increases overall GHG emissions compared to food crops, mostly because of indirect land use change based emissions (Searchinger et al., 2018). https://www.nature.com/articles/s41586-018-0757-z	Noted. Unclear how this comment relates to the specific text. However the potential negative GHG effects from LUC (including iLUC) is included in Box 7.7.	Government of France	Ministère de la Transition écologique et solidaire	France
46009	96	9	96	12	It can be hard for the reader to assess what "very large increases" of BECCS deployment signifies. This could be translated into more tangible language. It does not get clear, where a "large increase" of deployment ends and a "very large increase" starts. If it cannot be quantified, we suggest to just refer to this with "large increases", as "very large" might be interpreted as very unlikely to lead to adverse side-effects.	Accepted. Text completely reworked and vague term avoided.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
48023	96	9	96	13	The language is simply too strong and devoid of any conditionality here, which is in contradiction with many other sections and paragraphs in the same report, which call attention to the fact that impacts are context specific and can be mitigated or even reversed in appropriate contexts and using appropriate practices. The text should be therefore changed to read: It is indisputable that very large increases in the use of bioenergy and BECCS, as projected in many climate change mitigation scenarios originating from integrated assessment models, when developed in absence of proper management and in inappropriate contexts and regions, will put significant stresses on land use and ecosystems, and is subject to a range of sustainability concerns including competition for scarce land and freshwater, availability of phosphorous resources, land use change, and diminishing capacity of ecosystems to support biodiversity and essential ecosystem services.	Accepted. Text completely reworked.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50943	96	9	96	13	The language is simply too strong and devoid of any conditionality here, which is in contradiction with many other sections and paragraphs in the same report, which call attention to the fact that impacts are context specific and can be mitigated or even reversed in appropriate contexts and using appropriate practices. For an example of more balanced language, see SPM-30, p. D 3.3: "At very high deployment, bioenergy with CCS (BECCS) could lead to adverse side effects (medium confidence). Trade-offs can be addressed by complementary policies and investments or with the design of integrated cross sectoral policies (medium confidence)" The refereneced text in p. 96 should therefore be changed to read: "Very large increases in the use of bioenergy and BECCS, as projected in many climate change mitigation scenarios originating from integrated assessment models, when developed in absence of proper management and in inappropriate contexts and regions, could put significant stresses on land use and ecosystems, and is subject to a range of sustainability concerns including competition for scarce land and freshwater, availability of phosphorous resources, land use change, and diminishing capacity of ecosystems to support biodiversity and essential ecosystem services."	Duplicate comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
71855	96	9	96	26	also make reference to the BIOECONOMY cross-WG box and options for stronger integration with nature such as agroecology	Partially Accepted. Text has been completely reworked. A cross-reference to the Bioeconomy cross-WG box has been added at the appropriate point.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
79097	96	9	96	16	Air pollution (particularly PM and climate forcers) is another key concern (identified in the SPM), especially in light of framing of the transition away fossil fuels as a transition to cleaner energy systems. Furthemore, when biomass is extracted from forests or when it results in conversion of natural forest to plantation forest, it may be associated with carbon losses (including SOC) that is not re-absorbed or at the very least, not fully accounted for when effects of fuel substitution are calculated. It may also lead to nutrient deficits that reduce future productivity (e.g., de Oliviera Garcia et al., 2018, in Scientific Reports: https://www.nature.com/articles/s41598-018-22728-5)	Noted. Specific types of LUC lead to specific problems, as those mentioned by the reviewer. Unfortunately we do not have the space to cover all of these, however the text does indicate that when biomass productions happens as a result of land cover change, the original land cover type is very important in order to understand the effects.	Edith Juno	National Wildlife Federation	United States of America
83243	96	10	96	10	I suggest to change "will" into "would" since there's no indication that it is ever going to happen at the scales assumed in IAMs. We will see bottom-up deployment of BECCS facilities, starting in countries with credible net zero targets like the UK and Sweden (which doesn't mean that individual projects necessarily pass every 'environmental integrity' test), and then actors around the world will move on from that, based on actual experience. See also Chapter 12.7, Fridahl/Lehtveer 2019 (https://www.sciencedirect.com/science/article/pii/S2214629618302998) and Bellamy/Geden 2019 (https://www.nature.com/articles/s41561-019-0475-7)	Noted. Text completely re-worked.	Geden Oliver	German Institute for International and Security Affairs	Germany
71857	96	11	96	13	also mention food security explicitly (even if it's implicit in competition for land and water)	Partially accepted. Text has been completely re-worked, but explicit mention of the interaction with "food systems" has been added.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
3905	96	17		26	See my observation on page 100	Noted. The text commented upon was deleted in the revision	Rosa M Poch	ITPS and UdL	Spain
48025	96	17	96	26	Double-cropping (or sequential cropping) has been suggested as a way to conciliate energy and food security goals (Langeveld et al, 2014) and is emerging as important solution for agricultural sectors, as well as for bioenergy systems (Moreira et al 2020). The contribution of bioenergy coproducts as feed is another important factor that has been widely documented since 2010 (Taheripour et al, 2010). The combination of double cropping and production of DDG has also been documented (Moreira et al 2020) and is an important contribution to synergistic effects between biofuels and the food system. Dedicated crops to bioenergy (such as energy cane) is also an important solution (Grassi & Pereira, 2019; Liu et al, 2020). Therefore, this text should be updated as follows: "At the same time, literature (further described below) has also highlighted how the agriculture and forestry sectors can devise management approaches that enable biomass production and use for energy in conjunction with supply of food, construction timber, and other biobased products, reducing the conversion pressure on natural ecosystems. Principal means include sustainable intensification of existing arable cropping systems to produce significantly more biomass, double cropping, improvements in livestock productivity, forest management to increase wood production, changes to industrial processes to improve biomass conversion efficiencies and the use of residues and waste to produce fuels, electricity and heat. Changes in food consumption patterns towards less land demanding food can also help reduce the pressure on land resources (Taheripour et al. 2010; Langeveld et al, 2014; van Vuuren et al. 2018; Parodi et al. 2018; Springmann et al. 2018; Rosenzweig et al. 2020; Clark et al. 2020; Grassi & Pereira, 2019; Liu et al, 2020; Moreira et al. 2020) (Section 7.4 and Chapter 12 Section 12.4)." Complete reference to the aforementioned literature is presented below: Taheripour et al. (2010) "Biofuels and their By-Products: Global Economic and Environmental Implications," Biomass and Bioenergy, 2010, 34(3): 278-289. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Langeveld, J. W., Dixon, J., van Keulen, H., & Quist-Wessel, P. F. (2014). Analyzing the effect of biofuel expansion on land use in major producing countries: evidence of increased multiple cropping. Biofuels, Bioproducts and Biorefining, 8(1), 49-58. Grassi, M. C. B., & Pereira, G. A. G. (2019). Energy-cane and RenovaBio: Brazilian vectors to boost the development of Biofuels. Industrial crops and products, 129, 201-205. Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Melissa J. Scully et al 2021 Environ. Res. Lett. in press https://doi.org/10.1088/1748-9326/abde08	Noted. At relevant points we have made references to the potential of double cropping, and cited literature that higlights how the forestry sector can benefit from biomass provision. The topics are also further covered in 12.5, which we cross-reference in this section.	Marcelo moreira	UNICAMP - Agroicone	Brazil

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
50945	96	17	96	26	Double-cropping (or sequential cropping) has been suggested as a way to conciliate energy and food security goals (Langeveld et al, 2014) and is emerging as important solution for agricultural sectors, as well as for bioenergy systems (Moreira et al 2020). The contribution of bioenergy coproducts as feed is another important factor that has been widely documented since 2010 (Taheripour et al, 2010). The combination of double cropping and production of DDG has also been documented (Moreira et al 2020) and is an important contribution to synergistic effects between biofuels and the food system. Dedicated crops to bioenergy (such as energy cane) is also an important solution (Grassi & Pereira, 2019; Liu et al, 2020). Therefore, this text should be updated as follows: "At the same time, literature (further described below) has also highlighted how the agriculture and forestry sectors can devise management approaches that enable biomass production and use for energy in conjunction with supply of food, construction timber, and other biobased products, reducing the conversion pressure on natural ecosystems. Principal means include sustainable intensification of existing arable cropping systems to produce significantly more biomass, double cropping, improvements in livestock productivity, forest management to increase wood production, changes to industrial processes to improve biomass conversion efficiencies and the use of residues and waste to produce fuels, electricity and heat. Changes in food consumption patterns towards less land demanding food can also help reduce the pressure on land resources (Taheripour et al. 2010; Langeveld et al, 2014; van Vuuren et al. 2018; Parodi et al. 2018; Springmann et al. 2018; Rosenzweig et al. 2020; Clark et al. 2020; Grassi & Pereira, 2019; Liu et al, 2020; Moreira et al. 2020) (Section 7.4 and Chapter 12 Section 12.4)." Complete reference to the aforementioned literature is presented below: Taheripour et al. (2010) "Biofuels and their By-Products: Global Economic and Environmental Implications," Biomass and Bioenergy, 2010, 34(3): 278-289. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Langeveld, J. W., Dixon, J., van Keulen, H., & Quist-Wessel, P. F. (2014). Analyzing the effect of biofuel expansion on land use in major producing countries: evidence of increased multiple cropping. Biofuels, Bioproducts and Biorefining, 8(1), 49-58. Grassi, M. C. B., & Pereira, G. A. G. (2019). Energy-cane and RenovaBio: Brazilian vectors to boost the development of Biofuels. Industrial crops and products, 129, 201-205. Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Melissa J. Scully et al 2021 Environ. Res. Lett. in press https://doi.org/10.1088/1748-9326/abde08	Duplicate comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
1167	96	22	96	22	insert "sustainable" before "forest management"	Noted. Text has been completely reworked.	Reid Miner	Private Consultant	United States of America
48027	96	35	96	37	The sentence in lines 35-37 does not mention the contribution of biofuels in the non-energy or land use sector (e.g. production of DDG that substitutes feed production). It should be updated as follows: " […] It also excludes emissions associated with land use practices, e.g., nitrogen fertilizer use, benefits from bioenergy coproducts, and effects of biomass production systems on land carbon. […]" As mentioned in other comments, below we present additional references on the subject: Taheripour et al. (2010) "Biofuels and their By-Products: Global Economic and Environmental Implications," Biomass and Bioenergy, 2010, 34(3): 278-289. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216.	Noted. Text has been completely reworked.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50947	96	35	96	37	The sentence in lines 35-37 does not mention the contribution of biofuels in the non-energy or land use sector (e.g. production of DDG that substitutes feed production). It should be updated as follows: " […] It also excludes emissions associated with land use practices, e.g., nitrogen fertilizer use, benefits from bioenergy coproducts, and effects of biomass production systems on land carbon. […]" As mentioned in other comments, below we present additional references on the subject: Taheripour et al. (2010) "Biofuels and their By-Products: Global Economic and Environmental Implications," Biomass and Bioenergy, 2010, 34(3): 278-289. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216.	Duplicate comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
71859	96	37	96	38	The SRCCL was very critical of BECCS and large-scale bioenergy due to the many externalities. This needs to be made clearer.	Noted. Due to limited wordcount it is not possible to treat all externalities comprehensively. The SRCCL was critical to large scale and indeed referred to adverse side-effect. But it did also refer to possible co-benefit and stressed that outcome depends on many factors that can vary geographically and over time. Here, the revised text now says. "The SR1.5 and SRCCL highlighted that bioenergy and BECCS can be associated with multiple co-benefits and adverse side-effects that are context specific."	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21517	96	39	96	39	Among the recent developments regarding the bioenergy sector, we have now a much clearer view on global trade of biomass for energy. Proskurina, S., Junginger, M., Heinimö, J., Tekinel, B., Vakkilainen, E., 2019. Global biomass trade for energy— Part 2: Production and trade streams of wood pellets, liquid biofuels, charcoal, industrial roundwood and emerging energy biomass. Biofuels Bioprod. Biorefining 13, 371–387. https://doi.org/10.1002/bbb.1858	Noted. We have made reference to the importance of trade (and leakage of environmental damages) in the closing paragraph.	Government of France	Ministère de la Transition écologique et solidaire	France
73685	96	46			Please distinguish which work it is among the ones conducted by Smith et al. in 2020.	Amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
81291	96	46	96	47	Any additional mitigation option being built into IAMs will likely reduce reliance on BECCS, it's a simple economic trade-off. Enhanced agriculture mitigation through novel technologies or more rapid changes in demand would also have this effect. I suggest the statement is broadened to recognise this.	Noted. The text has been re-worked to show that the incorporation of multiple mitigation options has contributed to the reduced reliance on bioenergy and BECCS.	Andy Reisinger	Ministry for the Environment	New Zealand
48029	97	11	97	15	This paragraph would benefit from references to double cropping, dedicated crops and cover crops as additional strategies for the integration of bioenergy and agricultural systems, as described in relevant literature: Taheripour et al. (2010) "Biofuels and their By-Products: Global Economic and Environmental Implications," Biomass and Bioenergy, 2010, 34(3): 278-289. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Langeveld, J. W., Dixon, J., van Keulen, H., & Quist-Wessel, P. F. (2014). Analyzing the effect of biofuel expansion on land use in major producing countries: evidence of increased multiple cropping. Biofuels, Bioproducts and Biorefining, 8(1), 49-58. Grassi, M. C. B., & Pereira, G. A. G. (2019). Energy-cane and RenovaBio: Brazilian vectors to boost the development of Biofuels. Industrial crops and products, 129, 201-205. Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014.	Noted. At relevant points we have made references to the potential of double cropping, and cited literature that higlights how the forestry sector can benefit from biomass provision. The topics are also fucther covered in the cross-working group bioeconomy box.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50949	97	11	97	15	This paragraph would benefit from references to double cropping, dedicated crops and cover crops as additional strategies for the integration of bioenergy and agricultural systems, as described in relevant literature: Taheripour et al. (2010) "Biofuels and their By-Products: Global Economic and Environmental Implications," Biomass and Bioenergy, 2010, 34(3): 278-289. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Langeveld, J. W., Dixon, J., van Keulen, H., & Quist-Wessel, P. F. (2014). Analyzing the effect of biofuel expansion on land use in major producing countries: evidence of increased multiple cropping. Biofuels, Bioproducts and Biorefining, 8(1), 49-58. Grassi, M. C. B., & Pereira, G. A. G. (2019). Energy-cane and RenovaBio: Brazilian vectors to boost the development of Biofuels. Industrial crops and products, 129, 201-205. Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014.	Duplicate comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
48031	97	20	97	33	Regarding the varying conditions of deployment of bioenergy in terms of geographic location and prior land use, this excerpt would benefit from a careful assessment of the following paper, which addresses global bioenergy potential on abandoned cropland: Næss, Jan & Cavalett, Otavio & Cherubini, Francesco. (2021). The land–energy–water nexus of global bioenergy potentials from abandoned cropland. Nature Sustainability. 10.1038/s41893-020-00680-5: "We identified 83 million hectares of abandoned cropland between 1992 and 2015, corresponding to 5% of today's cropland area. Bioenergy potentials are 6–39 exajoules per year (11–68% of today's bioenergy demand), depending on multiple local and management factors. About 20 exajoules per year can be achieved by increasing today's global cropland area and water use by 3% and 8%, respectively, and without production inside biodiversity hotspots or irrigation in water-scarce areas. The consideration of context-specific practices and multiple environmental dimensions can mitigate trade-offs of bioenergy deployment."	Accepted. The text has been completely reworked, and the reference has been included.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50951	97	20	97	33	Regarding the varying conditions of deployment of bioenergy in terms of geographic location and prior land use, this excerpt would benefit from a careful assessment of the following paper, which addresses global bioenergy potential on abandoned cropland: Næss, Jan & Cavalett, Otavio & Cherubini, Francesco. (2021). The land–energy–water nexus of global bioenergy potentials from abandoned cropland. Nature Sustainability. 10.1038/s41893-020-00680-5: "We identified 83 million hectares of abandoned cropland between 1992 and 2015, corresponding to 5% of today's cropland area. Bioenergy potentials are 6–39 exajoules per year (11–68% of today's bioenergy demand), depending on multiple local and management factors. About 20 exajoules per year can be achieved by increasing today's global cropland area and water use by 3% and 8%, respectively, and without production inside biodiversity hotspots or irrigation in water-scarce areas. The consideration of context-specific practices and multiple environmental dimensions can mitigate trade-offs of bioenergy deployment."	Duplicate comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
9625	97	23	97	33	This discussion of "marginal land" is biased and incomplete. Empirical studies of allegedly marginal land have often found that the land assumed to be "marginal and degraded" was in fact inhabited by people, often people living in subsistence societies, and that the use of that land for energy crop plantations could result in severe sustainability concerns in terms of rural livelihoods. In some cases, it was even shown that the introduction of industrial, cash-crop oriented biofuel crops would actually reduce bioenergy production of the land, as people currently living there produce their own bioenergy on that land (e.g., Baka, 2014. Geoforum 54, 315–323. https://doi.org/10.1016/j.geoforum.2013.08.007, Baka, J., 2013. Development and Change 44, 409–428. https://doi.org/10.1111/dech.12018, Baka, J., Bailis, R., 2014. Ecological Economics 108, 8–17. https://doi.org/10.1016/j.ecolecon.2014.09.022 - more sources can certainly be found in the literature, and it is in the responsibility of the writing team to collect and assess this literature). The oppposite is also true in some cases, e.g. Harper et al, 2012. Agriculture, Ecosystems & Environment 163, 3–13. https://doi.org/10.1016/j.agee.2012.03.013, Harper, et al 2013. GCB Bioenergy https://doi.org/10.1111/gcbb.12090, Harper, et al. 2009. Energy & Fuels 24, 225–231. This para needs to reflect this variety of situations to be able to send a balanced message.	Noted. The SOD text referred to in this review comment states that "the use of marginal and degraded lands, as well as the use of integrated production systems, which can reduce land use pressure associated with bioenergy expansion, help restore the productive and adaptive capacity, and increase the ecological and market value of these lands". We do not see why approaches to achieve these objectives would per definition fail to address the concerns expressed in this review comment. Further, following citation of the SRCCL and presentation of results from recent regional assessments not included in the SRCCL (EU, China, Canada, and USA) the text stresses that "estimates are very sensitive to sustainability criteria, land class definitions, land mapping methods, and environmental and economic considerations of marginal land and other environmental and technical constraints." Nevertheless, we added text in the revision of the SOD saying "The definition marginal/abandoned/degraded land, and the methods used to assess such lands remain vague and inconsistent across studies (Jiang et al. 2019), causing large variation amongst them (Jiang et al. 2021). Furthermore, the availability of such lands has been contested since they may serve other functions (subsistence, biodiversity protection, etc.) (Baka, 2014).	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
49953	97	23	97	33	This discussion of "marginal land" ignores the many studies that show that marginal land or "marginal and degraded" land etc, was in most cases inhabited by people in subsistence, often in transumant societies. This is also the vein of the SRCCL and much info is available that needs to be incluced here (e.g., https://doi.org/10.1016/j.geoforum.2013.08.007, https://doi.org/10.1016/j.ecolecon.2014.09.022, including the seminal Young et al., 1999 "Is there really spare land? A critique of estimates of available cultivable land in developing countries" paper. Revision towards a balanced message is required. See also the land-grabbing discourse, which is relevant here.	Noted. The SOD text referred to in this review comment states that "the use of marginal and degraded lands, as well as the use of integrated production systems, which can reduce land use pressure associated with bioenergy expansion, help restore the productive and adaptive capacity, and increase the ecological and market value of these lands". We do not see why approaches to achieve these objectives would per definition fail to address the concerns expressed in this review comment. Further, following citation of the SRCCL and presentation of results from recent regional assessments not included in the SRCCL (EU, China, Canada, and USA) the text stresses that "estimates are very sensitive to sustainability criteria, land class definitions, land mapping methods, and environmental and economic considerations of marginal land and other environmental and technical constraints." Nevertheless, we added text in the revision of the SOD saying "The definition marginal/abandoned/degraded land, and the methods used to assess such lands remain vague and inconsistent across studies (Jiang et al. 2019), causing large variation amongst them (Jiang et al. 2021). Furthermore, the availability of such lands has been contested since they may serve other functions (subsistence, biodiversity protection, etc.) (Baka, 2014).	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
61347	97	23	97	23	The terms degraded and marginal land have been badly misused in some of the bioenergy literature, and are typical poorly defined. Land that is marginal from a cropping perspective, may be hugely important from a biodiversity perspective. There has typically been an over estimation of the availability of this land globally.	Accepted. Added text in the revision of the SOD saying "The definition marginal/abandoned/degraded land, and the methods used to assess such lands remain vague and inconsistent across studies (Jiang et al. 2019), causing large variation amongst them (Jiang et al. 2021). Furthermore, the availability of such lands has been contested since they may serve other functions (subsistence, biodiversity protection, etc.) (Baka, 2014).	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
63061	97	27	97	30	It is not accurate to say there is up to '185 Mha' of degraded or abandoned land in China. The original meaning of lines 39-40 in Zhang et al 2020 is that 'GIS land use mapping shows that 185 million hectares of marginal land have not been used for developing food products, which can be used for developing energy crops technically'. It is suggested to delete "185 Mha in China"	Noted. We did not delete the reference to this regional study but we have included text saying "The definition marginal/abandoned/degraded land, and the methods used to assess such lands remain vague and inconsistent across studies (Jiang et al. 2019), causing large variation amongst them (Jiang et al. 2021). Furthermore, the availability of such lands has been contested since they may serve other functions (subsistence, biodiversity protection, etc.) (Baka, 2014)."	Changke WANG	National Climate Center, China Meteorological Administration	China
21519	97	30	97	33	Estimates of biomass supply potentials on marginal and degraded lands may also be sensitive to accessibility constraints (See: Pirker et al., 2016. What are the limits to oil palm expansion? Global Environmental Changes)	Accepted. Added text in the revision of the SOD saying "The definition marginal/abandoned/degraded land, and the methods used to assess such lands remain vague and inconsistent across studies (Jiang et al. 2019), causing large variation amongst them (Jiang et al. 2021). Furthermore, the availability of such lands has been contested since they may serve other functions (subsistence, biodiversity protection, etc.) (Baka, 2014).	Government of France	Ministère de la Transition écologique et solidaire	France
9627	97	34	97	41	A technical energy crop potential of 245 EJ/yr as cited here is far above any plausible range. This is about the same amount of biomass as humanity harvests today for all purposes (food, fibre, energy), see Haberl (2015. Ecological Economics https://doi.org/10.1016/j.ecolecon.2014.10.002). Raising energy crop cultivation to that extent would have massive repercussions on global land systems. For example, the cited study by Kalt et al 2020 shows that GHG emissions rise sharply when aiming to raise bioenergy production over certain limits (that are in this study found te be around +/- 100 EJ/yr, depending on food system trajectories. Another study by Kalt et al. (2019, GCBB, doi:10.1111/gcbb.12626) shows that on a substantial fraction of the land that could be devoted to energy crops, natural climate solutions (C absorption by growing plants) would offer higher climate benefits than bioenergy. If the writing team believes that high numbers such as 250 EJ/yr should really be cited as the upper range of the technical potential, a lot more robust justification needs to be given, and it needs to be explained under what framework conditions in the rest of the land system (in particular, food systems) this could be realised. The recent study by Hanssen et al. (2020. Nature Climate Change, https://www.nature.com/artic les/s4155 8-020-0885-y) shows explicitly the drastic changes in global land systems that would be required to leverage such high potentials, with desastrous consequences for many other sustainability concerns (Creutzig et al., 2021, GCBB, doi 10.1111/gcbb.12798)	Noted. We are aware of the literature on this topic and we note that estimates of the future (2050) technical potential vary considerably due to possible variation of important determining factors, e.g., future food demand, future crop yield levels, productivity in animal food production, climate change, and how societies understand and prioritize nature conservation and soil/water/biodiversity protection + how land use is governed because of this. 245 EJ/yr is the higher end in the range 46-245 EJ/yr where the lower end can similarly be questioned. Further, section 7.4.4 explains that bioenergy and BECCS can be associated with a range of co-benefits and adverse side-effects, and that it is not possible to precisely determine the scale of bioenergy and BECCS deployment at which negative impacts outweigh benefits. Concerning the studies by Kalt referred to in the comment, see Box 7.7, Figure 1.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
71861	97	34	97	41	The chapter frequently makes reference to the large tradeoffs with other demands for land under 'very large' biomass mitigation and then suggests that it only requires better management to avoid these tradeoffs. So where do 400-500 million ha extra for biomass fit in that perspective?	Accepted. Text has been reworked to avoid this issue.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
3907	97	35		36	Remove brackets	Accepted. Text has been reworked to avoid this issue.	Rosa M Poch	ITPS and UdL	Spain
49955	97	38	97	38	The upper range is way to high for sustainable potentials - in particular, if repercussions with forest areas (and thus, large carbon stocks) are to be avoided. kalt et al conclude, based on a broad review and systemic integration of data based on first principles, that the the mediumrange of literature estimates (~40 to 90 EJ/yr) is only compatible with FAO yield and human diet projections if energy plantations expand into grazing areas (~4–5million km2) and grazing land is intensified globally. Now, such a grazing land intensification is not easily achieved and will be associated with massive sustainability challenges, given the already today high level of degradation. Furthermore, a key point for the entire chapter. I think it is a valid claim by Norton et al from the EASAC (10.1111/gcbb.12643) that all potentials that are assessed are also distinguishing short- and long-term effects. This is here particularly important due to the rapid-out-slow-in mechanism in ecosystems. In the shorter term, which definitely is important in our context, the potentials are much lower (see for instance, Hanssen 10.1038/s41558-020-0885-y).	Noted. We are aware of the literature on this topic and we note that estimates of the future (2050) technical potential vary considerably due to possible variation of important determining factors, e.g., future food demand, future crop yield levels, productivity in animal food production, climate change, and how societies understand and prioritize nature conservation and soil/water/biodiversity protection + how land use is governed because of this. 245 EJ/yr is the higher end in the range 46-245 EJ/yr where the lower end can similarly be questioned. Further, section 7.4.4 explains that bioenergy and BECCS can be associated with a range of co-benefits and adverse side-effects, and that it is not possible to precisely determine the scale of bioenergy and BECCS deployment at which negative impacts outweigh benefits. Concerning the studies by Kalt referred to in the comment, see Box 7.7, Figure 1.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria

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76941	97	38	97	38	What is the meaning of the 70EJ technical potential today? How much lignocellulosic crops is actually produced today, and where would be the rest deployed?	Noted. This text was changed in the revision, but just to explain: technical potentials are based on estimates of the extent of technically available land that could support cultivation of dedicated lignocellulosic crops. This is expressed in energy terms (primary biomass) through combining area with yield levels. These yield levels are derived from literature reporting yield levels in commercial cultivation, field trails, crop modelling.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76943	97	38	97	38	The high end of the potentials and area ranges (245EJ/yr on 500Mha) suggest the production of 25 tons dry matter/ha/hy on average, if the energy contents applies to in situ biomass. Yileds must be much higher if the energy is calculated downstream. Is that realistic on such a large area?	Noted. It is primary biomass. See also the answer to your other question on this sentence	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76945	97	38	97	38	The energy crop potentials are given in energy unit. Please clarify whether they represent the energy contents of the crop in situ (HHV or LHV) or the energy delivered by the bioenergy system.	Noted. Most potentials are given in HHV.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
3909	97	39			Remove brackets	Accepted. Text completely reworked.	Rosa M Poch	ITPS and UdL	Spain
73687	97	39			The work 'Hansen et al. 2019' cannot be found in the References.	Accepted. Reference is supposed to be "Hanssen et al. 2019".	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21521	97	43	97	43	Trade-related emissions should also be mentionned in Box 7.10, as an increasing share of biomass is now globally sourced (Proskurina et al., 2018).	Accepted. Ammended text to note that emissions also arise from the supply chain.	Government of France	Ministère de la Transition écologique et solidaire	France
48033	97	43	99	14	In Box 7.10, the discussion about calculating climate change mitigation values of bioenergy and BECCS correctly point out the wildly contrasting conclusions based on different assumptions and methodologies, but then goes on to give more weight and relevance in the text and in Figure 1 to some of the more extreme and biased methodologies, particularly the so-called “partial models” that incorporate unrealistic and uneconomical “foregone sequestration” assumptions about counterfactual “natural regrowth”. No literature at all is cited to support the numbers in the “partial models” curves (supposedly they come from a single paper, Daioglou et. al 2020?). This highlights an unproven, recent methodology with disputed assumptions while discarding a host of recent developments and precision building in LCA and ILUC literature, that has benefited from more precise modeling of national and regional level conditions. It is concerning because emissions at this level is extremely rare in specialized LCA literature, which has been omitted from the review and from the figure (we present some literature below, but strongly recommend to increase the list and invite specialized scientists). We specially missed publications from Wallace Tyner (lead bioenergy scientist from Purdue University) who has contributed for decades in this topic (including by developing values currently used in the LCFS and CORSIA) and not a single citation found in chapter 7 or 10 (please see Melissa et al 2021 for a non-comprehensive list of Tyner's work). Here we provide a short list of available literature, but we strongly recommend authors of chapter 7 to contact experts on the field, including the authors of the below mentioned literature. Figure 1 in Box 7.10 should be completely redrawn, with no emphasis placed on “partial models” based on “natural regrowth” counterfactuals due to low agreement in the methodology used. Further to that, the figure should be also revised to include the mitigation value curves including the CDR effects of BECCS and soil organic carbon sequestration. The is currently a note to the Figure explaining that those effects were not included. There is not reason why they shouldn’t be, since the estimations are already known. This is a common recurring problem throughout the WGIII report: BECCS mitigation potentials are alternately presented wwith only bioenergy fossil displacement values or CDR sequestration values, when the true benefit of BECCS, of interest to policy makers, is the fact that it combines both. Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8. Liu, B., & Rajagopal, D. (2019). Life-cycle energy and climate benefits of energy recovery from wastes and biomass residues in the United States. Nature Energy, 4(8), 700-708. Kang, Y., Yang, Q., Bartocci, P., Wei, H., Liu, S. S., Wu, Z., ... & Chen, H. (2020). Bioenergy in China: Evaluation of domestic biomass resources and the associated greenhouse gas mitigation potentials. Renewable and Sustainable Energy Reviews, 127, 109842. Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Melissa J. Scully et al 2021 Environ. Res. Lett. in press https://doi.org/10.1088/1748-9326/abde08 HERNANDES, THAYSE APARECIDA DOURADO ; SCARPARE, FABIO VALE ; SEABRA, JOAQUIM EUGÊNIO ABEL . Assessment of the recent land use change dynamics related to sugarcane expansion and the associated effects on water resources availability. JOURNAL OF CLEANER PRODUCTION , v. 197, p. 1328-1341, 2018.	Noted. We regret that the text in the SOD version seems to have caused misunderstanding. The figure in this box was developed both to present estimated mitigation potential and to demonstrate how methodological approaches can influence the result of analyses. We included the two "partial model" curves to show how two different counterfactual scenarios carry different types of information. We also stressed that the extra emissions representing "foregone sequestration" are not to be understood as real emissions in the scenario where the biomass supply system exists. The extra emissions are included to enable a view on the possible GHG mitigation effect of the bioenergy option at different levels of deployment, in comparison with another option (natural regeneration) for using the same land. The partial model "constant land cover" in contrast reflects supply chain emissions and changes in land carbon storage caused by the biomass supply system. We have revised the text and hope that it now better explains how the figure should be interpreted. Concerning the LCA studies highlighted, we regret that space limitations for section 7.4.4 did not allow comprehensive treatment of this literature and refer to what is reported in other sectoral chapters. Section 12.3 contains information about the combined mitigation effect of BECCS CDR and GHG savings from substitution. In this box, we have chosen to show these "Global emission-supply curves" to illustrate that biomass supply comes at many varying emission factors. Furthermore, the figure aims to illustrate that the emissions mitigation effect of bioenergy systems varies depending on where and how biomass supply systems are deployed. The concept of emissions-supply curves here build on the assumption that deployment consistently target the part of unused land/biomass resource that results in the lowest GHG emissions. We refrain from making ad-hoc additions to the figure by "including the CDR effects of BECCS and soil organic carbon sequestration", since these values would have to be taken from other studies, where methodologies may not be compatible. We have made a note that by adding these "mitigation" components, the emission-supply curves can be pushed downwards.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50953	97	43	99	14	In Box 7.10, the discussion about calculating climate change mitigation values of bioenergy and BECCS correctly points out the wildly contrasting conclusions based on different assumptions and methodologies, but then goes on to give more weight and relevance in the text and in Figure 1 to some of the more extreme and biased methodologies, particularly the so-called “partial models” that incorporate unrealistic and uneconomical “foregone sequestration” assumptions about counterfactual “natural regrowth”. No literature at all is cited to support the numbers in the “partial models” curves (supposedly they come from a single paper, Daioglou et. al 2020?). This highlights an unproven, recent methodology with disputed assumptions while discarding a host of recent developments and precision building in LCA and ILUC literature, that has benefited from more precise modeling of national and regional level conditions. It is concerning because emissions at this level is extremely rare in specialized LCA literature, which has been omitted from the review and from the figure (we present some literature below, but strongly recommend to increase the list and invite specialized scientists). We specially missed publications from Wallace Tyner (lead bioenergy scientist from Purdue University) who has contributed for decades in this topic (including by developing values currently used in the LCFS and CORSIA) and not a single citation found in chapter 7 or 10 (please see Melissa et al 2021 for a non-comprehensive list of Tyner's work). Here we provide a short list of available literature, but we strongly recommend authors of chapter 7 to contact experts on the field, including the authors of the below mentioned literature. Figure 1 in Box 7.10 should be completely redrawn, with no emphasis placed on “partial models” based on “natural regrowth” counterfactuals due to low agreement in the methodology used. Further to that, the figure should be also revised to include the mitigation value curves including the CDR effects of BECCS and soil organic carbon sequestration. The is currently a note to the Figure explaining that those effects were not included. There is not reason why they shouldn’t be, since the estimations are already known. This is a common recurring problem throughout the WGIII report: BECCS mitigation potentials are alternately presented wwith only bioenergy fossil displacement values or CDR sequestration values, when the true benefit of BECCS, of interest to policy makers, is the fact that it combines both. Staples, M. D., Malina, R., & Barrett, S. R. (2017). The limits of bioenergy for mitigating global life-cycle greenhouse gas emissions from fossil fuels. Nature Energy, 2(2), 1-8. Liu, B., & Rajagopal, D. (2019). Life-cycle energy and climate benefits of energy recovery from wastes and biomass residues in the United States. Nature Energy, 4(8), 700-708. Kang, Y., Yang, Q., Bartocci, P., Wei, H., Liu, S. S., Wu, Z., ... & Chen, H. (2020). Bioenergy in China: Evaluation of domestic biomass resources and the associated greenhouse gas mitigation potentials. Renewable and Sustainable Energy Reviews, 127, 109842. Liu, X., Kwon, H., Northrup, D., & Wang, M. (2020). Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters, 15(8), 084014. Moreira, M. M., Seabra, J. E., Lynd, L. R., Arantes, S. M., Cunha, M. P., & Guilhoto, J. J. (2020). Socio-environmental and land-use impacts of double-cropped maize ethanol in Brazil. Nature Sustainability, 3(3), 209-216. Melissa J. Scully et al 2021 Environ. Res. Lett. in press https://doi.org/10.1088/1748-9326/abde08 HERNANDES, THAYSE APARECIDA DOURADO ; SCARPARE, FABIO VALE ; SEABRA, JOAQUIM EUGÊNIO ABEL . Assessment of the recent land use change dynamics related to sugarcane expansion and the associated effects on water resources availability. JOURNAL OF CLEANER PRODUCTION , v. 197, p. 1328-1341, 2018.	Duplicate comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
80667	97	43	99	14	Box 7.10; CDR potential of BECCS must account for the carbon deficit generated for several decades to a century. Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, NATURE SCIENTIFIC REPORTS 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, ENVIRON. RES. LETT. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, ENVTL. RESEARCH LETTERS 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack of suitable long-distance biomass and CO2 transport. Baik E. et al., Geospatial Analysis of Near-term Potential for Carbon-negative Bioenergy in the United States, Proc. Nat'l. Acad. Sci.	Noted. The studies cited do take this into account. This is standard practice. The box specifically concerns climate change mitigation effect of bioenergy and BECCS so biodiversity is out of scope for this box	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80811	97	43	99	14	Box 7.10; CDR potential of BECCS must account for the carbon deficit generated for several decades to a century. Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, NATURE SCIENTIFIC REPORTS 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, ENVIRON. RES. LETT. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, ENVTL. RESEARCH LETTERS 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack of suitable long-distance biomass and CO2 transport. Baik E. et al., Geospatial Analysis of Near-term Potential for Carbon-negative Bioenergy in the United States, Proc. Nat'l. Acad. Sci.	Duplicate comment	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
9629	97	44	97	45	It has been demonstrated that supplying the markets with more renewable energy does not automatically result in a commensurate reduction of fossil energy use (York 2012, Nature Clim Change, doi 10.1038/nclimate1451). Hence I do not think it to be appropriate to assume that bioenergy (like any other renewable energy) always replaces the same amount of fossil fuels. Moreover, looking further into the future, decarbonization of the energy system may well result in situations where bioenergy competes with other renwable energies, and then GHG benefits may be lower or bioenergy may have even higher emissions.	Partially Accepted. We agree with the comment, including that marginal displacement effect varies over time as energy/transport/industry systems change and also depending on how policies and other factors influence substitution patterns: an observation that applies to all options not only bioenergy and motivates critical contemplation over methodology approaches for evaluating climate mitigation effect of different options (e.g., what is the payback time for solar cells manufactured using coal based electricity and competing with other lower-carbon solar cells on a RES market?). This is why we have stated the emissions reduction potential as a function of "GHG avoided when bioenergy is used instead of another energy source". We make no assumption that (the worst) fossil fuels, or any specific energy carrier for that matter, are substituted. The text has been revised to further indicate that the "change in GHG emissions" determines the mitigation potential.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
56085	97	44	97	46	The biomass language is overly prescriptive on how to do a biomass net GHG assessment. Not all circumstances warrant including avoided fossil fuel emissions as an inherent piece of the calculation. And IPCC should NOT be telling countries and practitioners how one must approach this issue. Suggest striking this text. At minimum, indicate that it is possible that assessments of biomass GHG outcomes CAN include these elements, when and where appropriate. As written, the text does not take into account all biomass GHG assessment contexts and in some cases could lead to double counting.	Noted. The intention of the text is to explain why there are contrasting results from assessments. The text has been revised to further indicate that the "change in GHG emissions" determines the mitigation potential.	Government of United States of America	U.S. Department of State	United States of America
76947	97	44	98	2	The factors listed should also include factors such as the energy penalty of CCS, supply chain emissions and losses of biomass over the production chain.	Partially accepted. Text has been revised and we have explicitly stated "supply chain emissions" and "efficiency of conversion", which relate to the factors listed by the reviewer.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
9631	97	45	97	46	This formulation is ambiguous and needs to be further specified. In many cases the counterfactual of not using the land to produce bioenergy would entail a C sink of the plants growing on that land. A full evaluation of the C effects of bioenergy needs to judged against that counterfactual, i.e. it is not sufficient to assess the C effects of the bioenergy and direct LU effects alone (Searchinger, 2010, Env Res Lett, Haberl, 2013, GCBB, doi 10.1111/gcbb.12071, Kalt et al. 2019, GCBB, doi:10.1111/gcbb.12626, Kalt et al. 2020, Env Res Lett, doi 10.1088/1748-9326/ab6c2e). This was also recognized in IPCC AR5, WGIII, Ch11, p877: "The combustion of biomass generates gross GHG emissions roughly equivalent to the combustion of fossil fuels. If bioenergy production is to generate a net reduction in emissions, it must do so by offsetting those emissions through increased net carbon uptake of biota and soils. The appropriate comparison is then between the net biosphere flux in the absence of bioenergy compared to the net biosphere flux in the presence of bioenergy production. Direct and indirect effects need to be considered in calculating these fluxes." If the IPCC now wants to introduce new criteria neglecting the counterfactual situation, this would require stringent arguments, for which I do not see any support in the current scientific literature. In any case, this would have to be explicitly argued, when judged against the quality criteria for assessment reports.	Noted. The comment seems to reflect a misunderstanding of Box 7.7 Figure 1 which explicitly addresses counterfactual emissions. We revised the text in order to highlight the distinction between emissions existing in the scenario where the biomass supply system operates, and the emission representing a "foregone sequestration" i.e., sequestration that can exist in a counterfactual scenario where the biomass supply system does not exist and land is instead subject to native vegetation regrowth. We hope that the text is more clear now. We also pointed out that the modeling protocol used for the scenarios in the AR6 database accounts for the land-use change and all other GHG emissions along a given transformation trajectory, enabling assessments of the warming level incurred. The results labeled "EMF33" and "partial models with constant land cover" are obtained with modeling approaches compatible with this protocol. The results in the category "partial models with natural regrowth" attribute additional CO2 emissions to the bioenergy system, corresponding to estimated uptake of CO2 in a counterfactual scenario where land is not used for bioenergy but instead subject to natural vegetation regrowth. While such analysis provides insights into implications of alternative land-use strategies, it does not identify the actual emissions due to bioenergy production and thus is not compatible with the identification of warming levels incurred by an individual transformation trajectory, and therefore not aligned with the protocol applied for the scenarios in the AR6 database.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
49957	97	45	97	45	The sentence is a bit misleading: "how the associated land use influences the amount of carbon stored..." If the reference value indeed is "the counterfactual scenario without mitigation measure" (pg41/ln37, see also pg98/ln36) - which I think is important and correct, then it is not (only) about land-use influencing the amount of C.stocks, but on the "opportunity cost" of using the land, ie. the natural regrowth carbon signal taht would occur in the absence of land use. This has been labeled "sink forgone" or similar and is essential here (10.1126/sciadv.aax2546, 10.1038/s41559-019-0824-3, 10.1038/s41586-018-0757-z)	Noted. The text has been revised and Figure 1 explicitly addresses counterfactual emissions. We revised the text in order to highlight the distinction between emissions existing in the scenario where the biomass supply system operates, and the emission representing a "foregone sequestration" i.e., sequestration that can exist in a counterfactual scenario where the biomass supply system does not exist and land is instead subject to native vegetation regrowth. We hope that the text is more clear now. We also pointed out that the modeling protocol used for the scenarios in the AR6 database accounts for the land-use change and all other GHG emissions along a given transformation trajectory, enabling assessments of the warming level incurred. The results labeled "EMF33" and "partial models with constant land cover" are obtained with modeling approaches compatible with this protocol. The results in the category "partial models with natural regrowth" attribute additional CO2 emissions to the bioenergy system, corresponding to estimated uptake of CO2 in a counterfactual scenario where land is not used for bioenergy but instead subject to natural vegetation regrowth. While such analysis provides insights into implications of alternative land-use strategies, it does not identify the actual emissions due to bioenergy production and thus is not compatible with the identification of warming levels incurred by an individual transformation trajectory, and therefore not aligned with the protocol applied for the scenarios in the AR6 database.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
84947	97	47	98	2	Are the particulate and black carbon distinct from aerosol? Isn't aerosol a particulate? Not sure whether (i) and (ii) are different because of the size of the particles, or the types of land?	Noted. Text completely revised and removed this ambiguous language.	Singfoong Cheah	Independent consultant, formerly more than 10 years with the National Renewable Energy Laboratory, USA	United States of America
77683	98	1	100	29	While the notes of caution and qualifications in this section are welcome, they do not adequately reflect the fact that, no matter how well designed, a large-scale bioenergy market for wood is already changing which forests are logged and how often. Moreover, the opportunity cost is not just the alternative of allowing forests to grow to their 'usual' logging age but of allowing forests to recover to their full biological and carbon carrying potential. Few models have any, let alone adequate data on which to assess this opportunity cost as most models are based on wood production forests and incorrectly assume peak carbon is reached at logging age (Mackey et al 2020, Keith et al 2009, 2015 cited above). More importantly, from the point of view of GHG accumulation in the atmosphere, is that reducing gross emissions now and by 2030 and 2050 is not aided by burning fuel that is instantly more emissive per unit of energy than coal (Booth cited above) and that will persist in the atmosphere well beyond 2030 and 2050	Noted. The "Natural Regrowth" results presented in Box 7.7 Figure 1, includes the emissions that would occur in a counterfactual scenario where the biomass supply system does not exist and the land is instead subject to natural vegetation regrowth, i.e., reflecting "full biological carbon carying potential". We revised the text in order to highlight the distinction between emissions existing in the scenario where the biomass supply system operates, and the emission representing a "foregone sequestration" i.e., sequestration that can exist in a counterfactual scenario where the biomass supply system does not exist and land is instead subject to native vegetation regrowth. We hope that the text is more clear now. We also pointed out that he modeling protocol used for the scenarios in the AR6 database accounts for the land-use change and all other GHG emissions along a given transformation trajectory, enabling assessments of the warming level incurred. The results labeled "EMF33" and "partial models with constant land cover" are obtained with modeling approaches compatible with this protocol. The results in the category "partial models with natural regrowth" attribute additional CO2 emissions to the bioenergy system, corresponding to estimated uptake of CO2 in a counterfactual scenario where land is not used for bioenergy but instead subject to natural vegetation regrowth. While such analysis provides insights into implications of alternative land-use strategies, it does not identify the actual emissions due to bioenergy production and thus is not compatible with the identification of warming levels incurred by an individual transformation trajectory, and therefore not aligned with the protocol applied for the scenarios in the AR6 database. Concerning C intensity of biomass and coal, we recommend DOI: 10.1111/gcbb.12844 and studies cited in this publication	Virginia Young	Australian Rainforest Conservation Society	Australia
84945	98	1	98	1	For the phrase in (ii), it would be helpful to clarify whether the authors meant aerosol emission associated with forests when bioenergy is being used, or just aerosol emission associated with a natural forest in general.	Noted. Text completely revised and removed this ambiguous language.	Singfoong Cheah	Independent consultant, formerly more than 10 years with the National Renewable Energy Laboratory, USA	United States of America
1169	98	3	98	11	This paragraph lists factors accounting for the varying conclusions of studies into the mitigation value of bioenergy. One important factor is missing, however. The list should include "the response of landowners to increased demand for biomass". The following references can be used. Abt, K., R. Abt and C. Galik, Effect of Bioenergy Demands and Supply Response on Markets, Carbon, and Land Use, Forest Science 58(5) 2012 and Favero et al., "Forests: Carbon sequestration, biomass energy, or both?", Science Advances. 2020; 6 : eaay6792 25 March 2020	Accepted. In the closing paragrpahs of the section this dynamic has been mentioned and the Favero et al. (2020) paper is cited.	Reid Miner	Private Consultant	United States of America
53413	98	12	98	12	Change "conclusion" to "conclusions".	Accepted.	Donald Smith	McGill University	Canada
9633	98	16	98	20	The study by Kalt et al. 2020, Env Res Lett cited elsewhere in the draft is a good example for the importance of counterfactuals	Agreed. The study is prominently cited and has been used in the production of Box 7.7 Figure 1.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
28389	98	16	98	29	The text only addresses bioenergy driving carbon losses from land and delayed mitigation potential. Equal focus should be given to those studies that illustrate contemporaneous and short beneficial impacts on carbon stocks- see supporting literature below.	Accepted. In the closing paragraphs of the section a discussion with appropriate references is given to potential beneficial impacts on carbon stocks as well as economic and social benefits of specific management practices.	Michael Goldsworthy	Drax	United Kingdom (of Great Britain and Northern Ireland)

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28391	98	16	98	29	Supporting literature In one of the main sourcing areas for wood pellet, the US South, around 85% of forests are privately owned and a key dynamic reflected is that increased demand is associated with more investment in forests, in particular leading to more carbon sequestered and stored as a result of healthy market demand. Aguilar, F.X. et al. found 'A one percentage-point increase in overlap of wood pellet mill procurement areas, denoting greater competition, was associated with larger C stocks in above and belowground live (2.07 tons C/ha; p = 0.00) and standing-dead (0.06 tons C/ha; p = 0.00) trees pools, and in soils (1.32 tons C/ha; p = 0.02).' They comment 'On the balance, there has been a net contemporaneous positive effect.' Duden et al. modelled impacts of wood pellet demand on forests in US SE and found that under a high pellet demand scenario there was greater retention of natural timberland (2,000-7,500km2) and increased establishment of pine plantation (8,000-20,000km2). Nepal also invetigated projected developments in timber price/harvest/inventory resulting from a wood energy demand increase in the US from 56 million m3 to 125 million m3 (High energy scenario) compared to a baseline increase of 56million m3 to 64 million m3 and found the following: Impact on non-sawtimber (pulpwood, sawmill residuals and logging residues) •Increase in wood energy demand for the high energy scenario is projected to bet met by largely through use of pulpwood: 19 million m3 additional pulpwood and 37 million m3 pulpwood diverted from existing markets •The price of feedstock for wood fuel increases from $18/t to $24/t (compared to reducing to $17/t in the baseline) •An additional 7 million tonnes of sawmill residues are produced, 4 million tonnes of which go to energy and 3 million tonnes to pulpwood •An additional 8 million tonnes of logging residues are produced. Impact on sawtimber •Sawtimber production increases (Softwood sawtimber production was 20 million m3 higher for the high energy scenario than in the baseline; Hardwood sawtimber production was 6 million m3 higher than in the baselines) Impact on forests •Total harvests increase 8% in the high energy scenario compared to the baseline (566 million m3 compared to 527 million m3 in 2050)	Noted. Literature has been added in the appropriate section.	Michael Goldsworthy	Drax	United Kingdom (of Great Britain and Northern Ireland)
76949	98	17	98	17	"counterfactual land use": This is important, but counterfactual analysis should include all components, like the energy replaced and alternative uses of biomass (where they exist).	Noted. We make clear in the text that "counterfactual" energy use is as important as the "counterfacual land use". As stressed in the revised opening paragraph, counterfactual energy use is dealt with in the appropriate energy chapters. This section focuses only on biomass supply and BECCS CDR effect.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
56087	98	20	98	21	This sentence implicitly assumes that benefits are achieved in the long term, wholesale. Tone this down by including 'potential future' in front of 'achievement'.	Noted. Text has been completely reworked.	Government of United States of America	U.S. Department of State	United States of America
49959	98	21	98	21	the "few years" should be substantiated, this is casual and potentially tendential	Noted. Text has been completely reworked.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
76951	98	21	98	21	Insert "or prevent" to read "LUC can delay or prevent the achievement". If land cannot provide sufficient additional biomass, then reductions cannot be possible.	Noted. Text has been completely reworked.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
9635	98	24	98	29	This study by Hanssen et al. 2020 also demonstrated the huge upfront C costs that more ambitious bioenergy targets may have, which raise enormous issues about timing of emissions. See eg. Creutzig et al. 2021, GCBB doi 10.1111/gcbb.12798 for a discussion of these aspects. In my view, the current text does not adequately reflect this critical issue, which is even more important given the need to reduce emissions fast in the coming decades, as agreed in the Paris agreement and elsewhere	Accepted. This issue has been explicitly mentioned in the revised text.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
1171	98	27	98	27	Again, the issue of timing is missing. Modify this sentence to read "...at mitigating GHG emissions, and the timing of mitigation benefits, vary a lot..."	Accepted. This issue has been explicitly mentioned in the revised text.	Reid Miner	Private Consultant	United States of America
21523	98	28	98	28	Booth (2018) warns that policy should not treat bioenergy as having zero or negligible emissions (https://doi.org/10.1088/1748-9326/aaac88).	Noted. The emissions supply-curves presented reflect a similar concerns. Nowehre in section 7.4.4. is bioenergy treated as emission free.	Government of France	Ministère de la Transition écologique et solidaire	France
49961	98	30	98	30	Maybe a bit misleading, becaue Fig. 7.10 does not show upfront "curves", but box-plots (which end up showing curves). Maybe revise text or figure (e.g. insert the "curve" as dashed line or something). But, the figure is excellent, and very imporant - also, very telling. The message it conveyes sould be made stronger up-front.	Noted. We have not revised the figure to show a curve as we want to prsent the uncertainty without giving importance to "medians". However we want to maintain the term "curve" since that term best decribes the dynamic between supply and emissions. The text was revised to explain this better	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
72667	98	30	99	14	This example is not clear. If the bioenergy is grown on cropland not needed for food, then there really isn't LUC (cropland to cropland), and there isn't any previous natural vegetation to regrow. So I don't understand how LUC is included, and what the regrowing vegetation is. I am also not sure how this figure relates to calculating the value of bioenergy and beccs. beccs does not appear to be included, and the calculation and presentation is not intuitive (or complete) with respect to the comparison between total net bioenergy emissions (and what comprises them) and total net fossul fuel emissions. It would more clear to have an example showing stacked bar plots comparing total bioenergy and fossil fuel net emissions side by side, broken down into each contributing component (and maybe a couple different time scales for bioenergy to show how regrowth affects results, both in the case of forest-derived feedstock and in the case of the counter-factual associated with clearing for specific crops).	Indeed "cropland to cropland" has very low (or no) emissions. This is represented in the low-emission side of the figure (this type of LUC is explicitly included in IAMs, and some of the partial studies - depending on socioeconomic assumptions). Indeed mitigation from bioenergy and BECCS is not included in the figure and we explicitly state that. We do not want to include total "net" emissions as this would require us to make ad-hoc assumptions about how the bioenergy is used. doing this could require us to make assumptions which may be inconsistent with the studies used to get the "emission-supply curves". furthermore, this mitigation potential is covered in relevant chapters of the report. We only want to display the emissions from biomass supply.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
56089	98	32	98	33	What are "partial models"? Partial equilibrium? Clarify.	Accepted. Clarifying text added.	Government of United States of America	U.S. Department of State	United States of America
76953	98	44	98	44	"converted into final energy carriers with the same efficiency": is this realistic? An indication of real-life conversion efficiencies would help.	Accepted. This was supposed to only be an illustration to help readers understand the text. Text has been modified to avoid this assumption, and to be explicit that the figure can only present the "primary biomass potential".	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
49963	98	45	98	47	This interpretation of the box-plots does not do justice to the wealth of information a box plot conveyes. This assertion holds only true if the median is taken as granted- but well, a median is a median, the "middle" of ranges. So this means with 150 EJ/yr, the range is of the inner quartiles is ~60 to 100 kgCO2/GJ. To be savely "below" the 75kgCO2/GJ, only 50 EJ are possible.	Accepted. Caveats have been explicity added.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
9639	98	46	98	47	The statement that "up to 150 EJ of biomass" (which should be rather something like "biomass with a calorific value of 150/yr", by the way) is not so very helpful and needs caveats. As the underlying studies, as well as the error bars in the Figure, show, there are many circumstances where the amount of energy is a lot lower, and many of these factors are not easily controled by policies (e.g. adoption of meat-rich diets). Also, as the paper by Kalt et al. 2019 (GCBB 10.1111/gcbb.12626) discusses at length, a large number of factors associated to both the quality of the land, as well as the efficiency with which the biomass is used (and hence the amount of fossil fuel that can be substituted) need to be factored in to find optima. Optimal values will hence under most assumptions on future developments be a lot lower, and I think it is not a good idea to raise overly optimistic expectations.	Accepted. Caveats have been explicity added. Section 7.4.4 informs that bioenergy potentials are uncertain and that bioenergy can be associated with both co-benefits and adverse side effects.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
76955	98	46	98	47	"Box 7.10 Figure 1, indicates that up to about 150 EJ of biomass can be produced and used for energy while achieving net GHG savings": 150EJ corresponds to 75 kg CO2/GJ, thus must include consideberable coal emissions. Can that be a realistic/relevant comparator for 2050?	Noted. This is merely an illustration in order to guide the reader into how to read the figure. We are uncertain how to interpret the reference to coal emissions	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
9641	99	4	99	5	This sentence should also mention the time dimensions of ambitious BECCS deployment, which is super-critical in view of the need for rapid decarbonization (see discussion the Hanssen et al. 2020 Nature Clim Change) paper as well as the rebuttal by Creutzig et al., 2021, GCBB	Noted. The time dimension has been stressed elsewhere in the text.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
49965	99	4	99	5	This disclaimer does not give an quantitative information, it is speculative. If important, it needs to be included earlier. The "if land management can improve the land carbon balance" is to casual and needs substance, in particular given the time-frame of C-balancing (parity time, carbon dept).	Rejected. The purpose of the disclaimer is not to give quantitative information but how to help with the interpretation of the figure. Time aspects have been made clear elsewhere.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
84949	99	4	99	5	If a natural gas technology has CCS, how would the GHG emission in kg CO2 GJ-1 compared to bioenergy with CCS?	The figure alows the reader to make this comparison by assuming a CDR factor (kgCO2/GJ) for biomass with CCS and comparing it to the emission factor of natural gas with CCS.	Singfoong Cheah	Independent consultant, formerly more than 10 years with the National Renewable Energy Laboratory, USA	United States of America
9637	99	5	99	14	Excellent figure, very important! Should play a larger role in overall messaging of the chapter	Noted- with thanks. The figure also acts as a "connection point" with other chapters.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
76957	99	6	99	14	Box 7.10: The chart is useful and informative in general. It is unclear what the negative range of the X axis represents (negative energy production?). The bar of the partial models may be offset to the left for visibility, but the cloud of dots also extends into the negative range. Please clarify.	Accepted. The negative aspect arises for cases where the biomass production leads to an increase in land-based carbon stocks. This has been made clear in the text.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
9643	99	16	99	22	A technical energy crop potential of 245 EJ/yr as cited here is far above any plausible range. This is about the same amount of biomass as humanity harvests today for all purposes (food, fibre, energy), see Haberl (2015. Ecological Economics https://doi.org/10.1016/j.ecolecon.2014.10.002). Raising energy crop cultivation to that extent would have massive repercussions on global land systems. For example, the cited study by Kalt et al 2020 shows that GHG emissions rise sharply when aiming to raise bioenergy production over certain limits (that are in this study found te be around +/- 100 EJ/yr, depending on food system trajectories. Another study by Kalt et al. (2019, GCBB, doi:10.1111/gcbb.12626) shows that on a substantial fraction of the land that could be devoted to energy crops, natural climate solutions (C absorption by growing plants) would offer higher climate benefits than bioenergy. If the writing team believes that high numbers such as 250 EJ/yr should really be cited as the upper range of the technical potential, a lot more robust justification needs to be given, and it needs to be explained under what framework conditions in the rest of the land system (in particular, food systems) this could be realised. The recent study by Hanssen et al. (2020. Nature Climate Change, https://www.nature.com/artic les/s4155 8-020-0885-y) shows explicitly the drastic changes in global land systems that would be required to leverage such high potentials, with desastrous consequences for many other sustainability concerns (Creutzig et al., 2021, GCBB, doi 10.1111/gcbb.12798)	Noted. Estimates of the future (2050) technical potential vary considerably due to possible variation of important determining factors, e.g., future food demand, future crop yield levels, productivity in animal food production, climate change, and how societies understand and prioritize nature conservation and soil/water/biodiversity protection + how land use is governed because of this. 245 EJ/yr is the higher end in the range 46-245 EJ/yr where the lower end can similarly be questioned. Further, section 7.4.4 explains that bioenergy and BECCS can be associated with a range of co-benefits and adverse side-effects, and that it is not possible to precisely determine the scale of bioenergy and BECCS deployment at which negative impacts outweigh benefits. Concerning the studies by Kalt referred to in the comment, see Box 7.7, Figure 1.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
29039	99	16	99	19	This seems to contradict other parts of the report (especially the Summary for Policymakers) which present a median of 0.8 GtCO2/a as potential for BECCS. The total ranges are also different.	consisency checks were done.	Jasmin Kemper	IEAGHG	United Kingdom (of Great Britain and Northern Ireland)
48035	99	16	99	22	This paragraph should be completely redrawn. There is simply no reference provided for the range of 0.5-3.5 GtCO2/y available at USD 100/tCO2 (lines 17-18), and this is a new estimation never before seen in IPCC reports, which is disputed and should be tagged as low evidence/low confidence, or else references should be provided. Also, the economic potential listed in line 19 for BECCS as derived by IAMs (also in Table 7.4) are wildly different from those found in regional assessments in Table 7.5 for the same carbon cost (US$ 100/t), and also massively deviate from the technical potential of BECCS, a strange result that does not conform to previous estimations and something that is not adequately explained in the report. We strongly question the economic potential for BECCS as derived from IAMs, in a way not transparently explained or referenced in the report. As shown also in Chapter 7, p. 99, l 17-19, a very low economic potential is given without no further explanation. As hinted in p. 96, l 39-44, there have been recent runs of IAMs that artificially limited BECCS, which would then have the effect of reducing its economic potential in the model results in a way that is completely circular and pre-determined by the models as an assumption. It would be completely inappropriate, therefore, to use those runs to inform a fair comparison of economic potential with other solutions.	Accepted. Added literature. As explained in section 7.4.4, the role of bioenergy and BECCS in mitigation pathways has been reduced as IAM-based studies have incorporated broader mitigation portfolios and have explored non-CO2 emissions reduction and a wider variation of underlying assumptions about socio-economic drivers and associated energy and food demand, as well as deployment limits such as land availability for A/R and for cultivation of crops used for bioenergy and BECCS.	Marcelo moreira	UNICAMP - Agroicone	Brazil
49967	99	16	99	22	I repeat what I wrote above: The 245 upper range is way to high for sustainable potentials - in particular, if repercussions with forest areas (and thus, large carbon stocks) are to be avoided. kalt et al conclude, based on a broad review and systemic integration of data based on first principles, that the the mediumrange of literature estimates (~40 to 90 EJ/yr) is only compatible with FAO yield and human diet projections if energy plantations expand into grazing areas (~4–5million km2) and grazing land is intensified globally. Now, such a grazing land intensification is not easily achieved and will be associated with massive sustainability challenges, given the already today high level of degradation.	Noted. This is technical potential and estimates of the future (2050) technical potential vary considerably due to possible variation of important determining factors, e.g., future food demand, future crop yield levels, productivity in animal food production, climate change, and how societies understand and prioritize nature conservation and soil/water/biodiversity protection + how land use is governed because of this. 245 EJ/yr is the higher end in the range 46-245 EJ/yr where the lower end can similarly be questioned. Further, section 7.4.4 explains that bioenergy and BECCS can be associated with a range of co-benefits and adverse side-effects, and that it is not possible to precisely determine the scale of bioenergy and BECCS deployment at which negative impacts outweigh benefits. Concerning the studies by Kalt referred to in the comment, see Box 7.7, Figure 1.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
49969	99	16	100	17	The flow of argument here is tendential: first, large technical potentials are "claimed", and than the inability to assess and quantify the sustainability implications follow. This might lead to mistinterpreations, as the paragraph giving numbers will gain more attention. The remainder of text has many "ifs" that do raise serious caveats (notable, biodiversity is missing), but which might not be take as important, as no numbers are given. Balanced language as well as the precautionary principle calls for an alternative "story-telling" here.	Noted. We have revised the text. We present the ranges based on the assessment made, but stress directly after that poor deployment can cause negative outcomes for GHG emissions, biodiversity, food security and a range of other sustainability criteria.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
50955	99	16	99	22	This paragraph should be completely redrawn. There is simply no reference provided for the range of 0.5-3.5 GtCO2/y available at USD 100/tCO2 (lines 17-18), and this is a new estimation never before seen in IPCC reports, which is disputed and should be tagged as low evidence/low confidence, or else references should be provided. Also, the economic potential listed in line 19 for BECCS as derived by IAMs (also in Table 7.4) are wildly different from those found in regional assessments in Table 7.5 for the same carbon cost (US$ 100/t), and also massively deviate from the technical potential of BECCS, a strange result that does not conform to previous estimations and something that is not adequately explained in the report. We strongly question the economic potential for BECCS as derived from IAMs, in a way not transparently explained or referenced in the report. As shown also in Chapter 7, p. 99, l 17-19, a very low economic potential is given without no further explanation. As hinted in p. 96, l 39-44, there have been recent runs of IAMs that artificially limited BECCS, which would then have the effect of reducing its economic potential in the model results in a way that is completely circular and pre-determined by the models as an assumption. It would be completely inappropriate, therefore, to use those runs to inform a fair comparison of economic potential with other solutions.	Duplicate Comment	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
76959	99	16	99	17	The "net CDR potential" would benefit from an explanation. Which curve on Figure 1 does it correspond to? Does it represent carbon sequestered (in CCS), or overall deviation from the counterfactual (including land use impacts)? What would be the corresponding land requirement?	Accepted. What is included depends on the study, but typically LUC and supply chain emissions are included. Text has been amended to highlight this.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
79101	99	16	100	29	Useful reference to help to identify sustainable thresholds: Creutzig, F., Erb, K.-H., Haberl, H., Hof, C., Hunsberger, C., & Roe, S. (2021). Considering sustainability thresholds for BECCS in IPCC and biodiversity assessments. GCB Bioenergy, 13(4), 510–515. https://doi.org/https://doi.org/10.1111/gcbb.12798	Accepted. Added reference.	Edith Juno	National Wildlife Federation	United States of America
56091	99	19	99	22	Add citations for these estimates as not included in previous section.	Accepted. Citations added	Government of United States of America	U.S. Department of State	United States of America
82845	100	1	102	40	Section 7.4.5.1 Shift to sustainable healthy diets - see comments to p. 61, l. 2-13 in this Chapter. Home food production in Global North may also include animals (e.g. Chicken, rabbits, pigs), though this is less often than fruits and vegetables and typical rather for rural areas (Vávra et al. 2021). Such meat production happens in non-industrialiazed way. Vávra, J. Smutná, Z., Hruška, V. (2021). Why I would want to live in the village if I was not interested in cultivating the plot? Home gardening in rural Czechia. Sustainability 13(2): 706. doi: 10.3390/su13020706.	Noted. The authors thank the reviewer for their suggestion and associated reference. Following consideration, it was decided not to include these additions.	Jan Vávra	University of South Bohemia	Czech Republic
1173	100	3	100	3	Again, the timing issue is missing from the list of implications of biomass energy deployment. To the list, should be added "the time horizon of concern". The following references can be used to support the additional text. Helin T, Sokka L, Soimakallio S, et al. 2013. Approaches for inclusion of forest carbon in life cycle assessment – a review. GCB Bioenergy 5: 475–86. Marland G, Buchholz T, and Kowalczyk T.2013. Accounting for carbon dioxide emissions. J Ind Ecol 17: 340–42. Buchholz T, Prisley S, Marland G, et al. 2014. Uncertainty in projecting GHG emissions from bioenergy. Nat Climate Change 4: 1045–47.	Noted. The concluding text was shortened and timing is not discussed here. But we added this aspect in response to a review comment on another part of section 7.4.4	Reid Miner	Private Consultant	United States of America
46011	100	8	100	10	Beyond the effects on food security and aspects of sustainable development, it might be appropriate to mention biodiversity as well, as biodiversity is possibly affected by poorly deployed AFOLU options.	Accepted. The revised text says: "Technical land availability does not imply that dedicated biomass production for bioenergy and BECCS is the most effective use of this land for mitigation. Further, implications of deployment for climate change mitigation and other sustainability criteria are context dependent and influenced by many factors, including rate and total scale. While governance has a critical influence on outcome, larger scale and higher expansion rate generally translates into higher risk for negative outcomes for GHG emissions, biodiversity, food security and a range of other sustainability criteria"	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
49997	100	8	100	9	this passage suggests that this is only the case with "poorly deployed options". But well, with an area demand of 500 Mha, even "best-practice" implementation will result in land competition, land displacement, pressures to convert pristine ecosystems, etc. Suggested to change to: BE or BECCS employment at scales that result in large area demand have a high potential to cause negative effects xx xx	Accepted. The revised text says: "Technical land availability does not imply that dedicated biomass production for bioenergy and BECCS is the most effective use of this land for mitigation. Further, implications of deployment for climate change mitigation and other sustainability criteria are context dependent and influenced by many factors, including rate and total scale. While governance has a critical influence on outcome, larger scale and higher expansion rate generally translates into higher risk for negative outcomes for GHG emissions, biodiversity, food security and a range of other sustainability criteria"	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
76961	100	8	100	17	The impacts of increasing forest harvest for bioenergy should be addressed. It is generally excluded from the scenarios, but cannot be excluded in reality as it is a comon practice.	Noted. The concluding text was shortened and discusses impacts generally for all feedstock supply systems: The revised text says: "Technical land availability does not imply that dedicated biomass production for bioenergy and BECCS is the most effective use of this land for mitigation. Further, implications of deployment for climate change mitigation and other sustainability criteria are context dependent and influenced by many factors, including rate and total scale. While governance has a critical influence on outcome, larger scale and higher expansion rate generally translates into higher risk for negative outcomes for GHG emissions, biodiversity, food security and a range of other sustainability criteria"	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
80669	100	8	100	29	Even “well-deployed” harvesting of forest biomass or using forest residue for bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 (“We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.”).	Reject. Literature has highlighted that there is significant potential with low payback periods (also see Box 7.7 Figure 1). Cited studies are very selective.	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80813	100	8	100	29	Even “well-deployed” harvesting of forest biomass or using forest residue for bioenergy is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 (“We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.”).	Duplicate comment	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
50827	100	11	100	11	"Junginger" i s o "Juninger"	Accepted. Thanks you for pointing this out.	Bert Metz	European Climate Foundation	Netherlands
11847	100	13	100	17	The future use of BECCS and BECCU are also important components when considering the European policy concerning LULUCF. If the LULUCF regulation reduces forest and agricultural production this will reduce possibilities for BECCS and BECCU.	Noted. The concluding text was shortened and the issue brought up in the comment is implicitly covered via the following text: "Strategies to enhance the benefits of bioenergy and BECCS include (i) management practices that protect carbon stocks and the productive and adaptive capacity of lands, as well as their environmental and social functions (van Ittersum et al. 2013, Gerssen-Gondelach et al. 2015; Moreira et al. 2020); (ii) supply chains from primary production to final consumption that are well managed and deployed at appropriate levels (Donnison et al. 2020; Fajardy et al. 2018); and (iii) development of a cross-sectoral agenda for biobased production within a circular economy, and international cooperation and governance of global trade in products to maximize synergies while limiting trade-offs concerning environmental, economic and social outcomes"	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
3911	100	14		17	The key question is to be able to manage different types of organic residues to their best use. Some legislations do not differentiate between them, so many residues that are suitable to increase SOM content and improve soil quality are used for energy production. So it would be necessary to indicate here that besides the many factors that have been indicated, another factor determining the sustainability or not of BECCS is the "quality" of the organic residue to produce energy while not decreasing SOM. See, for instance 10.1111/gcbb.12733	Noted. The concluding text was shortened and does not explicitly discuss the trade-off between residue use for energy vs for soil C management. Soil C management is covered in section 7.4.3.1 . See also section 12.5	Rosa M Poch	ITPS and UdL	Spain
15737	100	15	112	36	This whole section would benefit from additional efforts to imporve clarity to the reader, now a lot of picewise information is piled up but it is hard for the reader to get a good grip on the analysis made as well as the relevance of the outcomes. In fact this holds also for the following section on IAMs.	Accepted. The entire section has been re-written to improve readability.	Katarina Elofsson	Aarhus University	Denmark
29433	100	15	100	17	Consider adding information on the increasing volume of Waste to Energy plant and, biofuel-plants, enabling the potential for BECCS on these sources. It is important to enable incentive for harness these negative emissions since these sources of biogenic material already are being used and add no stress to area use. (Source: Asbjørn Torvanger (2018): Governance of bioenergy with carbon capture and storage (BECCS): accounting, rewarding, and the Paris agreement, Climate Policy, DOI: 10.1080/14693062.2018.1509044)	Noted. The section explicilty considers the use of residues from agricultural and forestry processes. Adding municipal solid waste is beyond the scope of the section.	Government of Norway	Norwegian Environment Agency	Norway
1175	100	16	100	16	The sentence is incomplete in describing the carbon benefits. At the end of the sentence, add the phrase "while, in some cases, also reducing emissions of methane associated with disposal."	Noted. The entire text has been re-written and the sentence commented upon was deleted.	Reid Miner	Private Consultant	United States of America
9645	100	18	100	25	The list of criteria needs to be completed by the need to consider counterfactuals, i.e. possible alternative uses of the land needed to produce bioenergy, see the discussion one page above in the draft, and the papers by Kalt et al. 2019 GCBB and Kalt et al 2020, Env Res Lett. This also concerns the effects of raising wood harvests in forests in order to increase the availability of woodfuels. Raising harvest volumes in forests has substantial effects on the C balance of the forest ('carbon debt' resulting from permanantly lower C stocks of more intensively used forests that result from juvenilization. See e.g. Campbell et al. 2012. Frontiers in Ecology and the Environment 10, 83–90. https://doi.org/10.1890/110057, Luyssaert et al. 2018. Nature 562, 259–262. https://doi.org/10.1038/s41586-018-0577-1, Naudts et al. 2016. Science 351, 597–600. https://doi.org/10.1126/science.aad7270, Schulze et al., 2012. GCB Bioenergy 4, 611–616. https://doi.org/10.1111/j.1757-1707.2012.01169.x, Haberl, H. 2013. GCB Bioenergy 5, 1–2. https://doi.org/10.1111/gcbb.12004, Holtsmark, B., 2012. Climatic Change 112, 415–428. https://doi.org/10.1007/s10584-011-0222-6	Noted. Box 7.7 addresses counterfactuals and is complemented with the following text in this concluding section: "Technical land availability does not imply that dedicated biomass production for bioenergy and BECCS is the most effective use of this land for mitigation. Further, implications of deployment for climate change mitigation and other sustainability criteria are context dependent and influenced by many factors, including rate and total scale. While governance has a critical influence on outcome, larger scale and higher expansion rate generally translates into higher risk for negative outcomes for GHG emissions, biodiversity, food security and a range of other sustainability criteria" Considering the references brought forward in the review comment, we note that the scientific literature also provides insights on C balances via studies that consider market-mediated effects and find that an increased biomass demand can provide incentives to maintain existing forests and potentially to expand forest areas, providing addition carbon sequestration as well as additional biomass.	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
56093	100	18	100	25	The third strategy described in this paragraph (on development of a common agenda) entails elements of the previous two strategies as described, and also implies that all three strategies should/must be in place to reduce risk of the negative consequences of bioenergy and BECCS. Paragraph could be rewritten as "Strategies to reduce the risk of negative consequences of bioenergy and BECCS include i, ii, and iii."	Accepted. Text revised appropriately.	Government of United States of America	U.S. Department of State	United States of America
49971	100	19	100	21	Protecting carbon stocks is key and a quantification, how this this affects potentials is needed. Also: the passage needs to take into account how other, alternative CDR systems operate on short terms and what the comparative advantages on the short term are. This is imporant to decide upoen BECCS pathways or not. The lock-in characteristics BECCS also need a mention, as well as the problem of permanences of CCS and the non-in-my-backyard movements.	Noted. Section 12.3 provides an overview of different CDR options and Ch3 addresses the role of CDR in mitigation pathways. We refer to these sections.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
71863	100	22	100	25	also make reference to the BIOECONOMY cross-WG box	Accepted.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76963	100	25	100	25	References should generally be limited to peer-reviewed sources. It is unclear whether the inclusion of the link implies the endorsement of scientific quaity.	Accepted. Link removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76965	100	25	100	25	Clarify whether the confidence statement applies to point iii only, or all points i-iii.	Noted. Confidence statement applies to the entire sentence.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
28815	100	26	100	29	It should be more explicit: BECCS is still pretty much in the theoretical level. This is very important as most IAM models include it as a done deal.	Accepted. Explicit statement that these technologies do not exist at a large scale has been added.	naikoa aguilar-amuchastegui	WWF-US	United States of America
46013	100	26	100	29	Please mention the uncertainties around the possibilities of long-term storage of the captured carbon and where a further discussion on this issue can be found in the report (see chapter 12, section 5; chapter 6, section 6.4).	Noted. A discussion on the long-term storage of captured carbon is beyond the scope of this section and, as noted by the reviewer, included elsewhere.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
51717	100	30	106	12	It is noticeable that only chapter 7 includes a separate section on demand-side measures. Given the mitigation potential of demand-side measures in other sectors, these seems to be politically motivated and imbalanced. Consider equal treatment of supply- and demand-side measures for all sectors across different chapters. This could also be well-integrated into chapter 5, which is currently duplicating a lot of the demand-side measures included here.	Noted. Ch. 7 endeavors to assess all relevant and available literature and accordingly, includes discussion on demand-side measures.	Florin Vladu	UNFCCC Secretariat	Germany
6089	100	31	101	2	another underreported risk of plant-based diet: potential higher land use for food plantation in the future due to increasing human population	Rejected. A shift towards sustainable healthy diets could reduce pressure on forests and land used for feed, support the preservation of biodiversity and planetary health	Liwah Wong	EIT Climate KIC, EIT RawMaterials	Germany
86783	100	32	100	35	The term "sustainable diets" has not been discussed nor agreed upon in the relevant multilateral fora. Its scope and implications are not clear, thus we suggest its deletion and replacement along the document for the agreed term "healthy diets" (as per the Rome Declaration on Nutrition, 2014).	Accepted. The term 'Sustainable healthy diets' has now been defined.	Government of Argentina	Ministry of Environment and Sustainable development of Argentina	Argentina
43175	100	35	100	39	35 In addition to climate mitigation gains, a 36 transition towards more diversified and well balanced diets from sustainable food systems (delete: plant-based consumption and reduced consumption of animal-based foods) 37 could reduce pressure on forests and land used for feed, support the preservation of biodiversity and 38 planetary health (FAO 2018), and contribute to preventing forms of malnutrition (i.e. undernutrition, 39 micronutrient deficiency, overweight and obesity) in developing countries (Chapter 12, Section 12.4.). Comment: Please refer to comments on plant-based diets on SPM page 20 lines 23-28	Accepted. The text has been amended.	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
60317	100	35	100	39	"More plant-based consumption" and "reduced consumption of animal-based foods" alone could not contribute to preventing undernutrition and micronutrient deficiency. In fact, many recent studies show that the consumption of animal-based foods is associated with less child stunting in low-income countries (e.g., Headey et al., 2018; Krebs et al., 2011; Dror and Allen, 2011; Headey and Palloni, 2020). Therefore, the health co-benefits of sustainable diets are mostly in non-commnicable diseases in high-income countries. [REFERENCE: (1) Headey, et al., 2018. https://doi.org/10.1093/ajae/aay053; (2) Headey, et al., 2020. https://doi.org/10.1093/jn/nxaa042; (3) Krebs, et al., 2011, https://doi.org/10.1177/156482651103200301; (4) Dror, et al., 2011. https://doi.org/10.1177/156482651103200307.]	Noted. However, the subsection does not compare animal-based diets and "sustainable healthy diets", rather it exclusively focuses on sustainable health diets and their mitigation potentials	Wenchao Wu	National Institute for Environmental Studies, Japan	Japan
81695	100	35	100	41	Suggest change sentence to "In addition to climate mitigation gains, reducing overconsumption (particularly of livestock sourced foods) and reducing food loss and waste could reduce pressure on forests and land used for feed, support the preservation of biodiversity and planetary health, and prevent overweight and obesity." You can reference the results of the study by Payne et al. 2016 (https://doi:10.1017/S136898001600049 5) which details that diets with lower GHG emissions can be highly heterogeneous with respect to nutrients, micronutrients and health outcomes and poor outcomes for sugar and micronutrient intakes can occur.	Accepted. The text has slightly been revised. However, a more recent reference is already cited	Government of New Zealand	Ministry for the Environment	New Zealand
86785	100	35	100	39	The phrase is biased as it does not recognize the important nutritional contribution of meat, as well as its central role in food security and poverty erradication. Additionally, we do not consider it appropriate to generalize on the climate mitigation gains of a plant-based diet vs. an animal based food one.	Noted. However, the subsection does not compare animal-based diets and "sustainable healthy diets", rather it exclusively focuses on sustainable health diets and their mitigation potentials	Government of Argentina	Ministry of Environment and Sustainable development of Argentina	Argentina
73689	100	38			Please distinguish which source it is among the ones by 'FAO' in 2018.	Accepted. The citation has been amended	Raehyun KIM	National Institute of Forest Science	Republic of Korea
46015	100	42	100	45	The sentence "However, transition towards sustainable healthy diets might drive habitat and biodiversity loss (particularly in the Atlantic Forest, Cerrado and Brazilian Amazon), and could have adverse impacts on the economic stability of the agricultural sector (Macdiarmid 2013; Aschemann-Witzel 2015; Van Loo et al. 2017)" should be deleted since it is likely wrong and therefore misleading. None of the mentioned sources describes negative effects on habitats/biodiversity or in the agricultural sector. Furthermore, the paper by Van Loo is about consumer's perception and not appropriate here. Macdiarmid mentions the valid risk for fish populations if meat is substituted by fish - but this is not a risk of shifts towards more plant-based diets. Aschemann-Witzel also entails no substantial sustainability risk of plant-based diets. However, there is scientific evidence that sustainable healthy diets reduce the demand for land compared to diets rich in animal-sourced foods and the dietary shift towards more plant-based diets therefore mitigates and reverses habitat loss as written in the draft earlier.	Accepted. Thanks for the good comment. The text has been revised	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
56261	100	42	100	45	A sentence that is not supported at all by the references provided, which do not correspond (not even on the topic addressed) to any of the claims made. Should be deleted as it does not present any evidence for being supported and generally it goes against the general scientific consensus on plant-based diets. "However, transition towards sustainable healthy diets might drive habitat and biodiversity loss (particularly in the Atlantic Forest, Cerrado and Brazilian Amazon), and could have adverse impacts on the economic stability of the agricultural sector (Macdiarmid 2013; Aschemann-Witzel 2015; Van Loo et al. 2017)" Please delete.	Accepted. The text has been revised	Reyes Tirado	Greenpeace and University of Exeter	Spain
60319	100	42	100	45	It is counterintuitive that transition towards sustainable healthy diets could drive habitat and biodiversity loss. This statement should be verified and if it is really the case, more detailed explanation is expected.	Accepted. The text has been revised	Wenchao Wu	National Institute for Environmental Studies, Japan	Japan
71865	100	42	100	45	why does transition towards sustainable healthy diets drive habitat and biodiversity loss and could have adverse impacts on the economic stability of the agricultural sector?	Accepted. The text has been revised	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
46017	100	47	101	2	The sentence suggests that synergies and conflicts of dietary shifts are in balance and policy makers hence should be careful. Since many scientific papers show that there are much more synergies than conflicts, this sentence should be reformulated.	Noted. The sentence has been revised in the SOD	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
5155	101	2	101	2	Subsidies or gouvernemental incentives to produce cheap vegan processed food, sausages, burgers, nuggets, that would be a cheaper alternative to the traditional, unhealthy, processed food.	Accepted. The sentence has been revised to indicate that a transition towards sustainable diets requires a combination of appropriate policies, financial and non-financial incentives .	Dorota Retelska	FIBL Biological Agriculture Research Laboratory	Switzerland
76967	101	5	101	5	Please clarify what is mean by "emissions from diverted agricultural production".	Noted. The whole sentence has been rephrased.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81701	101	7	101	10	Please check that this sentence is consistent with the SRCCL. One possible way of rewording this sentence is "In particular, balanced diets, featuring plant-based foods, such as those based on coarse grains, legumes, fruits and vegetables, nuts and seeds, and animal-sourced food produced in resilient, sustainable and efficient systems, together with the reduction of overconsumption in regions with high consumption (particularly of animal-sourced foods), as well as a reduction in food loss and waste can have a significant impact on GHG emissions from the food production lifecycle." This aligns with the IPCC Land Report findings. The SPM of the SRCCL does not refer to full substitution of animal products with plant products. Our suggestion also better acknowledges different countries' circumstances (both nutritional and GHG emissions intensity of production systems), and highlights the importance of addressing FL+W. Useful supporting publication: Adegbola T. Adesogan, Arie H. Havelaar, Sarah L. McKune, Marjatta Eilittä, Geoffrey E. Dahl, Animal source foods: Sustainability problem or malnutrition and sustainability solution? Perspective matters, Global Food Security, Volume 25, 2020, 100325, ISSN 2211-9124, https://doi.org/10.1016/j.gfs.2019.100325.	Noted. Thank you. Concening FLW, we have addressed this aspect in sub-section 7.4.1.2 in the SOD	Government of New Zealand	Ministry for the Environment	New Zealand
21525	101	14	101	19	A possibility could appear through the association with a Vegan diet, as this diet appears to be the one with the higher mitigation potentials . But a Vegan diet is completely incompatible with crop-livestock systems which appear to be models of farming for agroecological transitions. With the specialization process, a lot of farmers (including OF) consider that cropping systems, without livestock, are conducing to an agronomic standoff (for organic matter of the soil and control of weeds)	Noted. However, no change has been made becasue the section is limited by a standard scope and word count.	Government of France	Ministère de la Transition écologique et solidaire	France
56095	101	17	101	17	The phrase "balanced diet" is used without detail on what constitutes such a diet. This information should be included in parenthetical text.	Accepted. The whole sentence has been rephrased	Government of United States of America	U.S. Department of State	United States of America
82851	101	17	101	19	Consider removing "(veganism, vegetarianism)" after "featuring plant-based foods", or clarifying it to be "including but not limited to veganism and vegetarianism". While in most cases vegan diets have lower GHG footprints than other diets, there are other plant-forward diets (e.g., "low food chain," "Vegan Before 6" or 2/3 vegan, Meditteranean, New Nordic) that could substantially reduce GHG emissions without necessarily replacing all animal products. In many cases, low food chain and 2/3 vegan dietary scenarios have better GHG implications than lacto-ovo vegetarian diets (e.g., Kim et al. (2019). Country-specific dietary shifts to mitigate climate and water crises. Global environmental change, 101926. https://doi.org/10.1016/j.gloenvcha.2019.05.010). Climate-friendly diets do not require an all-or-nothing approach.	Accepted. The suggested deletion has been made.	Raychel Santo	Johns Hopkins Center for a Livable Future	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
9647	101	20	100	41	I think that the study by Theurl et al. 2020, Sci Tot Env, 10.1016/j.scitotenv.2020.139353 could also be helpful in this para (which does not convey the impression it is based on a large literature review, rather it retells main insights of only two papers, so I propose that more literature sources should be assessed and synthesized for writing this text)	Accepted. The suggested reference has been cited	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
49973	101	20	101	41	In Theurl et al (10.1016/j.scitotenv.2020.139353) we show that diets play a decisive role for the option space including GHG emissions.	Accepted. The suggested reference has been cited	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
11849	101	24	101	30	Springmann et al (2018) doesn't include CO2 emissions in their calculations which means that the statement is not correct. Further, its projections are totally dependent on some assumptions, which should be declared if the article is cited. They assume that population will grow with 50 % and global income grow three times. They also assume that the demand for crop land will increase by 67 percent. Looking back, that assumption seems unsubstantiated. The gross output of global agriculture grew from 3,760 calories per capita to 5,740 calories per capita between 1960 and 2012 while the population more than doubled and consumption of animal products increased a lot. But during the same period global crop land just increased by around 15 percent.	Rejected. The assumptions behind the estimates can be found in the cited reference. These details cannot be provided in the text becasue each section is limited by a standard scope and word count. However, the authors estimate that diet changes in line with global dietary guidelines for total energy intake and consumption of red meat, sugar, fruits, and vegetables, could reduce GHG emissions by 29% and other environmental impacts by 5–9% compared with the baseline in 2050.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
11851	101	30	101	35	It should be noted that the scenario by Poore and Nemecek (editorial: the year is 2018 and not 2019) includes the abandonment of all pastureland as well as the prohibition of pastoralism as a livelihood. Pastoralism constitute the livelihood of hundreds of million people and the land has almost no alternative food producing use. Further, if livestock I culled those pastureland will most likely be populated by wild herbivores, which may be a nice thing, but they are likely to emit more or less the same methane and nitrous oxide as the sheep, camels, cattle and goats they replace. If the reference to the article is kept those issues should be clarified.	Rejected. The assumptions behind the estimates can be found in the cited reference. These details cannot be provided in the text becasue each section is limited by a standard scope and word count.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
10685	101	42	102	6	There appears to be no discussion that reducing considerably the consumption of meat (mainly cattle) provides a very significant mitigating contribution. On the other hand, reducing the consumption of milk and dairy products has an impact 1-2 orders of magnitude weaker than beef or lamb, in terms of climate impact, according to Drew et al (2019) It would be quite useful to demonstrate that an economic and societal model exists where cows produce milk without producing meat; or at least to raise the question.	Rejected. A discussion of meat-based diets is out of the scope of this sub-section.	Philippe Waldteufel	CNRS	France
21593	101	45	101	48	It might be useful to illustrate some of the steps being of political and legal translations taken in different countries. For example, european sstrategy " farm to fork".	Noted. Indeed this might be useful; however, the section is limited by a standard scope and word count	Government of France	Ministère de la Transition écologique et solidaire	France
21527	101	48	101	48	At the Europe level, Prudhomme et al., 2020 found that substituting ruminant products by legumes lead to -231 to -259 MtCO2eq emissions reductions without and with reforestation, with more emissions reductions than a legumes substitution supply-side scenario (-10 MtCO2eq), and that the associated reductions could happen substancially outside of Europe in the scenario without reforestation. https://link.springer.com/article/10.1007%2Fs10113-020-01651-4	Noted. However, the reference has not been cited becasue the subsection is limited by a standard scope and word count	Government of France	Ministère de la Transition écologique et solidaire	France
81699	102	1	102	3	The values presented for plant-based and animal diets (1.2-1.8 kg CO2 kg-1 and 12-21 kg CO2 kg-1, respectively) are incorrect. The values listed are related to the LCA data of whole plant-sourced and animal-sourced food items, respectively (as highlighted by the units). The actual daily GWP100 values for the hypothetical diets of this study can be found in the ESI materials - suggest include these here instead.	Noted. The sentenec has been omitted during the revision of the subsection	Government of New Zealand	Ministry for the Environment	New Zealand
81703	102	1	102	27	Suggest this section includes narratives and references on the limitations of these studies suggesting a shift to plant based diets - i.e. they do not take into account the socio-economic and environmental (including potential increased emissions from potential increases in deforestation) impacts from making the requisite land-use changes to bring about the food supply change, and often do not take into account the lack of availability or affordability of plant based high nutrition alternatives in developing countries.	Rejected. No room for including these details as the the subsection is limited by a standard scope and word count	Government of New Zealand	Ministry for the Environment	New Zealand
10687	102	10	102	10	replace "if" by "is"	Noted. The whole sentence has been revised.	Philippe Waldteufel	CNRS	France
50847	102	11	102	11	"3.95 ± 0.96 in GHG emissions appear possible", 3.95± 0.96 Mt CO2_eq yr-1 or t CO2-eq capita-1?	Noted. The sentence to which the comment refers has been omitted during the revision	Wen Zhang	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
4743	102	18	102	18	I suggest also referrring to the following study, which shows that switching to a healthy diet in the US keeps GHG emissions essentially unchanged. In the United States, switching to the healthy diet that meets the Dietary Guidelines for Americans (DGA) but remains closest to the current diet keeps GHG emissions essentially unchanged, while switching to a DGA-compliant vegetarian diet or a DGA-compliant omnivore diet that minimizes energy consumption in the food system reduces life-cycle GHG emissions by 32% and 22%, respectively (Hitaj et al. 2019). Hitaj, C., Rehkamp, S., Canning, P. and C. J. Peters, 2019: Greenhouse gas emissions in the United States food system: current and healthy diet scenarios. Environ. Sci. Technol., https://doi.org/10.1021/acs.est.8b06828.	Rejected. The suggested reference is irrelevant to the corresponding paragraph. The paragraph focuses on the mitigation potentials and the gains (=GHG emission reductions) from a transition towards sustainable healthy diets.	Claudia Hitaj	Luxembourg Institute of Science & Technology	Luxembourg
71867	102	21	102	26	Are affluent diets (line 26) the same as healthy diets (line 22)?	Noted. The sentence to which the comment refers has been omitted during the revision	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
37501	102	24	102	26	The sentence "Decreased environmental impacts…." is poorly articulated. How can those who consume above recommended dietary energy have decreased environmental impacts. What you mean is that if people who presently consume above the recommended dietary energy shift to a healthy diet, this would result in decreased environmental impacts.	Accepted. The who sentence has been re-phrased during the revision	Government of India	Ministry of Environment, Forests and Climate Change	India
18367	102	28	102	40	The authors should note the difficulty of pursuing such policies at the national or regional scale without joined up activity: The market feedbacks in a globalised supply chain are complex, and reduced consumer demand in a single territory or region could leverage price impacts that result in consumption increases and rebound effects in other areas that erode or even negate national gains. See for example https://www.sciencedirect.com/science/article/pii/S0959652618338496	Accepted. Due to space and word count limitations, this cannot be explicitly mentioned. However, the last sentence in the revised version of the sub-section indirectly embed this meaning.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
60321	102	28	102	40	In the critical assessement and conclusion part, two points could be mentioned. (1) As the definition of FAO and WHO 2019 for sustainable healthy diets also include other dimensions that might cause trade-off, such as affordability and cultural acceptability, these aspects should also be covered in the dietary transition; (2) So far the scientific community understands well the environment and health benefits of sustainable healthy diets transition. But we have limited knowledge about how we could achieve it and more research is expected.	Rejected. The FAO definition is already included and the corresponding reference is cited. The space and word count limitations does not allow for such level of details.	Wenchao Wu	National Institute for Environmental Studies, Japan	Japan
71869	102	41	103	46	food loss and food waste are very different and should not be discussed together because they arise at different places along the food chain and have fundamentally different solutions.	Accepted. Each of these two terms (food loss, and food waste) has been defined in the first paragraph of the revised sub-section	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
82847	102	41	103	46	Section 7.4.5.2 Reduce food loss and waste. In case of home food production, particular way of garden management (including composting) is important for the GHG mitigation potential (Cleveland et al. 2017). Domestic animals are seen as part of household economic cycle and fed with food waste which means less waste and efficient use of food (Vávra et al. 2021). Home produced food is treated as more valuable than food from shops and, for example, rather composted (more environmentally friendly way) than thrown away to regular waste containers (Sosna et al. 2019). Cleveland, D.A., Phares, N., Nightingale, K.D., Weatherby, R.L., Radis, W., Ballard, J., Campagna, M., Kurtz, D., Livingston, K., Riechers, G., Wilkins, K., 2017. The potential for urban household vegetable gardens to reduce greenhouse gas emissions. Landsc. Urban Plan. 157, 365e374. https://doi.org/10.1016/j.landurbplan.2016.07.008. Sosna, D.; Brunclíková, L.; Galeta, P. (2019) Rescuing things: Food waste in the rural environment in the Czech Republic. Journal of Cleaner Production 214, 319–330. Vávra, J. Smutná, Z., Hruška, V. (2021). Why I would want to live in the village if I was not interested in cultivating the plot? Home gardening in rural Czechia. Sustainability 13(2): 706. doi: 10.3390/su13020706.	Rejected. The comment is unclear and the focus of the subsection is not on home gardening, rather it is on the mitigation potential of reducing food loss and waste	Jan Vávra	University of South Bohemia	Czech Republic
83887	102	41	103	46	Last report on food waste - United Nations Environment Programme (2021). Food Waste Index Report 2021. Nairobi. https://wedocs.unep.org/bitstream/handle/20.500.11822/35280/FoodWaste.pdf	Accepted. The reference (UNEP, 2021) has been cited.	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
76385	102	42	102	44	Van der Voor and Pedercini (2013) showed that Food loss occurs through spoilage, spilling or other unintended consequences due to limitations in agricultural infrastructure, storage and packaging, especially in developing countries. Pedercini, M., and Voorn, van der, T. Global food and nutrition scenarios, a background paper prepared for the World Economic and Social Survey 2013. UN World Economic and Social Survey 2013. Sustainable Development Challenges. United Nations publication. E/2013/50/Rev. 1. ST/ESA/344.	Noted. However, a more recent reference is already cited.	Tom van der Voorn	Institute of Environmental Systems Research	Netherlands

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
24993	102	45			Add: "Food waste also occurs in the food supply chain prior to the consumer due to socio-economic relations between powerful supply chain actors and their suppliers – including overproduction, cosmetic out-grading, and unfair trading practices. This occurs particularly in developed countries and developing countries exporting to developed countries." Justification: There is considerable evidence for the existence of food waste in the supply chain due to overproduction, cosmetic outgrading and unfair trading practices (Gille, 2012; Gunders, 2012; Colbert and Stuart, 2015; Colbert, 2017a, 2017b; Bowman, 2018; Devin and Richards, 2018; Gascón, 2018; Soma, 2018; Johnson et al., 2019; Sinclair Taylor, Parfitt and Jarosz, 2019; Stangherlin, Duarte Ribeiro and Barcellos, 2019; Markou et al., 2020; Messner, Johnson and Richards, 2021). There is a lack of data globally on primary production food waste, and particularly food left unharvested (Stenmarck et al., 2016; Redlingshöfer, Coudurier and Georget, 2017; Hartikainen et al., 2018; Porter et al., 2018) – however, evidence suggests that this is likely to be high in both developed countries (FAO, 2011; Hartikainen, 2017; Redlingshöfer, Coudurier and Georget, 2017; Devin and Richards, 2018; Garcia-Herrero et al., 2018; Hartikainen et al., 2018; Johnson, 2018; Johnson et al., 2018; Porter et al., 2018; WRAP, 2019; Messner, Johnson and Richards, 2021) and developing countries (Clapp, 1994; FAO, 2011; Gille, 2012; Colbert, 2015, 2017a, 2017b; Colbert and Stuart, 2015; Soma, 2018). FAO have previously estimated that 32% of global food waste occurs at agricultural level (distinct from the post-harvest stage, where an additional 23% of food waste occurs) – this is more than any other stage of the supply chain (FAO, 2011). Reporting of post-harvest losses is required for the FAO's Food Loss Index, but measuring and reporting harvest losses through for instance crop cutting surveys is optional (Fabi, 2017) and in practice no country (to Feedback's knowledge) has yet reported robust national level data – a global data gap which urgently needs to be filled in light of the considerable evidence from smaller-scale studies and estimates cited above.	Rejected. Most of the suggested additions are already reflected in the text. In addition, the space and word count limitations does not allow for such level of details.	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
63063	102	45	102	45	Please delete 'other unintended consequences'.	Rejected. The suggested deletion is unjustified. The definition of food loss in the sub-section is based on definitions reported in the cited references	Changke WANG	National Climate Center, China Meteorological Administration	China
72669	102	45	103	4	This may be more of an issue with my limited knowledge of these approaches, but I think the mitigation activities need to be more clearly explained. Is this a shift from ch4 to co2 emissions by diverting waste away from landfills? The listed practices are all post growth/harvest, and the food waste has to go somewhere, and it still generates fairly immediate emissions regardless of its final disposition. Do people eat it? Is it composted? It seems like a primary pathway for emissions reductions is in lowering land use, land conversion, fertilization, etc; in essence the potential benefits of a corresponding reduction in production and increase in production efficiency. Unless there is large reduction associated with reducing methane emissions from food in garbage.	Noted.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
24995	102	46	102	48	Removal: "Food waste typically takes place at the distribution (retail and food service) and consumption stages in the food supply chain and refers to food appropriate for human consumption that is discarded or left to spoil (HLPE 2014)" Explanation: This claim is often repeated in the literature, but there is a lack of evidence for this assertion. There is considerable evidence that large volumes of food waste occur intentionally due to socio-economic causes at primary production level in developed countries, including pre-harvest, harvest and post-harvest levels (FAO, 2011; Hartikainen, 2017; Redlingshöfer, Coudurier and Georget, 2017; Devin and Richards, 2018; Garcia-Herrero et al., 2018; Hartikainen et al., 2018; Johnson, 2018; Johnson et al., 2018; Porter et al., 2018; WRAP, 2019; Messner, Johnson and Richards, 2021) – and that this also occurs in developing countries particularly when exporting to developed countries (Clapp, 1994; FAO, 2011; Gille, 2012; Colbert, 2015, 2017a, 2017b; Colbert and Stuart, 2015; Soma, 2018). There is considerable evidence that large volumes of food waste occur intentionally due to socio-economic factors rather than technical and infrastructural limitations at manufacturing level in developed countries (FUSIONS, 2016; Sheppard and Rahimifard, 2019; WRAP, 2020). Currently available evidence suggests that comparatively low volumes of food waste often occur at the retail stage in developed countries (FAO, 2011; FUSIONS, 2016; WRAP, 2020) – although there is evidence that retailer policy is a factor in causing considerable levels of food waste in their suppliers through such policies as cosmetic standards and unfair trading practices (Gille, 2012; Gunders, 2012; Colbert and Stuart, 2015; Colbert, 2017a; Bowman, 2018; Devin and Richards, 2018; Gascón, 2018; Soma, 2018; Johnson et al., 2019; Sinclair Taylor, Parfitt and Jarosz, 2019; Stangherlin, Duarte Ribeiro and Barcellos, 2019; Markou et al., 2020; Messner, Johnson and Richards, 2021). There is strong evidence that more food waste arises at the consumer and food service stages in developed countries than in developing countries – but the evidence suggests that food loss in the supply chain is replaced by food waste due to the reasons cited above.	Noted. The amended text of the FLW subsection takes most of these aspects into consideration.	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
24997	102			49	Replace "taxing and other incentives to reduce retail and consumer-level waste in developed countries" with "taxing and other incentives to reduce business and consumer-level waste in developed countries". Explanation: As noted in evidence provided above, considerably less food is wasted at the retail stage than at primary production, manufacturing and catering stages in almost all developed countries – so taxes and incentives should not be focused on retailers only, although their behaviour does often contribute to food waste in their suppliers.	Accepted. The suggested change has been made.	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
1177	103	1	103	1	add "improved packaging" to the list of options that can reduce food waste. Use the following references to support the added text. Elisa Poyatos-Racionero, Jose Vicente Ros-Lis, José-Luis Vivancos, Ramón Martínez-Máñez, Recent advances on intelligent packaging as tools to reduce food waste, Journal of Cleaner Production, Volume 172, 2018, Pages 3398-3409, ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2017.11.075. (http://www.sciencedirect.com/science/article/pii/S095965261732735X) and Wikström, F.; Williams, H.; Trischler, J.; Rowe, Z. The Importance of Packaging Functions for Food Waste of Different Products in Households. Sustainability 2019, 11, 2641. https://doi.org/10.3390/su11092641	Noted. The corresponding sentence already refers to "investing in harvesting and post-harvesting technologies", which includes "packaging".	Reid Miner	Private Consultant	United States of America
24999	103	1			After: "in developed countries", Add: "mandatory food waste reporting and reduction targets for large food businesses, regulation of unfair trading practices, active marketing of cosmetically imperfect products". Explanation: It is important recognise regulatory solutions to food waste arising in the pre-consumer supply chain – such as unfair trading practices legislation (EU Platform on Food Losses and Food Waste, 2019, p. 10; Sinclair Taylor, Parfitt and Jarosz, 2019) and mandatory food waste reporting and targets (HM Government, 2018; EU Platform on Food Losses and Food Waste, 2019, p. 27; Tesco PLC, 2019). Creative marketing of cosmetically imperfect practices can significantly reduce cosmetic outgrading (Federico, Dewitz and Magdalena, 2017; van Giesen and de Hooge, 2019).	Accepted. The suggested addition has been included in the revised version of the subsection	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
25001	103	19			Add: "Styles et al. (2020) found that reducing UK food waste by 50% from farm to fork through ambitious regulation, with afforestation on the roughly 3 million hectares of grassland spared by this domestically and overseas, would save approximately 51 MtCO2-eq yr−1, and also spare approximately 0.8 million hectares of cropland domestically and overseas for food production." Explanation: An adapted version of this Life Cycle Assessment has been submitted for peer review, and is expected to be published later in 2021.	Rejected. The article based on which the estimates are based has not yet been published.	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
25003	103	40			After: "and reducing food losses along food supply chains by 2030." Add: "Champions 12.3 recommend that states aiming to achieve SDG 12.3 should apply the "halve per capita" in practice to food losses and waste along the whole supply chain from the point that crops and livestock are ready for harvest or slaughter to the consumer level (Hanson, 2017)." Justification: It is inconsistent and counter-productive to apply a concrete 50% reduction target for food waste at retail and consumer level, and only aim for non-concrete "reduction" for food loss and waste at other stages of the supply chain. As has been argued elsewhere, there is ample evidence that food loss and waste are considerable in primary production, manufacturing and catering sectors also. We therefore strongly recommend that the IPCC cite the Champions 12.3 recommended best practice, which was intended to correct this illogical restriction of the 50% reduction target to retail and consumer stages. That reduction is recommended "from the point that crops and livestock are ready for harvest or slaughter" (Hanson, 2017) emphasises that harvest food waste (i.e. edible food left unharvested in the field) should be included in global measurement and reduction efforts.	Rejected. The revised version of the text already includes some of these ingredients. In addition, the space and word count limitations does not allow for such level of details.	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
17049	104	1	106	12	As the world's population increases, many resources are needed, so it is important to actively use sustainable resources such as wood. As the area of planted forests in the world is increasing (FRA 2020), the supply of wood products obtained from sustainably managed forests will increase. Demand for wood products should be increased to mitigate climate change of increased use of other materials. Therefore, the carbon storage and material substitution of wood products should be emphasized and the use of wood products should be recommended.	noted, the section reflects this. thank you	Yukari Matsumura	Institution	Japan
49975	104	1	106	12	When "enhanced use of wood" is listed as mitigation measure, I wonder why "reduction of wood use" is not also mentioned. With the decarbonization of the industiral system, the comparative advantages of using wood (if the exist at all in the sort run) diminish - and many trade-offs relate to the harvest and managment of forests: biodiversity, biophysical impacts (10.1126/science.aad7270, 10.1038/s41586-018-0577-1) that could be reduced if forest use was decreased. Also, most of the wood products are short-lived (paper, boards) that could substituted with other materials (e.g. from cropland or recycling) or replaced by digitalization trends.	we changed the title to modified wood use. biophycal efects of forest management are in 7.2.4. we treat conservation in other sections 7.4.2.1 and 7.4.2.6. we balance all messures in the whole 7.4	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
49977	104	1	104	1	the term "enhanced" is ambigous. What does it mean? More wood? Better use of wood, higher efficiency? Improved management? Longer-lasting products? Needs an unambigous term	we changed the title to modified wood use	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
56097	104	2	104	5	What about storage in wood products in landfills? If not covered in this chapter, refer readers to where this topic is covered.	reject. life time of wood is treated in the HWP section. landfills are outside scope	Government of United States of America	U.S. Department of State	United States of America
77685	104	2	104	28	While improving the management of wood production forests and enhancing wood products is commendable, it has lower mitigation value in natural forests than encouraging long-term recovery (Keith et al 2015, Moomaw et al 2019, cited above)	reject, although it may be true. we treat conservation in others section. 7.4.2.1.	Virginia Young	Australian Rainforest Conservation Society	Australia

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28703	104	3	104	3	fate'? - one definiton: a power beyond human control. Should this not be 'market choice'?	reject, it is not always a market choice	Delton Alderman	USFS	United States of America
49989	104	5	104	7	It needs a mention here that the overall C balance depends on the comparative lifetime. How long is C stored in wood products, and how long in forest biomass and soils? With forests usually becoming easily older than 250 years (with 300 years many forests still show net-sequestration; 10.1038/nature07276 -which means, their lifetime is even much longer), wood products have to "compete" with this lifespan. This should be made clear first hand. Than, the potential of moving from todays average lifetime to a longer one with current harevest:increment ratios should be elaborated.	reject, although it may be true. we treat conservation in others section. 7.4.2.1. we have to balance all measures, while conservation will be needed, also renewable resources will be needed	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
48761	104	8			As mentioned in the first observation, native species use to have long-lived wood products, increasing lifetime of the sequestration. Another fact to consider the distinction beween exotic and native species trees in the management.	reject, this is not always true. native species lke oak and beech (Europe) are used pre dominantly for firewood.	Alfredo Erlwein	Soil Science Institute, Universidad Austral de Chile	Chile
1179	104	13	104	13	The sentence is incomplete without a mention of the research pointing of the potential, in some instances, for landowner responses to reverse these losses. The following phrase should be added to the sentencje. "...although, in some cases, it appears that landowner responses to increased demand can reverse these losses over time." The following references can be used to support the added text. Abt, K., R. Abt and C. Galik, Effect of Bioenergy Demands and Supply Response on Markets, Carbon, and Land Use, Forest Science 58(5) 2012 and Favero et al., "Forests: Carbon sequestration, biomass energy, or both?", Science Advances. 2020; 6 : eaay6792 25 March 2020	reject, we point in L 17-19 a short term effect of harvest. in L 14-16 we point at longer term effect, provided the management is sutainablly done	Reid Miner	Private Consultant	United States of America
9649	104	14	104	17	The sentence starting with "First of all, ..." is highly problematic. This reads like marketing speach of the forest industry. The statement is highly speculative ("could potentially activate or lead to"), but the aim is obviously to create the impression that this were an effect that is to be expected or at least very likely. This highly contentious statement (forest ecologists probably would have the opposite opinion, and large literatures exist that find the contrary, see e.g. See e.g. Pingoud, et al. 2018. J Environm Manage 210, 96–103. https://doi.org/10.1016/j.jenvman.2017.12.076, Campbell et al. 2012. Frontiers in Ecology and the Environment 10, 83–90. https://doi.org/10.1890/110057, Luyssaert et al. 2018. Nature 562, 259–262. https://doi.org/10.1038/s41586-018-0577-1, Naudts et al. 2016. Science 351, 597–600. https://doi.org/10.1126/science.aad7270, Schulze et al., 2012. GCB Bioenergy 4, 611–616. https://doi.org/10.1111/j.1757-1707.2012.01169.x, Haberl, H. 2013. GCB Bioenergy 5, 1–2. https://doi.org/10.1111/gcbb.12004, Holtsmark, B., 2012. Climatic Change 112, 415–428. https://doi.org/10.1007/s10584-011-0222-6) is made based on only one reference, not on an assessment of the literature (as is required in an IPCC product).	sentence has been removed	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
76969	104	14	104	14	The benefits and risks also depend on what is being replaced by the product or whether it replaces anything (or used for something that would otherwise not be produced).	accept, but we point at subsitution uncertainty in L 33-36	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
49979	104	17	104	17	The paper qouted here (Verkerk) does not show this, but claim this. It is more a commentary than an empirical study that would give evidence or substantiate the claims. For the sake of a balanced assessement style, this should be made clear.	sentence has been removed	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
49983	104	17	104	19	The text as it is written suggest the two effects to be equal, or side-by-side. But on the short term, the effect of C-stock reduciton in forests is much stronger. It mobilizes a stock that needs to be compansated by fluxes. The resulting parity time is imporant here (This also holds true in cases where forests are returning, as the existing sinks will immediately be reduced). The assertion needs to make this slow-in/rapid out characteristic (10.1126/science.1084460) serious and bring the arguments in a balanced way.	reject, not true. sustainable mangement at larger scales, the fluxes in and out compensate and ther is still a sink	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
63721	104	17	104	19	Whether or not increasing harvest for wood products decrease carbon storage only for the short term depends on a variety of factors. Suggest revising as follows: "...but that would decrease carbon storage in forest biomass in the short term, with the period of reduced carbon storage relative to not harvesting dependent on factors such as the age of the forest, species and harvesting and forest regeneration practices"	reject, current line is correct, and described well	Government of Canada	Environment and Climate Change Canada	Canada
9651	104	18	104	19	Permanently increased harvest in forests (even at sustainable levels of wood harvest) reduce the long-term equilibrium C stock of the forest, so it is not correct to state that this were only a short-term effect. See Holtsmark 2012 Climatic Change, Pingoud 2018 J Environm Manage and many other works	sentence has been revised, reference to short term has been removed	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
9653	104	19	104	22	Reducing harvests locally only leads to raised harvests elsewhere if timber use is not reduced. This is a bit of a strawman argument. In my view this whole part (lines 14-28) needs to be redrafted for clarity. The main process is that over long periods of time, above the Maximum Sustainable Yield (MSY) level (i.e. "optimal forestry" in terms of maximized timber production of the forest), there is a tradeoff between the long-term equilibrium C stock of the forest. This immediate follows from the relation between rotation time and equlibrium C stock of the forest. At MSY (i.e. optimal wood harvest), aboveground C stocks in the forest are at about 50% of the long-term maximum of the climax ecosystem (old-growth forest with patch dynamics according to Shugart). Below MSY, C stocks and harvests fall with rotation period, hence this is to be avoided. MSY is the economic optimum, i.e. maximum sustained wood harvest, but has the lowes C stock (except for the to-be-avoided situation below MSY). Above MSY, the lower the harvest, the higher the C stock, and vice versa, because longer rotation period means that the average stand age is higher, which means C stocks are larger. The discussion here seems to aim at blurring these interrelations rather than clarifying the underlying processes	sentence is phrased to indciate it may happen and supporting references are given. no change, also due to space limitations	Helmut Haberl	University of Natural Resources and Life Sciences, Vienna	Austria
73691	104	19			Please distinguish which source it is among the ones from 'Smith et al.' in 2019.	reference to SRCCL, Chapter 6	Raehyun KIM	National Institute of Forest Science	Republic of Korea
49981	104	20	104	22	This is principally true - but then the mitigation measure should be, as with food/feed, that less wood products are used. Like this, the caveat introduced by the half-sentence results in a bias. The argument of "reducing the demand for wood products" is important here. As said above, this measure of reduced consumption is missing in overall terms. It all has to do with the turnover time of wood products compared to (recovering) forests. And the large potentials already discussed for forest restoration (10.1038/nature25138, 10.1111/gcb.13876, 10.1038/s41586-020-2784-9) need to be factored in here.	reject, although it may be true. we treat conservation in others section. 7.4.2.1. we balance all measures, while conservation will be needed, also renewable resources will be needed	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
8133	104	22	104	22	Reference "Kallio and Solberg 2018 is missing in the references' list, please add.	thank, refs are updated	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
49985	104	23	104	23	the text suggests there are environmental risks only with poor management. But risks and impacts prevail also with "sustainable use" practices (NB, sustainable in forestry relates to sustainable production, and not sustainability in terms of e.g. SDGs), because harvesting wood and species selection is associated with impacts such as biodiversity impacts (eg. Marques: 10.1038/s41559-019-0824-3), biophyscial impacts (in Europe with the long history of "sustainable forestry". The assertion made by the EEA that 70% harvest:increment ratio represents a sustainability threshold, and that most countries in Europe are far above this value, is key here and needs a mention (https://www.eea.europa.eu/data-and-maps/indicators/forest-growing-stock-increment-and-fellings-3/assessment). Ignoring this source is not an option, given the key role the EEA plays in Europe's environmental policy and the pivotal role of Europe for sustainable forestry as global role model.	reject, although it may be true. we treat conservation in others section. 7.4.2.1. we balance all measures, while conservation will be needed, also renewable resources will be needed	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
63723	104	42	104	42	Replace "...if harvested wood products are used for products with long carbon retention time" with "if harvested wood is used for products with long carbon retention time"	accept, edits are made overall to improve	Government of Canada	Environment and Climate Change Canada	Canada
29641	104	43	104	44	Enhanced use of wood products is currently not considered in integrated assessment models used for mitigation pathways. Please consider elaborating on the reasons for this. However, we believe the potential for such applications are useful for policy makers. Please consider including information about the significant potential in the Technical Summary.	reject, outside scope in this section. does come back in future research needs	Government of Norway	Norwegian Environment Agency	Norway
50001	104	43	104	44	In IAMs it is even not clear to which degree harvest-C-stock interlinkages are represented, and many forest use and managemetn aspects are missing. See e.g. https://doi.org/10.5194/essd-10-2141-2018. The statement should be broadened.	accept, but lack of space,. we need ot shorten section as whole	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
63725	104	47	105	3	Description of carbon storage in wood products as a "sink" may be confusing to some readers as, strictly speaking, it is not a sink per the definition of "sink" in the glossary (i.e. a process, activity or mechanism which removes GHGs from the atmosphere). Rather, the forest acts as a sink and wood products involve the transfer of carbon from the forest to the wood products pool where the carbon is stored for varying periods depending on the product. In keeping with the IPCC production approach which most but not all countries use, the cited study by Johnston and Radeloff (and other studies) assumes that the carbon in wood that leaves the forest is accounted as an emission in the forest, so that it can then be counted as a removal (sink) for wood products. Thus, any counting of the wood product sink must also consider the emissions/removals in the forest as well as the matieral subsitutation impacts to form a balanced view of the net mitigation potenial of using more or less wood. This is noted earlier and later in the section. For clarity, suggest the following revision: "A global forest sector modelling study (Johnston and Radeloff 2019) estimated that carbon storage in wood products represented a net sink of 0.34 GtCO2-eq yr-1 globally in 2015 and which could provide provide an average mitigation potential of 0.33-0.41 GtCO2-1 eq yr-1 for the period 2020-2050, based on the future socio-economic development (SSP scenarios) and its effect on the production and consumption of wood products. In this study the removal of harvested carbon from the forest for products was treated as an emission, so that storage of the wood in the products then constitutes a sink."	accept, replaced to ' increase in stock'	Government of Canada	Environment and Climate Change Canada	Canada
76971	104	48	104	48	"Storage in wood products represented a net sink of": it would be more apropapriate to refer to increase in the HWP pool. Wood products do not meet the definition of "sink" as they do not remove carbon from the atmosphere (just delay of emission of carbon removed by trees).	accept, replaced to ' increase in stock'	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
76973	105	1	105	4	Please explain what "mitigation potential" estimates include. Is it just the HWP pool itself, or includes a full comparison with a counterfactual AFOLU scenario (including land use and alternative fates of biomass)?	accept done. speciefied it is HWP pool	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
56099	105	3	105	4	What is 'traded feedstock' if it is not traded in terms of substitution (the next sentence says it is not)?	accept, clarified	Government of United States of America	U.S. Department of State	United States of America
49987	105	10	105	13	It needs to be mentioned here that Churkina do not assess the impact of additional harvest on the C-balance of ecosystems, but claim shifts in the use portfolio (from paper to construction wood) which is of course possible, but also not straightforward to achieve. The text should include this aspect. Likewise, the paper by Hertwich (10.1088/1748-9326/ab0fe3) shows the large comparative per-unit-product benefits of construciton wood, but also introduces the disclaimer that it is inknown today what increased wood harvest will do to the existing forests and that- given the already high harvest pressure in many forests (eg. https://www.eea.europa.eu/data-and-maps/indicators/forest-growing-stock-increment-and-fellings-3/assessment)- it is unclear how much wood is available in overall terms and how much degradation this could cause. Here I would add: and when conserving the sink function is important - and that obviously is the case for many nations to achieve the GHG mitigation targets - the potentials are probably much smaller).	reject, . reviewer oposes any kind of wood use. we treat conservation in others section. 7.4.2.1. we balance all measures, while conservation will be needed, also renewable resources will be needed	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
25049	105	17	105	19	suggest adding the word temporary in the following sentence "Another study (Oliver et al. 2014) estimated that using wood to substitute for concrete and steel as building materials could provide a technical mitigation potential of 0.78-1.73 GtCO2 yr-1 achieved through temporary carbon storage in wood products and through material and energy substitution." In addition, more and more research papers are questioning the concept of buildings as carbon sinks in carbon accounting and this should be acknowledged here. We recommend insist adding a reference to the following paper "Based on a typical LCA study, it is possible to test the overall LCA impacts of wood building construction against a concrete building, controlling for the GHG impacts of three different forest management scenarios: a silvicultural success rate of 90 per cent, a net permanent loss of soil carbon attributed to a clear-cut harvest and carbon losses from the conversion of primary forest to secondary managed forest.1 Compared to a baseline that assumes biogenic carbon emissions are zero over the building life cycle, cradle-to-gate life-cycle emissions for wood buildings increased between 5 and 72 per cent depending on the scenario. Aggregating these impacts suggests that a wood building could have greater embodied emissions than a concrete building (see Figures ES1 and ES2). [Emission Omissions: Carbon accounting gaps in the built environment, Life-cycle assessment (LCA) studies are the best tool we have to measure the carbon footprints of building products at each phase of their lifespan, but they have some flaws. By Seton Stiebert, Daniella Echeverría, Philip Gass, Lucy Kitson on April 1, 2019] We also recommend checking data used for product comparison. There are many estimations of material related embodied emissions out there and we believe all assessment should be represented here. To provide a better idea of the ranges we recommend adding the following reference figure 5 of the following report https://www.chathamhouse.org/sites/default/files/publications/research/2018-06-13-making-concrete-change-cement-lehne-preston.pdf. Source: Authors' analysis of data from Hammond and Jones (2011), Inventory of Carbon & Energy V2.0.	reject, we do point at large uncertainty in LCA of products. L 34-35. and several other place.	|Claude Lorea	GCCA	Belgium
1181	105	19	105	19	Add a sentence indicating that the substitution benefits of WTE are addressed in the Chapter in Energy (at least they should be).	reject, not necessary. we need to cut text	Reid Miner	Private Consultant	United States of America
73693	105	28			Please make the authors' names same between the in-text citation and the one in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
63727	105	32	105	35	Smyth et al. 2018 should be Xu et al. 2018, and Xu et al. 2020 should deleted (not in reference list). Note that some of the studies cited are sub-national. For Mexico could add Olguin et al. 2018. Applying a systems approach to assess carbon emission reductions from climate change mitigation in Mexico's forest sector. Environ. Res. Lett. 13 doi.org/10.1088/1748-9326/aaaa03	thank, refs are updated	Government of Canada	Environment and Climate Change Canada	Canada
1183	105	35	105	35	Suggest adding the following study to the citations shown here. Upton, B., R. Miner, M. Spinney and L. Heath. 2008. The greenhouse gas and energy impacts of using wood instead of alternatives in residential construction in the United States. Biomass and Bioenergy. 32 (2008) 1-10, January 2008, Elsevier	thank, refs are updated	Reid Miner	Private Consultant	United States of America
76975	105	45	105	48	The last statement ("Finally") should be presented up front, as it is essential for the framing and understanding of HWP and its benefits.	reject. we also point at forest management risks at P 104, L 22-28.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73695	105	48			Please make clear the publication year of the work 'Smyth et al.'.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
151	106	3	106	6	Please add the capitalized words to the sentence: "There is strong evidence and high agreement at the product level that material substitution provides benefits for climate change mitigation as wood products are ON AVERAGE associated with less FOSSIL greenhouse emissions over their lifetime compared to products made from emission-intensive and non-renewable materials". These additions are necessary, as there are also wood-based products with no apparent substitute (e.g. hygiene papers) and there can be wood-based products whose emissions are higher compared to alternative products. Importantly, substitution impacts measure fossil emissions only, while the biogenic impacts are captured by changes in the forest carbon sinks in the LULUCF sector. The overall emissions of wood-based products are thus in most cases higher than for fossil products per functional unit, while only the fossil emissions are lower.	accept ,done	Elias Hurmekoski	University of Helsinki	Finland
49991	106	4	106	12	This is true at the product level, but scale effects are key here and need to be explicitly stated. The overall affects per area or in total are not necessairly the same (as the analoguous with organic farming shows us). Scale effects are important and the "medium confidence" assertion is based on studies that do not take the turnover-time differences or increased harvest-C-stock repercussions into account and only regard the direct C-balance of forests, but not the "sink forgone", and also ignor the decarbonization trends of the industrial system. I do not see more than "low agreement" in overall terms, so this should be low confidence (see qoutes on pg 105 ln 48). Furhtermore, as stated, the text fails to assess the GHG effects of reduced wood product consumption altogether.	reject, term medium confidence is certainly warranted. there is a lot of convincing evidence on the role of HWP in buildings. .	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
153	106	7	106	9	This statement must be revised or at least specified to refer to a certain time span and region. There is abundant evidence that the substitution impacts and HWP carbon sinks associated with an increase in harvest level are on average smaller than the associated reduction of the forest carbon sink, in the short to medium term (at least for several decades in the European and boreal context: see Chen et al. 2018. https://doi.org/10.1093/forestry/cpx056; Gustavsson et al. 2017. https://doi.org/10.1016/j.rser.2016.09.056; Gustavsson et al. 2021. https://doi.org/10.1016/j.rser.2020.110435; Heinonen et al.2017. https://doi.org/10.1016/j.forpol.2017.03.011; Jonsson et al. 2021. https://doi.org/10.1016/j.techfore.2020.120478; Köhl et al. 2020. https://doi.org/10.1016/j.ecolind.2019.106057; Lundmark et al. 2014. https://doi.org/10.3390/f5040557; Matsumoto et al. 2016. https://doi.org/10.1007/s10310-016-0527-4; Pingoud et al. 2018. https://doi.org/10.1016/j.jenvman.2017.12.076; Seppälä et al. 2019. https://doi.org/10.1016/j.jenvman.2019.06.031; Smyth et al. 2014. https://doi.org/10.5194/bg-11-3515-2014; Soimakallio et al. 2016. https://doi.org/10.1021/acs.est.6b00122; Valade et al. 2018. https://doi.org/10.1186/s13021-018-0113-5; Werner et al. 2010. https://doi.org/10.1016/j.envsci.2009.10.004). That is, compared to baseline and ignoring systemic impacts such as carbon leakage, an increase in harvest level leads to an increase of CO2 concentration in the atmosphere at least for decades, despite the substitution impacts and HWP carbon sink. Thus, one can argue that forest products contribute to climate change mitigation, but only in the very long-term.	accept, done with specification of sustainably managed.	Elias Hurmekoski	University of Helsinki	Finland
56101	106	14	115	20	The entire section on IAMs suffers from lack of clarity in regard to what is included and how in the modeling and, more importantly, what assumptions are being made as part of the included parameters and mitigation options. For example, there is no discussion here on the mechanics or assumptions regarding BECCS within the IAMs and results presented here. This section needs to make it clear that BECCS in IAMs relies on a carbon neutral assumption. Also, it needs to make it clear to what extent these BECCS values are being counted in the other relevant chapters. Obviously, here in the IAM results, the net negative attributes of BECCS are indeed being included and therefore should not be in other chapters. It is essential to make mapping clear to other estimates in other chapters.	Noted. Not enough space in chapter 7 but details are listed in the Annex.	Government of United States of America	U.S. Department of State	United States of America
71871	106	14	115	20	Section 7.5 modeling approaches all follow an approach that leads to certain temperature outcomes (eg 2°C) and provides insights into what that would mean in terms of mitigation needed in the AFOLU sector. This is certainly important, but this approach needs to be contrasted with approaches that start from assumptions of policy or behavioral change (such as 'vegetarian or Mediterranean diets; grassfed ruminants; adoption of lab grown meat, etc.) in order to see what kind of transformational change reaching the temperature targets actually entails.	Noted. This is totally true but maybe misunderstood. All these scenarios are based on exactly such unerlying assumptions such as dietary changes. This can also be seen in the selection of the IPs.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
77687	106	15	106	47	This section would benefit from including some discussion of the new information/accounting system developed by UNSEA-EA to help increase understanding of the importance of ecosystem condition for the provision of all ecosystem services including carbon sequestration and long-term carbon storage. Keith et al explore the usefulness of the UNSEA-EA approach in their 2021 paper and suggest a comprehensive accounting framework utilising a natural baseline to facilitate decision making (Keith H, Vardon M, Obst C, Young V, Houghton RA, Mackey B. 2021 Evaluating nature-based solutions for climate mitigation and conservation requires comprehensive carbon accounting. Science of the Total Environment 769:144341)	Rejected. This paper suggestion is too specific and does not fit into the text.	Virginia Young	Australian Rainforest Conservation Society	Australia
1355	106	19	106	19	An explicit description of trade-offs between biodiversity and food availability indicators for an emission reduction target in the AFOLU sector is provided by Prudhomme et al. (2020), Combining mitigation strategies to increase co-benefits for biodiversity and food security. Showing only co-benefit between reforestation and biodiversity do not represent the diversity of forest type and their influence on biodiversity.	Accepted. Reference has been added to the list.	Rémi Prudhomme	CIRED	France
21529	106	19	106	19	An explicit description of trade-offs between biodiversity and food availability indicators for an emission reduction target in the AFOLU sector is provided by Prudhomme et al. (2020), Combining mitigation strategies to increase co-benefits for biodiversity and food security	Accepted. Reference has been added to the list.	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
56103	106	34	106	47	In earlier sections, it was made clear that estimated reductions from BECCS were not included in this chapter, but instead in energy or industry. However, this section on IAMs seems to be including BECCS estimates as part of the overall results. How then are the estimates in this section on IAMs reconciled with the previous estimates and discourse that sought rather painstakingly to make it clear that BECCS was not included here to avoid double counting?	Noted. BECCS has been included first of all due to the great interest of other reviewers, and secondly as the biomass needed for eg energy systems is based on land resources - and in consequences of high importance for the land system. Therefore, BECCS numbers have been incuded here.	Government of United States of America	U.S. Department of State	United States of America
21531	106	38	106	39	the temporal dimension of the processes should be mentioned too	Accepted. Text has been modified as suggested by the reviewer.	Government of France	Ministère de la Transition écologique et solidaire	France
8501	106	43			(Riahi et al 2017), use proper format (Riahi et al., 2017),	Accepted. Changed accordingly.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10259	106	43	106	43	(Riahi et al 2017), use proper format (Riahi et al., 2017),	Accepted. Changed accordingly.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
21533	106	46	106	46	"limited to" seems inappropriate for the large scope of the content of Chapter 7	Noted. The limitation does not refer to the full chapter which indeed covers a broader range of options but the portfolio of mitigation options embeded in the IAMs as stated in the text.	Government of France	Ministère de la Transition écologique et solidaire	France
3913	107	4		8	Please refer here to the ongoing work of the GSP/ITPS (FAO) on soil recarbonisation (RECSOIL). It comprises among others a technical manual of SOC management that will appear in the first half of this year, compiling the most comprehensive set of management practices proved to increase SOC stocks. http://www.fao.org/global-soil-partnership/areas-of-work/recarbonization-of-global-soils/en/	Rejected. First of all there is no page indicated and secondly this aspect is covered in 7.4.	Rosa M Poch	ITPS and UdL	Spain
83245	107	5	107	5	I suggest to delete "especially nature-based solutions" which is not necessary in the sentence and tends to make everything else look 'unnatural' (see https://www.nature.com/articles/s41558-019-0661-z?proof=t)	Rejected. Nature based solutions are a standing expression for land-based mitigation.	Geden Oliver	German Institute for International and Security Affairs	Germany
83247	107	20	107	20	Replca "bioenergy" with "BECCS" or "bioenergy with CCS"	Noted. The term BECCS has been included, though the paragraph has been extensively revised.	Geden Oliver	German Institute for International and Security Affairs	Germany
30773	107	26	107	32	It would be better to mention other papers as well, even if the results have not been updated to the AR6 database. For instance, Hayashi et al. (2020) On the feasibility of cropland and forest area expansions required to achieve long-term temperature targets (https://link.springer.com/article/10.1007/s11625-020-00791-0) evaluated land-use change and mitigation measures (including BECCS and afforestation) for scenarios to achieve the 2 and 1.5 C targets.	Rejected. This section specifically refers to IAM papers indicating their capability to cover mitigation options.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
76977	107	26	107	27	"Land sector [...] turns from a source into a sink": Land is already a significant sink. Much of that sink is not presented as part of AFOLU (not considered direct anthropogenic), but it is presented as land sink. The wording here shoudl be more circumspect. Perhaps "land sector" shoudl be replaced by "AFOLU", or "anthropogenic" should be inserted.	Accepted. As suggested land has been converted to AFOLU.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
80671	107	26	107	32	Use of the land sector for bioenergy or BECCS does not provide effective mitigation because it results in a carbon deficit for many years, generally several decades to a century. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack	Noted. BECCS indeed is debated highly controversial and can interact with many other sustainability dimensions. This is debated in very much detail in chapter 7.4. Here the text describes the characteristics of many mitigation pathways also indicating the intercation with other sustainability dimensions. Many papers cited refer to bioenergy and not BECCS.	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80815	107	26	107	32	Use of the land sector for bioenergy or BECCS does not provide effective mitigation because it results in a carbon deficit for many years, generally several decades to a century. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack	Noted. BECCS indeed is debated highly controversial and can interact with many other sustainability dimensions. This is debated in very much detail in chapter 7.4. Here the text describes the characteristics of many mitigation pathways also indicating the intercation with other sustainability dimensions. Many papers cited refer to bioenergy and not BECCS.	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America

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3915	107	28			Add, to point (i): "... to reforestation and to certain management practices, (ii)...", since reforestation/afforestation is not the only soil management practice changing soil from source to sink.	Rejected. This section describes what the IAM scenarios can tell. The reviewer is right in principal but as stated on p6 almost any of the scenarios includes management (of SOC).	Rosa M Poch	ITPS and UdL	Spain
3917	107	28		30	Point (iii) is not absolutely true, some agricultural systems are net sinks.	Rejected. This section only refers to residual non-CO2 emissions and not to net-sinks.	Rosa M Poch	ITPS and UdL	Spain
76979	107	28	107	28	"bioenergy or BECCS": BECCS is bioenergy. Propose changing to "bioenergy with or withou CCS"	Accepted. We changed to "bioenergy with or without CCS" as suggested by the reviewer.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
56105	107	39	107	41	More clarity is needed on what is meant by 'slightly negative'. Does this mean a net sink, or declining emissions but still a net source?	Accepted. As suggested by the reviewer the text has been modified to "slightly negative (i.e. AFOLU systems turn into a sink)"	Government of United States of America	U.S. Department of State	United States of America
83251	107	41	108	22	I assume that the regional allocation (in text and figure) for BECCS implies that CCS is done in this regions (consistent with UNFCCC/IPCC inventory guidelines). If so, how much biomass trade is involved, let's say from LAM to OECD1990. Can this be indicated in the text?	Rejected. The data to add on traded biomass is not available in the database.	Geden Oliver	German Institute for International and Security Affairs	Germany
8135	108	1	108	16	Figure 7.13: Please revise text, afforestation and reforestation are land-use changes, so naming them additionally is unneccessary.	Rejected. Indeed Co2 emissions also include affforestation/reforestation. But due to many other requests it is important to highlight here that these scenarios also incude CO2 removals.	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
70197	108	1	108	1	Rigth Y axis legend the selected font is faint consider to use another	Accepted. Changed accordingly.	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain
11265	108	2			This figure is informative but the comparison between regions is difficult since the area of each region is different perhaps presenting the data per m-2 may provide also another view on these results.	Rejected. The purpose of this figure is to show total emissions by region.	Bertrand Guenet	CNRS	France
56107	108	7	108	8	It is essential to make clear here that these assessments count biogenic CO2 as zero in the stack in addition to capture and storage, as this accounting assumption is part of what drives BECCS estimates.	Rejected. These assessment do not account biogenic CO2 as zero. It is contained in the figure in the category AFOLU / CO2.	Government of United States of America	U.S. Department of State	United States of America
83253	108	7	108	7	I suggest to use "removals" instead of "negative emissions"	Accepted. Changed to carbon dioxide removal	Geden Oliver	German Institute for International and Security Affairs	Germany
71873	108	30	109	2	... but also on the economxy ... Add: and potential sociopolitical repercussions	Accepted: As suggested by the reviewer the text now contains "and potential sociopolitical repercussions"	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70199	109	1	109	1	Rigth Y axis legend the selected font is faint consider to use another	Accepted. Changed accordingly.	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain
11853	109	18	109	19	Reference is needed to which models are used. It is unclear if several models are used and results are presented as mean and variances from different models, or if one model is constructed with sensitivity analysis. It is also unclear if computable general or partial equilibrium models are used.	Accepted. Added a sentence refereing to the more detailed model descriptions in the Annex.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
15733	110	2	110	7	These lines are hard to understand for other persons than the one who did the modelling.	Accepted. We have reformulated the text.	Katarina Elofsson	Aarhus University	Denmark
73697	110	9			Please distinguish which work it is between the ones by 'Harmsen et al.' in 2019.	Accepted. Changed accordingly.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
15735	110	10	110	10	"structural options triggered by a carbon price" - what carbon price is though of here?	Accepted. We have removed the confusing reference to carbon price.	Katarina Elofsson	Aarhus University	Denmark
56109	110	14	110	18	The text says that BECCS is usually accounted for in other sectors, yet this segment on IAMs is including BECCS in the scenario runs and outputs. This inconsistency needs to be better explained. Why are the runs here using/employing BECCS? How does it relate to scenarios and outcomes being reported in other chapters? Are there clear communication lines between chapters to avoid double counting?	Accepted. The initial formulation was indeed misleading. We have reformulated to clarify. The rest - BECCS deployment as part of the scenarios - cannot be modified. However, that's the originality of this section. Pure LULUCF potentials without interaction with the other economic sectors are provided in 7.4.	Government of United States of America	U.S. Department of State	United States of America
76981	110	16	110	16	The competition issue is rightly emphasized and should include competition with wood products (both for enhancing the HWP pool and for substitution).	Accepted. We have added this element in the text.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76983	110	17	110	17	The source of feedstock should not be limited to residues and energy plantations, as other sources play a very significant role. In particular, increases in forest harvest (for energy) and use of agricultural commodities shoudl be mentioned.	Accepted. We made this sentence more general to open to other feedstocks.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
72671	110	19	110	23	Can you provide a table of the selected models and a basic breakdown of what each includes and assumes? There are several conditions that have to be met for inclusion here, and there are many unspecified differences among the models chosen.	Noted. A reference to a summary table of models in the annex was added in the text as a response to an earlier comment already (page 109)	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
61401	111	1	111	1	The fonts and sizes of the charactors in Figure7.15 should be uniformed. Besides, fingers in 'CO2', 'CH4' and 'N2O' of titles of the subplots and the legend should be subscripted.	Accepted. Changed accordingly.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
56111	111	2	111	15	It is not clear what mitigation options are being included in Figure 7.15. The preceding text says that there may be different options included across models, but it is important to explain what the range of options reflected in these estimates included. Specifically, it is critical to inform readers whether this includes BECCS or not, as that is a significant driver of reductions if reflected in these values. If not reflected, then what is driving these? AF/RF?	Accepted. The broad categories have been explicited in the caption.	Government of United States of America	U.S. Department of State	United States of America
21535	111		111		We recommend to put 2030 and 2050 in larger font in the figure	Accepted. Changed accordingly.	Government of France	Ministère de la Transition écologique et solidaire	France
56113	112	24	112	29	The finding that CO2 from land use increases in scenarios with a carbon price is counterintuitive. The reason for this finding should be elaborated.	Accepted. This is elaborated in the following paragraph and here we added a reference to it.	Government of United States of America	U.S. Department of State	United States of America
19783	112	30	112	30	the change in land use would substantialy explain the climate change	Accepted. Sentence rephrased for more clarity following the next comment.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
76985	112	30	112	30	"Land use is at the centre of the interdependencies with other mitigation measures, including bioenergy." It may be better to phrase it as "Land use is at the centre of the interdependencies with other sectors, including energy." Bioenergy has been framed throughout as a land-based mitigation measure. Also, the interdependencies are more numerous.	Accepted. Changed accordingly.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76987	112	33	112	33	Replace "Negative CO2 mitigation" with "increase in GHG emissions". Not only is "negative mitigation" an odd formulation, but if mitigation is negative, it cannot be considered mitigation at all.	Accepted. Changed accordingly.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
76989	112	37	113	45	This section is too short and rather one-sided. The title should be revised as SDGs include climate change mitigation. It may be better to frame it as "interaction of mitigation in the AFOLU sector with other SDGs".	Partly accepted. We have reviewed the title accordingly. However, as the suggestion to expand this section lacked concrete directions, the section has been expanded only following the other review comments.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
3919	112	38			Remove comma at the end of the line.	Accepted. Changed accordingly.	Rosa M Poch	ITPS and UdL	Spain
49995	112	43	112	43	Camia, A., J. Giuntoli, R. Jonsson, N. Robert, N.E. Cazzaniga, G. Jasinevicius, V. Avitabile, G. Grassi, J.I. Barredo, und S. Mubareka. The use of woody biomas for energy production in the EU. Bd. EUR 30548 EN. Luxembourg: Publications Office of the European Union, 2021. ISBN 978-92-76-27867-2 show that many forestry measures do not have positive repercussions on biodiversity, and often even fail to yield C-benefits.	Accepted. The reference has been duely integrated in the text.	Karlheinz Erb	Institute of Social Ecology, Univ. for Natural Resources and Life Sciences Vienna	Austria
51719	112	44	112	45	Needs rephrasing. The sentence implies that there are any scenarios under which it could be justified to deforest primary forests and plant monoculture bioenergy plantations. It is very clear that this is not the case, given the many values and unique ecosystem services that primary forests provide (compare also Cancun Safeguards)	Accepted. Reformulated accordingly.	Florin Vladu	UNFCCC Secretariat	Germany
76991	112	44	112	45	The better protection of highly biodiverse ecosystems would likely limit the availability of biomass for bioenergy, but not necessarily its mitigation potential. The conversion of many (most) such ecosystems imply very significant GHG emissions, which can make the bioenergy so produced counterproductive for mitigation in the timeframes considered here.	Accepted. The synergies between biodiversity and carbon sequastration were highlighted earlier in the paragraph. The refered sentece has been reformulated also as a result of ther comments.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73699	112	45			Please clarify the date retrieved / the issue date of the source 'Frank et al. in press'.	Accepted. Changed accordingly.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
15739	113	1	113	1	Heading says "regional marginal abatement costs" but section describes regional AFOLU abatement for different carbon prices.	Accepted. Title changed accordingly.	Katarina Elofsson	Aarhus University	Denmark
61403	113	1	111	1	In Figure7.16, fingers in 'CO2', 'CH4' and 'N2O' of titles of the subplots and the legend should be subscripted.	Accepted. Changed accordingly.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
71875	113	1	113	12	Because of the way models determine economic costs, developing countries seem to have higher mitigation potentials at given carbon prices. However, experience shows that not to be the case because price signals are not as effective due to the much greater inefficiencies of governance and limited human, technical, and financial capacities. This results in overestimating the economic potentials - often vastly. One solution to this problem is to defer it to 'realistic potentials'. But these potentials are rarely ever calculated and never make it into global assessments. A better solution would therefore be to include efficiency criteria better into the IAMs. This should not be too difficult as there are global indicators for good governance and human development that could be easily used to obtain an idea of the expected efficiency losses. It would be great if something like this could be done to improve the accuracy of the mitigation potentials.	Partly accepted. As this review is based on existing results and cannot be directly amended for the efficiency considerations, we added a sentence highlighting the issue, and refer to section 7.6 for further discussion.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

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21537	113	7	113	7	Please add some details to the means values "from 0 to 250 USD"	Accepted. Details added.	Government of France	Ministère de la Transition écologique et solidaire	France
56115	114	15	114	16	Do these IPs and CDRs therein include BECCS? Make this clear.	Rejected. That the Ips also use BECCS is decribed in detail in the individual IP sectin as well as in the related figures. Here the text highligts that CDR options in generl are used - besides GHG emission reduction measures.	Government of United States of America	U.S. Department of State	United States of America
56117	114	17	114	17	What is the RCP for the ModAct? Is it BAU? Why report the RCP for only one of the three models used? Be consistent.	Rejected. As decribed in the following lines the IP ModAct includes National Determined Contributions (NDCs) 18 in all sectors including AFOLU only and not BAU.	Government of United States of America	U.S. Department of State	United States of America
73701	114	19			The work 'Grassi et al. 2019' cannot be found in the References.	thank, refs are updated	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73703	114	25			The work 'Stevanović et al. 2017' cannot be found in the References.	thank, refs are updated	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73705	114	25			The work 'Frank et al. 2017b' cannot be found in the References.	thank, refs are updated	Raehyun KIM	National Institute of Forest Science	Republic of Korea
56119	114	28	114	29	Make it clear which IP here (1.5 or ModAct) is the 1.9RCP.	Accepted. The text has been modified to describe more clearly that the RCP1.9 refers to the IP 1.5-SUP.	Government of United States of America	U.S. Department of State	United States of America
56121	114	31	114	32	Only due to AF/RF? Not anything -- no negative net emissions -- estimated from BECCS? This is rare if correct. Explain why/how.	Rejected. The text refers to the figure 7.17 where the disctinction is made between AFOLU CO2 and BECCS emissions. In the description of IP 1.5 SUP a clear decription of both emission categories is made.	Government of United States of America	U.S. Department of State	United States of America
56123	114	35	114	41	These sentences, and most of the entire IAM section, do not clearly define/differentiate when BECCS is being modeled and/or included in the results. Are these BECCS values expressed here included in the ranges and values provided above? If so, are they also included in the energy/industry chapters?	Noted. BECCS is modeled and included in the results as it is also displayed and included in all figures of the IAM section. This also described in detail in e.g. section 7.5.1.	Government of United States of America	U.S. Department of State	United States of America
8503	114	42			REFERENZ) what is this	thank, refs are updated	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10261	114	42	114	42	REFERENZ) what is this	thank, refs are updated	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
56125	114	42	114	42	What is the RCP for the 1.5SP?	Accepted. The text now contains a clear description that the 1.5SP refers to RCP1.9.	Government of United States of America	U.S. Department of State	United States of America
19785	115	2	115	2	see pleases precision farming	unclear comment	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
76993	115	2	115	2	"agricultural land converted to bioenergy cropland": The terminology shoudl be clarified as energy crops are agricultural crops, produced on cropland. Consider "agricultural land dedicated to bioenergy".	Accepted. The text has been modified as suggested.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73707	115	13			Please check the reference after 'IMAGE' and the reference.	thank, refs are updated	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73709	115	14			Please check the in-text citation after 'AIM' and the reference.	thank, refs are updated	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73711	115	14			The work 'Soergel et al.' is under submission.	thank, refs are updated	Raehyun KIM	National Institute of Forest Science	Republic of Korea
11855	116	1	116	1	The chapter would benefit from an introduction of the specific policy design problem associated with AFOLU compared with other mitigation measures, which mainly includes uncertainty in effect, and assurance of additionality and permanence.	Noted and thank you for this suggestion. This was considered.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
56127	116	1	116	18	Figure 7.18 is just a black box. This could be interpreted any number of ways….	thank, is improved	Government of United States of America	U.S. Department of State	United States of America
76995	116	2	120	5	Section 7.6.1 should be balanced and include the full range of instruments. It currently focusses excessively on project-based mechanisms, regulated and voluntary offsets, and does not consider national policies and measures that are not linked to the markets, but may be more influential.	these more general policy issues are included throughout section 7.6, where we do include discussion of these other policy instruments	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
61405	116	4	116	4	"NGO's" should be "NGOs"	thanks	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
51721	116	5	116	8	It may be noteworthy that the A/R projects within CDM required a new type of credits to address non-permanence. Since this issue, as well as some others, were never solved at the project level, CDM never moved ahead with accepting other LULUCF activities, including reducing emisions from deforestation.	Thanks. Will include more discussion on permanence and temporary crediting.	Florin Vladu	UNFCCC Secretariat	Germany
76997	116	7	116	9	The representation of the Kyoto Protocol and CDM are questionable. The CDM did not "follow" the Kyoto Protocol, but is part of it. It did not "shift focus towards emission reduction projects". The opposite could be argued, as the text of the Protocol did not foresee sinks in the CDM (only referred to emission reductions), but they were included later anyway. The CDM dedicated disproportionate attention and effort to LULUCF, including dedicated methodologies and bodies. This is important to note as the reasons for limited uptake of CDM afforestation/reforestation projects was multiple and not limited to the regulatory constraints, but also the low abatement potential (poor cost/performance ratio) compared to other mitigation opportunities. It is also unhelpful to discuss "AFOLU" in that context, as the CDM has special rules only for LULUCF (limiting it to afforestation/reforestation, see above), but agriculture projects have been eligible just like any other sector. Therefore any difference in uptake must be due to factors other than CDM rules.	Thanks Will clean up the language and discussion on cdm. However, note some inaccuracies in the comment, particularly the cost-advantage question of forest sinks, which have been shown through numerous WGIII reports, and studies cited in such reports, as well as this one, to be low cost relative to most other options (hence, cost-effective).	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
56129	116	11	116	11	CCX no longer exists and the text should state such. It was a carbon market that collapsed several years ago.	Agree, but not clear that this needs to be referenced	Government of United States of America	U.S. Department of State	United States of America
76999	116	13	116	13	"COP meeting in Bali": It would seem preferable to mention which COP of which convention, perhaps mentioning the decision concerned.	Changed	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81293	116	13			Please use the correct COP number (COP13)	Thanks.	Andy Reisinger	Ministry for the Environment	New Zealand
51723	116	14	116	16	The terminology is wrong. The initiatives listed are not working with "projects" like the CDM, but aim for national-level implementation of REDD+, potentially with jurisditional level implementation as an interim step, in line with Decision 1/CP.16. The activities and initiatives should also not be called "mechanisms", as this has very specific connotations in the UNFCCC context (CDM, JI, Article 6), and could be confusing.	The term "project" is widely used in the literature to describe to a range of subnational implementation of REDD+. Will drop the use the "mechanism" here.	Florin Vladu	UNFCCC Secretariat	Germany
51725	116	16	116	19	It is misleading to refer to "project-based emissions reductions" when projects have not been mentioned before (see comments on the earlier sentence, which misleadingly refers to national-level programme as "projects")	Changed "project-based emission reductions" to "project-based mitigation actions" to mirror exact language used on UNFCCC NAMA site. Project-based is used in Decision 1/CP16	Florin Vladu	UNFCCC Secretariat	Germany
72783	116	21	116	23	Some literature on the inclusion of land-use in NDCs (which shows that there are high uncertainties / ambiguity) includes Fyson and Jeffery 2019, Earth's Future. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019EF001190 and Forsell, N., Turkovska, O., Gusti, M. et al. Assessing the INDCs' land use, land use change, and forest emission projections. Carbon Balance Manage 11, 26 (2016). https://doi.org/10.1186/s13021-016-0068-3	Thanks included both citations;	Matthew Gidden	Climate Analytics	Germany
28817	116	24	116	26	Missing Figure 7.18	Thanks. Improved in FGD	naikoa aguilar-amuchastegui	WWF-US	United States of America
47625	116	24	116	25	Can not see the figure 7.18	Thanks. Improved in FGD	Andriamihaja RANAIVOSON	Directorate General of Meteorology	Madagascar
47763	116	24	116	25	Figure is not clear	Thanks. Improved in FGD	Yulizar Yulizar	Universitas Pertamina	Indonesia
50849	116	24	116	25	Figure 7.18 is almost blank	Thanks. Improved in FGD	Wen Zhang	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
61105	116	24	116	27	Figure 7.18 is not visible.	Thanks. Improved in FGD	LOKESH CHANDRA DUBE	TERI School of Advanced Studies	India
61407	116	24	116	24	The Figure7.18 is displayed incorrect.	Thanks. Improved in FGD	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
63729	116	24	116	24	It seems to have a problem with the Figure 7.18…	Thanks. Improved in FGD	Government of Canada	Environment and Climate Change Canada	Canada
70201	116	24	116	25	I could not see the printer version of figure 7.18	Thanks. Improved in FGD	Miguel Ángel Casermeiro	Universidad Complutense de Madrid	Spain
71877	116	24	116	26	unreadable	Thanks. Improved in FGD	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
72673	116	24	116	26	figure 7.18 is just a black box with a blue arrow	Thanks. Improved in FGD	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
79823	116	24	116	26	There is only one line and the image is black.	Thanks. Improved in FGD	Lucia Helena ANJOS	UFRRJ	Brazil
82351	116	24	116	26	Figure 7.18: just a blue arrow on a black field… I don't think that these are the mentioned milestones… ;-)	Thanks. Improved in FGD	Amin Hasanein	Islamic Relief Deutschland	Germany
84807	116	24	116	26	Figure 7.18 is not legible (only a blue arrow is shown).	Thanks. Improved in FGD	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
53729	116	25	116	25	Figure 7.18 is missing.	Thanks. Improved in FGD	ZHENG XINZHU	China University of Petroleum (Beijing)	China
81295	116	25			I wonder whether a black canvas is intentional to describe the state of policy development in AFOLU?	Thanks. Improved in FGD	Andy Reisinger	Ministry for the Environment	New Zealand
10689	116	26	116	26	According to this version of figure 7.18 the future is very dark… (joke!)	Thanks. Improved in FGD	Philippe Waldteufel	CNRS	France
11267	116	26			In the version I downloaded this figure is only a black box with a blue arrow.	Thanks. Improved in FGD	Bertrand Guenet	CNRS	France
1437	116		116		figure 7.18 , what is the meaning of this figure?	Thanks. Improved in FGD	Hamideh Dalaei	climatologist at Islamic Republic of IRAN Meteorological Organisation	Iran
3195	116		116		figure 7.18 is blank with no specific explanation.	Thanks. Improved in FGD	Hamideh Dalaei	climatologist at Islamic Republic of IRAN Meteorological Organisation	Iran
3921	116				Fig 7.18 not visible	Thanks. Improved in FGD	Rosa M Poch	ITPS and UdL	Spain
27763	116		116		Figure 7.18 is not properly presented.	Thanks. Improved in FGD	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
43433	116		116		figure 7.18 is blank with no specific explanation.	Thanks. Improved in FGD	sadegh zeyaeyan	Head of national center for forecasting and weather hazards management of Islamic Republic of Iran Meteorological Organization (IRIMO)	Iran
50339	116		116		figure 7.18 is blank with no specific explanation.	Thanks. Improved in FGD	Government of Iran	Islamic Republic of Iran Meteorological Organization (IRIMO)	Iran
81721	116		116		Figure 7.18 appears blank - suggest address.	Thanks. Improved in FGD	Government of New Zealand	Ministry for the Environment	New Zealand
51727	117	1	117	11	The whole section is misleading. There are no agreed standards, and all of the mentioned "protocols' have very limited use and distribution, a small empiric use case, and little scientific evaluation. This is one of the reasons for intensive debates on Article 6 of the Paris Agreement. Suggest deletion of the section.	Disagree. There are many agreed standards. The bulk of the emission reductions are REDD+, reported through country Biennial Update Reports, Technical Annex 1 pursuant to several COP decisions, including for example, Decision 14/CP.19. CDM forest and CDM Ag emission reductions follow CDM protocols. Australia, New Zealand and California all have agreed standards for AFOLU-related emission reductions.	Florin Vladu	UNFCCC Secretariat	Germany
72785	117	1	118	26	This section on "offsetting" should include some critique of the use of "offsets" in the AFOLU sector to compensate for emissions in other sectors. Key questions for the validity and efficacy of using land-based emissions reductions and removals to offset emissions in other sectors are whether the emissions reductions / removals are additional and permanent (in the case of Brazil, are the offsets created considered permanent, given that deforestation rates have recently increased?), and whether they are being traded in a bounded system. Please be very careful with the wording used to describe the use of offsetting and its limits (e.g. as noted by Mackey et al 2013, the reduction or prevention of LULUCF emissions cannot meaningfully counteract the effects of continuing emissions from others sources. Recent literature has looked at the limits of offsetting (see the Oxford offsetting principels, Seddon et al 2021 https://doi.org/10.1111/gcb.15513, Mace et al 2021 (forthcoming) Large-scale carbon dioxide removal to meet the 1.5°C limit: key governance gaps, challenges and priority responses.	Thanks for this comment. We have included the Krug 2018 citation to reflect many of the uncertainties and issues you raise. Brazil is also addressed through one of our case studies in a box in the chapter.	Matthew Gidden	Climate Analytics	Germany
56131	117	2	117	2	Suggest adding 'seek to' in front of 'account for' as not all credit systems can avoid all these challenges in all project applications.	Thanks. Adopted.	Government of United States of America	U.S. Department of State	United States of America
73713	117	9			Please distinguish which work it is between the ones by 'Hamrick and Gallant' in 2017.	thanks. Have distinguished as 2017a or 2017b in revision.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
51729	117	12	117	17	This section is completely wrong in the use of the word "offset". Not all emission reductions included in table 7.9 can be considered "offsets". The issues around temporary credits to address non-permance would be a mandatory addition for any this sectoin, including the impact on offsetting this type of tCERs has compared to CERs.	thanks. Some of the tons listed in the table are emission reductions and some are offsets. Have changed the text to state "… finds emission reductions or offsets of at least…."	Florin Vladu	UNFCCC Secretariat	Germany
81705	117	18	119	26	We do not agree with the numbers in Table 7.9 (they've cited EPA annual reports in presenting ETS sequestration impacts, which is not a good representation of actual policy effect or relate to how effective the NZ ETS has been is achieving mitigation outcomes). This statement on our transparency "Other countries like…, New Zealand have good inventories, but not available online either" is also incorrect and should be altered. We suggest referencing NZ's 3rd Biennial report and NZ's 7th National Communication which provides estimated mitigation from the NZ ETS (including the effectiveness of all NZ policies and measures in reducing CO2 concentrations), see Chapter 4.3 Policies and measures, and their effects, Chapters 4.3.6 and Chapter 5.3.5 Land use, land-use change and forestry. https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/21-12-17%20Web%20FINAL%20-%20Seventh%20National%20Communication%202017.pdf Section 7.6.2 also needs to be updated for NZ in regards to current NZ ETS accounting settings and carbon price controls. And as New Zealand's carbon price has increased - it would be helpful to reflect this here (rather than reflect the 2017 price).	Noted. This will be checked and modified accordingly.	Government of New Zealand	Ministry for the Environment	New Zealand
51731	117	19	117	19	The correct term is "biennial update reports". Submissions of "biennial reports" are only made by developed countries, which are not eligible for REDD+ implementation.	thanks.	Florin Vladu	UNFCCC Secretariat	Germany
56133	117	20	117	23	California uses its own state-run system and does not represent national policy. It should be made clear that California operates on a regional level only. It is also not the largest agricultural area in the U.S. so the U.S. does not actually have a policy.	referred to the "US State of California"	Government of United States of America	U.S. Department of State	United States of America
8751	117	24	117	24	I would refer to efforts to reduce deforestation. Brazil's reduced deforestation cannot be attributed to REDD+ because the measures that were taken and successfully reduced deforestation were adopted before REDD+ as such existed. The same applies to table 7.9. Where REDD+ is referenced, there should be some attribution to REDD+ as policy and incentive framework possible. See also Box 7.12 which confirms this interpretation.	Thanks. Changed text.	Charlotte Streck	University of Potsdam	Germany
10691	117	24	117	30	Since it is widely known (or at least often reported and strongly believed) that Brazilian authorities have been very active in destroying the amazonian forest since the beginning of 2019, what is reported here is unexpected and might deserve an update. Moreover, there is neither a (Carvalho et al, 2019) in the reference list, nor any reference to "Brazil's Third Biennial Report (Ministry of Finance 2019)". I see that more information about Brazil is given in the following pages. In any case, the inadequate referencing here ought to be corrected.	sorry for the problems with the references .These have been corrected. The case study on brazil illustrates the issue raised by the reviewer.	Philippe Waldteufel	CNRS	France
51733	117	24	117	26	This sentence is fundamentally wrong. The emission reductions reported by Brazil and verified in accordance with decisoin 14/CP.19 are NOT considered carbon offsets, but actual emission reductions that qualify for results-based payments in accordance with the Warsaw Framework for REDD+. Consider also that decision 14/CP.19 considers further verification modalities could be required for inclusion of REDD+ in market-based mechanisms (paragraph 15), which has never been discussed further. See also comments on table 7.9	The text has been changed to "..share of emission reductions or carbon offsets in …."	Florin Vladu	UNFCCC Secretariat	Germany
73715	117	25	117	26	The work by 'Carvalho et al. 2019' cannot be found in the References.	Noted. It was a mistake. Was supposed to be Nepstad et al. 2014.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73717	117	26			The work by 'Simonet et al. (2018)' cannot be found in the References.	Should be Simonet et al., 2019, updated in text.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28819	117	28	117	31	1. UNFCCC does not aprove methodologies. A non-intrusive technical assessment is performed to the submissions of the REL/FREL as wel as to the BUR by members of the roster of experts (nominated by the countries-usually one from Annex 1 and 1 from non-Annex 1 countries). After that process a Technical Asssessment Report is mede public with both, the original and if it is the case, the modified submissions. However the country is free to accept ot not the observations made by the TA team. It is neede to say the TA is in essence a perre review process that is in some case more stringent and superior to what happens with peer reviewed literatura because it is expected countries comply with the REDD+ Warsaw framework (not the the case in academia). 2. This bring another point that cold be part of the knowl;edge gaps section: It is ideal ro run a comparison between IAM and REDD+ Reference levels in similar manner to with GHGis. In any case it is expected FREL and MRV data will bvetter inform GHGis. However that is still not the case for most countries.	thanks. Have changed the text.	naikoa aguilar-amuchastegui	WWF-US	United States of America
73719	117	28			The report by 'Ministry of Finance 2019' cannot be found in the References.	have updated referenced to Ministry of Foreign Affairs, 2019, as it's the Biennial Update Report.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77001	117	32	117	33	It is odd to examplify "carbon removal" with an "emission reduction fund". Also, it is questionable whether regulatory "markets" would provide the largest share of removals. Perhaps removal credits. For removals themselves, non-market instrumenbts, such as support schemes for afforestation and soil protection, policies for forest protection or government-funded projects for ecosystem restoration (such as wetlands and grasslands) seem much more important.	the table title has been changed to "...emission offsets or reductions in AFOLU..." in order to more accurately reflect the data in the table. Agree that government policies and measures have affected carbon, but through literature review, we have found no comprehensive assessment of the carbon associated with past government policies, nor have we found peer reviewed impact analysis that captures policy driven carbon gains, aside from the references related to the REDD+ efforts. We do add discussion on policy drivers in this section, however.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
85815	117	32	117	34	This line is not correct, credits purchased by the Australian Government are not used to offset emissions in other sectors, and the fund is intended to incentivise Australian businesses across all sectors of the economy to reduce emissions or sequester carbon. We suggest deleting the last words of the sentence such that it reads: 'Data from the Australia Emissions Reduction Fund is an estimate of carbon credits in agriculture and forestry purchased by the Australian government.' Suggest that authors consider providing contextual information on Australia's Emissions Reduction Fund, which is one of the world's largest offset policy mechanisms. 'Australia's Emissions Reduction Fund (ERF) is a voluntary scheme that aims to provide incentives for a range of organisations and individuals to adopt new practices and technologies to reduce their emissions. Activities supported through the Emissions Reduction Fund have provided important environmental, economic, social and cultural benefits for farmers, businesses, landholders, Indigenous Australians and communities. Australia's independent Climate Change Authority found in its 2020 review of the ERF that the Fund generates high integrity, low cost carbon offsets, supports voluntary abatement actions and provides a foundation for pursuing broader environmental, social and productivity benefits and has been successful in incentivising low cost abatement from the agriculture, land and waste sectors.' https://www.climatechangeauthority.gov.au/publications/review-emissions-reduction-fund-2020	made proposed deletion to sentence. Did not additional contextual information due to space constraints.	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
63065	117	42	117	44	It is suggested that the meaning of this sentence should be further clarified.	The New Zealand market pays forests for carbon gains, but carbon losses at harvest time are debited, providing the correct incentive to landowners as they make economic decisions about holding or harvesting lling their forest stocks. Have adjuste d language a bit to try to reflect this, but have limited space to add significant context.	Changke WANG	National Climate Center, China Meteorological Administration	China
8753	117	46	118	21	I suggest referring to the 2020 updates on the voluntary carbon market: Donofrio et al (2020) Voluntary Carbon and the Post-Pandemic Recovery, Ecosystem Market Place and Forest Trends; and Donofrio et al (2020), The Only Constant is Change, Ecosystem Market Place and Forest Trends. (Hamrick and Gallant data are outdated).	Thanks. Have updated the references to include more of the previous reports from Forest Trends/Ecosystem Marketplace as the data were obtained from individual reports. Do not include the 2020 references since we use data only through 2018.	Charlotte Streck	University of Potsdam	Germany
51735	117	46	118	11	The mixing of compliance and voluntary markets without any consideration to their overlaps, structural differences, and how to compare them given different levels of transparency and potential double-counting is misleading. This should be addressed when discussing voluntary markets as a mitigation option.	Thanks. Have included text on this issue noting the possibility but also noting that the likelihood of double counting is low given that it can only happen in California, and most of the transactions have been outside the US.	Florin Vladu	UNFCCC Secretariat	Germany
73721	117	46			Please distinguish which source it is between the ones by 'Hamrick and Gallant' in 2017.	Have updated these references.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1519	118	5	118	6	The sentence says that over 100 Mt of AFOLU was sold from 2010-2018; however, the reference used here is the State of Forest Carbon Finance 2017, which only has data up until 2016. In the SOFCF 2017, the report tracked 144 Mt AFOLU offsets transacted between 2010-2016, if that is helpful.	Have updated the reference to Table 1 in Hamrick and Gallant 2018.	Kelley Hamrick	The Nature Conservancy	United States of America
21539	118	5	118	5	This finding is questionable, Voluntary demand for offsets has been plateauing since 2008 (eg. Donofrio, S., Maguire, P., Zwick, S., & Merry, W. (2020). Voluntary Carbon and the Post-Pandemic Recovery.). I would reformulate as follows: "The voluntary demand for carbon offsets has been plateauing since 2008 but the share of offsets sourced from nature-based projects has been rising, mostly thanks to large supplies from REDD+ projects."	Our reading of Donofrio et als 2020 report is not consistent with this interpretation. Voluntary transaction volumes more than doubled from 2017 to 2019, as did values. We have, however, revised the text which has eliminated this statement.	Government of France	Ministère de la Transition écologique et solidaire	France
77003	118	5	118	11	The discussion of "voluntary offset markets" shoudl include some consideration of how they link to "mitigation" as interpreted in thsi chapter (e.g., comparison with the counterfactual, which should include what is being offset) and in the context of the Paris Agreement.	Thanks, have noted that the voluntary credits are offsets developed under the major standard setting organizations.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73723	118	11			Please distinguish which source it is between the ones by 'Hamrick and Gallant' in 2017.	thanks have updated the references	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1523	118	12	118	12	Again, I'm not sure if this data is referencing the State of Forest Carbon Finance 2017... in SOFCF 2017, the report tracked a total of $996.6 M towrads the voluntary forest carbon offsets across all time (data collection started in early 2000s). We tracked ~$1.6M towards compliance markets, so maybe that number was mixed up here?	thanks have updated the references	Kelley Hamrick	The Nature Conservancy	United States of America
51737	118	19	118	21	Unclear which costs are referred to. The costs to achieve emission reductions? Or the cost fo retiring or providing results-based payments for a ton? (Note: not offsetting, as much of the listed activites are not offsetting activities).	revised this sentence to clarify that government and business expenditures on many programs in Brazil from 2004-2015 were not included.	Florin Vladu	UNFCCC Secretariat	Germany
60303	118	19	118	21	The following references (respectively published by the World Bank and the Brazilian Institute for Applied Economics Research/IPEA) may help in what regards costs of Afforestation and Reforestation under the CDM and other aspects relevant to the potential of carbon finance for A/R, at the global level and in Brazil:. 10) WORLD BANK. BioCarbon fund experience: insights from afforestation and reforestation clean development mechanism projects. Washington: World Bank, 2011. Available at: https://openknowledge.worldbank.org/handle/10986/27108 11) MARQUES, Fabio N.A.. "Forestry CDM in Brazil: Fundamentals, Legacy and Elements for the Futures". In: Legacy of the CDM: lessons learned and impacts from the Clean Development Mechanism in Brazil as insights for new mechanisms / editors: Flavia Witkowski Frangetto, Ana Paula Beber Veiga, Gustavo Luedemann. – Brasília: IPEA, 2019. 417 p. Avaliable at: http://repositorio.ipea.gov.br/bitstream/11058/9574/1/Forest%20CDM%20in%20Brazil.pdf	clarified in the text that the financing estimates left out are the government expenditures for the program to reduce deforestation (not afforestation or CDM) from 2004-2015, and the business costs for the soy and cattle moratoriums.	FABIO MARQUES	Brazilian Forestry Industry / Plantar Carbon Consulting	Brazil
66341	118	19	118	21	Ecosystem market place has a more up to date data than that cited and this includes business expenditures as a whole, although does not give a breakdwon, also CDP muust have corprate expenditure data on offsets	thanks have updated the references	Alex Osborne-Saponja	Sustainalytics	Canada
1521	118	23	118	23	I'm not sure where the Voluntary Market data comes from. The State of Forest Carbon Finance 2017 is cited, but the report only goes through 2016 and data through 2018 is provided. From 2009-2016, the report tracked 159.5 Mt transacted. If this is meant to show total volume issued, the total is 69.6 Mt from 2008-2016; note that there is a higher volume of traded offests because offsets can be traded more than once.	thanks have updated the references	Kelley Hamrick	The Nature Conservancy	United States of America
51739	118	23	118	24	Table 7.9 has two fundamental difficulties. First, it is titled "emission reductions", but lumps together emission reductions and offsets. By definition, an offset doesn't reduce emissions, but counterbalances other emissions, with zero net mitigation effect for the atmosphere. These should be considered separately. Second, it lumps together all different efforts, despite the significant difference between emission reductions at project-level and at national level. At the very least, difficulties with the comparability of such numbers should be described	Thanks. Have changed the title of the table. Agree that projects and country-level/programmatic efforts are different, but they need to be added together, while trying to avoid double counting, to get an aggregate estimate of carbon offsets/emission reductions due to land-based activities to date.	Florin Vladu	UNFCCC Secretariat	Germany
77005	118	23	118	26	The title of Table 7.9 should be more circumspect. Numbers seem to reflect the claimed/credited reduction from offset projects only. It does not include emission reductions in agriculture or LULUCF achieved through mitigation policies or mitigation-related efforts in other policies. Moreover, it does not reflect on the substantiated questions raised about the effectiveness of some of the schemes. For example, there is a lot of analysis related to CDM showing that, despite efforts to ensure integrity, some of the claimed reductions are undermined by questionable additionality or permanence. Box 7.11 makes a generally dismissive comment on REDD+. Similar concerns may also apply to some of the other schemes. Thus it may be too optimistic to report all the reductions as "achieved" in the context of a scientific assessment.	retitled table 7.9 to "Estimates of achieved...". Claimed and reported credits are used when they are reported through a standard setting organization (including CDM, ACR, Gold Standard, etc.), through an official report to the UNFCCC, or appear in a peer reviewed journal article. Discussions about permanence, additionality, leakage, etc. appear elsewhere in this section.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
84809	118	23	118	24	Table 7.9 sets out achieved emissions reductions from example funds/mechanisms. It appears from Australian Government sources (ERF Auction Results) that about 37MtCO2-e had been delivered by the end of 2018). Suggest the figures provided are checked and updated, as needed (noting the Australian Govermment ERF has figures for contracted (not yet delivered) and delivered (achieved) abatement).	we have only included ACCUs, which are stated as "achieved emissions reductions"	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
73725	118	25			Unlike from the References, the date of the date from 'Clean Development Mechanism Registry: https://cdm.unfccc.int/Registry/index.html' cannot be found in the in-text citation.	included date accessed in note.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21541	118		118		We regret the ignorance in the reflection of land-constrained countries with regard to their population (e.g. table 7.9. P. 7-118: only land-abundant countries are reported)	have retitled the table as follows: "Estimates of achieved emission offsets or reductions in AFOLU through 2018. Data include CDM, voluntary carbon standards, compliance markets, and reduced deforestation from official UNFCCC reports. Carbon sequestration due to other government policies not included."	Government of France	Ministère de la Transition écologique et solidaire	France
85817	118		118		Table 7.9: The figure provided for Australia appears to be incorrect, trying to replicate what was done returns a figure of 34.2 rather than 33.7 (it looks like perhaps agriculture was omitted when summing up). Also, it is not clear how the financing figure was derived (the price of credits is not a public figure for the ERF). It would be appropriate to use the average auction price for the period the credits were purchased (as of June 2018 this price was $12.22 AUD per tonne of abatement).	downloaded on 10/24/2019, including 27.6 mt forestry, 5.6 mt savanna, and 0.4 savanna.	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
73727	119	1			The source of 'UNFCCC REDD+ Web Platform (https://redd.unfccc.int/submissions.html)' cannot be found in the References.	the material obtained is found directly at that link	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73729	119	1	119	2	The source of 'UNFCCC Biennial Report database (https://unfccc.int/BURs)' cannot be found in the References.	the biennial update reports can be found at the link provided.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73731	119	3	119	4	Please distinguish which source it is between the ones by 'Hamrick, K and Gallant, M.' in 2017.	thanks have updated the references	Raehyun KIM	National Institute of Forest Science	Republic of Korea
85819	119	5	119	6	Some of the qualifications and the source of the financing figure are unclear from this footnote. We suggest that the financing figure be derived based on the average price noted above and that the footnote be revised to include – 'The Australian data is in financial years so the total included is only to 30 June 2018. This data includes only the emissions reduction credits purchased by the Australian Government. The financing estimate is derived using the average auction price for the period over which the credits were purchased.'	thanks. Updated footnote.	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
73733	119	10	119	12	The source of 'Surrendered forest carbon credits from post-1989 forests in New Zealand. Environmental Protection 11 Authority. 2017 New Zealand Emissions Trading Scheme Facts and Figures 2017. New Zealand 12 Government.' cannot be found in the References.	thanks. Provided website from which to get the data.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
71879	119	16	120	4	The purpose of the box is not entirely clear. It is evident that implementation of actions designed to improve sustainable development and increase mitigation is difficult. But why would a specific approach that happened to work in BC be applicable in SE Asia, Africa and LAC? Also, the case study only presents what was done, but does not demonstrate or evaluate its effectiveness or efficiency in terms of mitigation.	will eliminate the box and take some of concepts into text	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
77007	119	16	120	4	The language of the Box does not always meet scientific standards. Terms like "impressive scale" include value judgement and should be avoided. References should be precise. E.g., "Bruntland inspired norms" is not only vague (what norms are they?) but also too casual.	will eliminate the box and take some of concepts into text	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
77009	119	16	120	4	The purpose of the box is unclear and its framing should be improved. First, it is not clear what "micro-level design" means in the context of the policy affecting 12% of the area of a rather big province like British Columbia, more land than the total area of many countries. Moreover, it refers to the results of a policy designed 25 years ago and not with mitigation in mind. Without questioning their overall usefulness or effectiveness, can they be considered as "mitigation" as defined in this chapter? Are they not part of the baseline? And if they are "mitigation", then	will eliminate the box and take some of concepts into text	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81297	119	16	120	4	Box 7.11: I feel this box should be expanded both in length and substance. There have been several publications that discuss the risk to food security from 'blunt' emissions pricing in AFOLU, and on the ability and options to manage these risks. In addition, various OECD publications that explore the benefits of subsidy vs tax instruments to achieve mitigation outcomes and their efficacy and impact on food prices. These are really important issues that deserve a more visible treatment in this chapter.	We address these points about food price impacts of policies in the main text, in particular in sections showing the SDG implications, feasibilty and tradeoffs of land based mitigation	Andy Reisinger	Ministry for the Environment	New Zealand
77689	119	27	119	34	"...the vast majority of policy design to date has been developed in ways that have failed to meaningfully address the climate crisis in general and the role of agriculture and forests in particular" is a profoundly important statement and should be elevated to the executive summary.	will eliminate the box and take this concept into the text.	Virginia Young	Australian Rainforest Conservation Society	Australia
51741	119	29	119	31	This is overly simplistic. While significant emission reductions have not been achieved in most REDD+ countries, the different starting poitns have to be considered. The improvements in forest monitoring capacity and institutional arrangements have been widely recognized by practitioners in the field (see also below, lines 22-27 on page 121). This should also warrant a discussion to which extend results-based payments of US$ 5 per ton on average can compete with the return-on-investment into commodities that drive deforestation, such as beef, soy and palm oil	will eliminate the box and consider this point as we take some concepts from the box into text	Florin Vladu	UNFCCC Secretariat	Germany
73735	119	30			The work 'Streck et al. 2009' cannot be found in the References.	thanks	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8561	119	49	119	49	Lessons on next page better	will eliminate the box and take some of concepts into text	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
8755	120	8	120	8	You may want to add a reference to Colombia's carbon tax and AFOLU offsetting provisions. I haven't had the change to look for sources, even though this one may be helpful: Reardon, Sara. "FARC and the forest: Peace is destroying Colombia's jungle -- and opening it to science." Nature, vol. 558, no. 7709, 2018, p. 169. Accessed 9 Mar. 2021.	thanks.	Charlotte Streck	University of Potsdam	Germany
18369	120	8	120	31	While the issue of emissions leakage more broadly is discussed elsewhere, the particular risks associated with the unilateral pursuit of emissions pricing in a trade-exposed, emissions intensive sector like agriculture may warrant specific comment. See for example https://doi.org/10.1016/j.jclepro.2018.12.139	included a sentence on implementation of carbon taxes in the food sector.	Government of United Kingdom (of Great Britain and Northern Ireland)	Department for Business, Energy & Industrial Strategy	United Kingdom (of Great Britain and Northern Ireland)
20397	120	8	120	31	This section reads more like a briefing of existing policies (which was the topic of the section 7.6.1), although I would have expected a review of research that has looked into carbon pricing/taxation in the AFOLU sector. Now, there is not a single citation to peer-reviewed journal articles under this heading. There is a signigicant amount of forest economic literature that should be reviewed. For example, it could start with van Kooten et al. (1995), who investigated first how pricing carbon would affect the rotation length in commercial forests. Ekholm 2015 (http://dx.doi.org/10.1016/j.forpol.2015.10.007) tied this to the increasing carbon price that's associated with long-term mitigation action. Sohngen and Mendelsohn (Amer. J. Agr. Econ., 2003) analyse forest carbon sequestration in a macreoconomic context. I would guess similar studies have been conducted also for agriculture.	This section is intended to review what we know about how different policy instruments have been used and how effective they have been. The van Kooten subsidy and tax scheme has been used in New Zealand as we reference	Tommi Ekholm	Finnish Meteorological Institute	Finland
77011	120	8	120	31	The review of emissions trading and carbon taxes should cover not only (not even primarily) the state of inclusion of the sector in such schemes, but (also) the literature on theoretical considerations and scheme designs, e.g. assessing to what extent a cap-and-trade scheme ("inclusion as part of the cap") could accommodate emissions/removals in the sector in an efficient manner. This section does not include a single peer-reviewed source, despite the rich literature on the design of trading and environmental tax systems.	Interesting point, however, this section was intended to review actual implementation of policy and what we have learned so far. We do not believe adding citations to theoretical studies would contribute to our understanding of what has and hasn't worked. We have retitled the section to try to avoid confusion, however.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
56135	120	18	120	18	CARB also includes Quebec in its regional market. Again, however, California does not represent the rest of U.S. agricultural lands.	our focus is on the inclusion of carbon offsets in cap and trade and tax systems.	Government of United States of America	U.S. Department of State	United States of America
73737	120	20			The source of '(https://ww3.arb.ca.gov/cc/ghgsectors/tropicalforests/ca_tropical_forest_standard_english.pdf)' cannot be found in the References.	Thanks	Raehyun KIM	National Institute of Forest Science	Republic of Korea
63731	120	21	120	23	Incorrect statement. Should be changed for: "Quebec has an emissions trading program that plans on allowing forest and agricultural offsets generated within the province to be utilised." Currently, there is only one existing protocol for AFOLU in manure management (no projects registered yet). An A/R protocol is currently in development. See: https://www.environnement.gouv.qc.ca/changements/carbone/credits-compensatoires/index.htm#protocoles-en-vigueur	adopted.Thanks	Government of Canada	Environment and Climate Change Canada	Canada
73739	120	26			The work 'OECD 2018' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73741	120	27			The work 'OECD 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
46019	120	28	120	30	The sentence "...some countries have exempted purchases of fuels..." is not clear. Particularly, it is no clear in which sense the verb "to exempt" (to exclude, to leave out, etc) is used here. Countries have excluded the purchases of fuel from what - taxes? Perhaps something else is meant, like subsidize?	revised sentence	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
56137	120	30	120	31	Provide citations to support assertion that "bioenergy, produced from agricultural products, agricultural waste, and wood is exempted from explicit carbon taxes in most countries".	revised sentence	Government of United States of America	U.S. Department of State	United States of America
73743	120	30			The work 'OECD 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21543	120	32	120	33	We think that there are several mistakes. The Bali COP took place in 2007 and not in 2006. Furthermore, REDD+ did not emerged at that time. It is a result of longer and deeper process. First, a call from NGO made in 2002 for using climate fund to struggle deforestation (WILLEM DEN BESTEN (J.), ARTS (B.), VERKOOIJEN (P.), « The evolution of REDD+ : An analysis of discursive-institutional dynamics », Environmental Science and Policy, vol. 35, 2014, p. 42), and a similar one made by two Brazilian Institutes and supporting inclusion of measures to tackle deforestation in the climate regime (DE CARVALHO (F.V.), « The Brasilian position on forests and climate change from 1997 to 2012 : from veto to proposition », Revista Brasileira de Politica Internacional, vol. 55, 2012, p. 161). Then a coalition of government, NGO and private sector studied this question, and a formal proposition was sent to the COP in Montreal in 2005. For two year REDD was discussed scientifically by the SBSTA and politically in the "dialogue". This last track of negotiation lead to the inclusion of REDD+ in the Bali action Plan (Decision 1/CP.13, article 1 b) iii)). For a complete analysis of the legal framework for REDD+ and its building see : J. Dellaux, Le mécanisme visant la conservation des forêts tropicales de la Convention-cadre sur les changements climatiques (REDD+) : illustration de l'adaptativité du droit international, sous la direction de Sandrine Maljean-Dubois et Marcelo Varella, Thèse, Université Aix-Marseille, 2017, 737 p. available at : https://www.researchgate.net/publication/349141790	Thanks. we have updated this discussion.	Government of France	Ministère de la Transition écologique et solidaire	France
21545	120	32	120	32	It is surprising that REDD+ did not received more attention in this chapter on AFOLU as it is one of the main mechanism in forest sector in the climate regime. We can notably regret that it is not explained how the REDD+ work and its legal framework. Presented that way it looks likes REDD+ is a program or initiative rather than a specific mechanism regulated under the UNFCCC. For a complete analysis of REDD+, see J. Dellaux, op.cit., available at : https://www.researchgate.net/publication/349141790.	Noted. thanks.	Government of France	Ministère de la Transition écologique et solidaire	France
21595	120	32	120	32	Amalgaming REDD + with PES is a little dubious - No mention of the disastrous effects of subsidies to industrial agriculture (such as subsidies for chemical fertilizers, water and electricity to pump it: several tens of billions of dollars per year ...), which make alternative approach (such as agroecology, natural farming) more difficult to emerge and be price-competitive	REDD+ is a form of PES, as carbon is one of the most important ecosystem services of forests, so we have elevated REDD+ here due to its importance in AFOLU policy. We have included discussion of the limitations of PES, although we do not try to accomplish a full literature review.	Government of France	Ministère de la Transition écologique et solidaire	France
51743	120	32	120	33	The COP at Bali was in 2007	thanks	Florin Vladu	UNFCCC Secretariat	Germany
8757	120	33	120	33	The Bali COP took place in 2007.	thanks	Charlotte Streck	University of Potsdam	Germany
8759	120	33	120	39	This is not correct. REDD+ (as clarified in the WFR and Art. 5 PA) is supposed to be funded by multiple, market and non-market, private and public sources. The Results-based Finance, i.e. PES, is only one finance modality.	REDD+ is a payment for an ecosystem service, whatever the source of the payment. We have revised this section to clarify this.	Charlotte Streck	University of Potsdam	Germany
73745	120	35			The work 'Wunder 2007' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21547	120	36	120	37	("REDD+ may operate...") : This sentence shall be more precise because like this it could be seen as a mistake. Indeed, contrary to the CDM mechanism, REDD+ follow a national approach and not a project approach (Decision 1/CP.16). Project approach is supposed to be temporary.	have revised text. Thanks	Government of France	Ministère de la Transition écologique et solidaire	France
73747	120	36			The work 'Salzman et al., 2018' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
51745	120	37	120	39	This is wrong. The measurment unit for REDD+ results is ONLY in t CO2 eq, calculated in accordance with IPCC methodologies. Area measurements or rates of deforestation are not sufficient. Compare decisions 12/CP.17 and 13/CP.19	revised. thanks.	Florin Vladu	UNFCCC Secretariat	Germany
21549	120	38	120	39	conditionning of payment should be exposed more precisely, explaining how they are conditionned to the respect of several 'legal' conditions : notably the Cancun element (Decision 1/CP.16) and a MRV process (Warsaw framework).	rates of deforestation only included as an example, not as the only crterion.	Government of France	Ministère de la Transition écologique et solidaire	France
56139	120	40	120	40	In the U.S., this is mostly water quality trading and/or ecosystem trading, which is very different from potential of carbon trading.	disagree. Conservation/No Till is one of the most important proposed agricultural practices and faces the exact same additionality issue in carbon trading as in WQ trading.	Government of United States of America	U.S. Department of State	United States of America
73749	120	43			The work 'Claasen et al., 2018' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73751	120	43			The work 'Wu et al. 2000' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73753	120	44			The work 'Pfaff and Robalino 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73755	120	46			The work 'Alix-Garcia et al. 2015' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73757	120	46			The work 'Robalino et al. 2015' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73759	120	47			It is likely to be a typo between 'Borner (in the in-text citation)' and 'Börner (in the References)'.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73761	120	47			The work 'Burivalova et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21551	121	1	121	1	REDD+ associated risks of leakage in a country are limited by the national approach. Futhermore, COP decision 1.CP16 invites Parties to promote measures in order to reduce leakage.	revised text.	Government of France	Ministère de la Transition écologique et solidaire	France
51747	121	4	121	4	The number of US$ 1.3 billion requires a reference. It also appears to be very low, considering that REDD+ funding includes all phases of REDD+, including readiness, and all sources of finance, including bilateral and multilateral.	the actual dispersal based on records we were able to obtain is much lower than the funds committed.	Florin Vladu	UNFCCC Secretariat	Germany
73763	121	6	121	7	There is a difference between 'UN REDD Programme (in the in-text citation)' and 'UN-REDD, P. (in the References)'.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73765	121	8			The work 'FCPF Annual Report, 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73767	121	12			The wotk 'Amazon Fund Annual Report, 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73769	121	13			The work 'Roopsind et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
70065	121	15	121	17	The original text says: "The Amazon Fund has an additional USD 200 million available for allocation. However, disagreements between the Brazilian federal government and the main donors, Norway and Germany, on the governance resulted in the fund's suspension." It is important to consider that the Amazon Fund was working very well until the new Brazilian federal government assumed in the beginning of 2019. Since of that, because of ideological thinking of the new government, the Fund is blocked. (Hecht, 2020, see Box 7.12).	Rejected. Thanks, but as stated in the comment, this aspect is considered in the Box.	PEDRO CORTES	University of Sao Paulo - USP	Brazil
73771	121	17			The work 'Hecht, 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
51749	121	19	121	21	The GCF also has a dedicated REDD+ pilot window with US$ 500 million, which is about to be allocated completely.	Noted and thanks. The paragraph in question has been revised.	Florin Vladu	UNFCCC Secretariat	Germany
73773	121	23			The work 'Arts et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
51751	121	26	121	27	Only countries that have fulfilled all requirements of decision 9/CP.19 are eligible for results-based payments. It would be very confusing if the IPCC used different standards. Guyana is not among those countries, many other are, and have already reported payments, e.g. .Chile, Colombia, Ecuador. The authoritative source on results-based payments is the Lima Info Hub for REDD+, available at: https://redd.unfccc.int/info-hub.html	Thanks revised.	Florin Vladu	UNFCCC Secretariat	Germany
21553	121	27	121	27	it is more than 3 countries that received RB payments, see notably: https://redd.unfccc.int/info-hub.html.	Thanks revised.	Government of France	Ministère de la Transition écologique et solidaire	France
73775	121	28	121	29	The work 'Simonet et al., (2018)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73777	121	30			The work 'Roopsind et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
51753	121	34	121	35	In the context of REDD+ it should not be forgotten that this doesn't include only 2 activities, but 5, including conservation, enhancement of forest carbon stocks, and sustainable management of forests.	agreed but we have only found empirical evidence on deforestation	Florin Vladu	UNFCCC Secretariat	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21555	121	36	121	36	This section is surprisingly silent on the assessment of the effectiveness of PES. There is convincing evidence that most Agri-Environmental Measures from the EU Common Ag. Policy suffer from large windfall effects, greatly impairing their actual impact (eg. Chabé-Ferret and Subervie, 2013). Chabé-Ferret, S., Subervie, J., 2013. How much green for the buck? Estimating additional and windfall effects of French agro-environmental schemes by DID-matching. Journal of Environmental Economics and Management 65, 12–27. https://doi.org/10.1016/j.jeem.2012.09.003	thanks. Have included Chabe-Feret/Subervie artilcle, although we believe it substantiates our earlier point that the evidence is that payments for some practices pass additionality and others don't (Chabe use windfall rather than additionality, although they meant the same thing).	Government of France	Ministère de la Transition écologique et solidaire	France
21597	122	1	122	1	Amalgaming REDD + with PES is a little dubious - No mention of the disastrous effects of subsidies to industrial agriculture (such as subsidies for chemical fertilizers, water and electricity to pump it: several tens of billions of dollars per year ...), which make alternative approach (such as agroecology, natural farming) more difficult to emerge and be price-competitive	Disagree. REDD+ is clearly a PES program. Many ag subsidies are not PES programs, although some are.	Government of France	Ministère de la Transition écologique et solidaire	France
15741	122	6	122	7	These lines seem to indicate that EU agri-environmental policies could contribute quite substantially to GHG reductions. However, very little of the funding in question is actually targeting GHGs. So one should avoid giving this impression.	We have adjusted the language here and included an additional citation.	Katarina Elofsson	Aarhus University	Denmark
21557	122	7	122	9	We suggest to add: "The 2003 CAP reform was mostly consistent with climate change mitigation, driving an estimated 2% decline in GHG emissions from agriculture in France (Baudrier et al., 2015)." Baudrier, M., Bellassen, V., Foucherot, C., 2015. The previous Common Agricultural Policy (2003-2013) reduced French agricultural emissions, Climate Report. CDC Climat Research & INRA, Paris, France.	we have included this citation. Thanks	Government of France	Ministère de la Transition écologique et solidaire	France
56141	122	11	122	11	U.S. Department of Agriculture is cited here but not in the reference list.	Thanks, references were revised.	Government of United States of America	U.S. Department of State	United States of America
56143	122	18	122	18	Zu citation is probably Zhu (found in reference list), or a Zu reference is missing.	Thanks, references were revised.	Government of United States of America	U.S. Department of State	United States of America
81709	122	20	122	28	Suggest include a narrative here on how there is evidence of reforming subsidies and supporting an enabling trade system can improve environmental outcomes i.e. there are several OECD reports which outline the potential harmful negative impacts of trade distorting subsidies, including the 2020 report "The Economic and Environmental Impacts of Climate Change and Trade Liberalisation on the Agricultural Sector". The OECD estimates that roughly 75% of the $708 billion in support to agriculture is production distorting, while only 15% goes to public goods. Further, the Dasgupta review on the economics of biodiversity released last month estimated that the total cost globally of subsidies that damage nature is around $4-6 trillion per year. See: OECD (2021), Making Better Policies for Food Systems, OECD Publishing, Paris, https://doi.org/10.1787/ddfba4de-en.And can ref: OECD (2020) Agricultural Policy Monitoring and Evaluation 2020. And: Dasgupta, P. (2021), The Economics of Biodiversity: The Dasgupta Review. (London: HM Treasury)	Agree subsidies are important and have enhanced the discussion. Note the scale of agricultural subsidies estimated in Dasgupta is $718 billion/yr, not $4-$6 trilllon. That higher number seems to include subsidies in Oil and Gas plus their social cost of carbon. Oil and gas are outside the scope of this chapter.	Government of New Zealand	Ministry for the Environment	New Zealand
86279	122	24	122	25	Where it reads "..."Brazil has developed subsidy programs aimed at reducing greenhouse gas emissions from agriculture, and in particular from the animal agriculture industry..." I would suggest to be read as "...In 2010, Brazil has developed a national strategy to reduce greenhouse gas emissions from agriculture promoting a set of agricultural practices such as restoration of degraded pasture, integrated crop-livestock-forestry systems, and biological nitrogen fixation aiming at emissions reduction between 133.9 and 162.9 M t CO2e within 10 years. Additionally, low-interest credit line was offered to farmers to motivate adoption of practices (Sá et al., 2017; Piao et al., 2021) ...".	cannot find the Sa et al and Piao et al articles. have revised the text a bit to reflect comment.	Pedro Luiz Oliveira Almeida Machado	Embrapa - Brazilian Agricultural Research Corporation	Brazil
63067	122	28	124	27	It is suggested to discuss agricultural emission mitigation from land-use change and management. For exemple, Lai et al.(2016) concluded that China's terrestrial ecosystem lose 1.45 Pg C from land-use change and managemen, especially from the rapid growth of construction land, which highlights the importance of strengthening land use management. Lai, L., Huang, X., Yang, H., et al.(2016). Carbon emissions from land-use change and management in China between 1990 and 2010. Science Advances, 2(11), e1601063.	adjusted text to incorporate uncertainty raised by this citation and included cite.	Changke WANG	National Climate Center, China Meteorological Administration	China
84811	122	28	122	46	It is suggested that 'regulatory approaches' also discuss intersecting and broader environmental laws (environmental impact assessment and laws regulating the removal of vegetation / biodiversity from areas). These laws, and environmental market mechanisms established by them (including biobanks, environmental trusts and offset schemes) have the potential to overlap and contribute to mitigation from a different primary driver. These parallel regulatory frameworks that restrict or prevent the removal of native vegetation, control development on new/existing agricultural areas, regulate waste and pollution, and require assessment and avoidance, minimimisation or offsetting of various impacts on the environment (eg: biodiversity and native vegetation offsets) are relevant in their direct and indirect influence on climate mitigation and adaptation. These are broadly indicated in the current text, however the section would benefit from confirmation that the establishment of criminal and other environmental law offences in some regions has also assisted carbon sink establishment.	noted.	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
21559	122	32	122	34	This section should stress more the fact that "regulation" is really THE key driver of reduction in deforestation in Brazil, much more than the REDD+ mechanism presented before (see for instance : Soares-Filho, Britaldo, et Raoni Rajão. 2018. « Traditional Conservation Strategies Still the Best Option ». Nature Sustainability 1 (11): 608‑10. https://doi.org/10.1038/s41893-018-0179-9.)	noted.	Government of France	Ministère de la Transition écologique et solidaire	France
21599	122	35	122	36	This part of the sentence is unclear and lacks of rigorous demonstration, because it suggests that risks of political reversal makes regulation approches weaker than other approaches. But this critique applies for several other approaches, like REDD+, that was paused under Bolsonaro Government in spite of beeing based in other mechanisms than regulation.	noted.	Government of France	Ministère de la Transition écologique et solidaire	France
21561	122	41	122	43	In other parts of the chapter, the enhancement of carbon storage capacity in OECD countries is mainly linked with the afforestation/reforestation process due to rural-urban migration over the past decades in almost all of theses countries : may this part of the chapter mention those two explanations (strong regulation + spontaneous afforestation/reforestation), and compare both ?	no space to make a comparison. here we illustrate that quantifying a link between regulations and changes carbon fluxes in land use is complicated.	Government of France	Ministère de la Transition écologique et solidaire	France
73779	122	46			The work 'Mayer Pelicice 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73781	122	46			The work 'Walker et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73783	122	48			Please distinguish which source it is among the ones from 'FAO' in 2020.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
56145	123	1	123		Define "land sparing".	Noted and thank you. This was considered but deemed unnecessary.	Government of United States of America	U.S. Department of State	United States of America
21563	123	2	123	4	Land sparing policies would also have a rebound effect (Desquilbet etal 2017) reversing the findings in favor of land sparing strategies to conserve biodiversy (Green et al. 2005)" . - Desquilbet M., Dorin B., Couvet D., 2017. "Land Sharing vs Land Sparing to Conserve Biodiversity: How Agricultural Markets Make the Difference", Environmental Modeling & Assessment, 22:3, June, pp. 185-200. - Green R. E., Cornell S. J., Scharlemann J. P. W., Balmford A., 2005. "Farming and the fate of wild nature", Science, 307:5709, JAN 28, pp. 550-5	Noted. however, the results in the Desquilbet paper are extremely context dependent in that they depend on convexity conditions of production functions, parameter values and numerous other factors that make it really difficult to figure out what the key points are.	Government of France	Ministère de la Transition écologique et solidaire	France
73785	123	5			The work 'Burivalova et al., 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73787	123	13			The work 'Bebber and Butt 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73789	123	15			The work 'Herrera et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77013	123	15	123	15	"Because protected areas may drastically limit less intrusive economic activity,such as logging or harvesting non-timber forest products, they may be relatively costly approaches for forest conservation": Please clarify or delete. What could be more intrusive than "logging", especially in a in a protected area? It may be cheaper to allow logging, but would that be a better (or even comparable) "approach for forest conservation"?	agree, but the point of the statement is that these are valuable economic activities so the opportunity costs may be high. Of course it still may be worth making the area a protected zone if indeed government has the resources to actually protect it, but that has been they problem of many protected areas formed to date.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21565	123	18	123	18	We suggest to mention also "Group farming" - Agarwal Bina, Dorin Bruno, 2019. "Group farming in France: Why do some regions have more cooperative ventures than others?", Environment and Planning A: Economy and Space, 51:3, May, pp. 781-804. Agarwal Bina, 2020. "A tale of two experiments: institutional innovations in women's group farming in India", Canadian Journal of Development Studies / Revue canadienne d'études du développement, 41:2, 2020/04/02, pp. 169-92.	Group farming would be included in community forest management as the groups are communities.	Government of France	Ministère de la Transition écologique et solidaire	France
73791	123	23			The work 'RRI, 2018' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73793	123	26			The work 'Alix-Garcia 2007' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73795	123	27			The work 'Deininger and Minten 2002' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73797	123	27			The work 'Burivalova et al., 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61409	123	31	123	31	The term 'greenhouse gases' or 'GHG' should be uniformed after its first appearance.	Thanks.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
66343	123	31	123	40	Has any consideration been given to understanding the impacts of the CAP in the UK and EU speaking to peatland restoration, carbon sinks and biodiversity co-benefits speaking to agriculture. There were specicif carbon related projects in NI which spoke to this.	yes. discussed earlier in the agro-environmental subsidies section	Alex Osborne-Saponja	Sustainalytics	Canada

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73799	123	36			The work 'Henderson et al., 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77015	123	41	123	47	Reference should be made to the 1991 Nitrates Directive of the EU, as it is older and covers the whole territory of the EU.	focusing on regulations here. The EU nitrate directiive did not impose regulations, although it encouraged member states to regulate nitrates. There is little evidence that regulations were implemented. The same can be said for the US, which has similar directives in place through the Clean Water Act of 1972 which have not resulted in meaningful regulation of nitrates in agriculture, even where drinkin water is to be protected.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81707	123	41	123	47	Suggest amend this sentence to say "New Zealand appears to be one of the first OECD countries to explicitly regulate synthetic nitrogen applications, as they passed regulations in 2020 to set a per hectare limit on synthetic nitrogen application by farmers on pastoral land. This limit was set to drive improvements in freshwater and therefore the co-benefits for New Zealand's emissions are unclear." We are concerned about the current wording referencing Lake Taupō as it is small scheme which may not be easily replicated at scale again. Our per hectare limit also applies only to pastoral land (land used for grazing livestock), and the fertiliser sale regulations have not been developed yet. This wording also seems innappropriate 'this follows implementation of a successful nitrogen pollution….'. as these policies are unrelated - the nitrogen cap has been set at a national level and will likely have the greatest effect in Canterbury. You can reference https://www.mfe.govt.nz/fresh-water/freshwater-acts-and-regulations/national-environmental-standards-freshwater (which is the MfE webpage which provides details on the regs and a link to them) or this: https://www.legislation.govt.nz/regulation/public/2020/0174/latest/LMS364099.html	noted. have adjusted text.	Government of New Zealand	Ministry for the Environment	New Zealand
56147	124	17	124	18	What policies are being referenced by 'both'. EUREDII, USRFS, and The Netherlands policies were all named above.	now clarified what EU REDII and US RFS means	Government of United States of America	U.S. Department of State	United States of America
56149	124	18	124	19	The statement that in two policies "biofuels must reduce emissions compared to the fossil alternative by a specific level" does not support the statement that "this emission accounting aims to account for direct and indirect land use change". To conduct a full LCA of biofuels emissions and sequestration estimates allows for accounting for dLUC and iLUC -- not the overall comparison of those estimates versus FFs. This statement should be rectified.	accept, although the polcies do stipulate a emisison reduction requirement, we decided to remove sentence	Government of United States of America	U.S. Department of State	United States of America
77017	124	18	124	20	"While this emission accounting aims to account for direct and indirect land use change, the emission factors used may not appropriately cover the future emissions taking place during biofuel production if high demand arises after 2050 (Daioglou et al. 2020),": Without prejudice to the source quoted, the use of the term "accounting" in this statement is misleading and should be changed. The EU directive referred to in these lines addresses the question of both direct and indirect emissions associated with liquid biofuels (including iLUC) primarily by defining a series of sustainability and GHG emission criteria, including the phasing out of those identifed as high iLUC risk. Accounting towards the mandatory GHG threshold is mandatory for emissions and removals from those direct land use changes that are not prohibited by the sustainability criteria.	accept, removed	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73801	124	25			The work 'Favero et al (2020)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61349	124	28	124	28	Mention should be made of Land Degradation Neutrality and the extent of country parties commitment to reaching this SDG and UNCCD goal.	noted.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
77019	124	28	124	38	The relevance of these schemes to mitigation is unclear. The connection should be made (consistent with the interpretation of "mitigation" used in the chapter) or the section can be deleted.	Forest certification is a primary example of a voluntary program that affects carbon stocks on nearly a 0.5 billion ha globally.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73803	124	33			The work 'Kraxner et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61413	124	36	124	36	The term 'UN FAO' should be in line with 'FAO' in other places.	noted	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
73805	124	36			It seems to be a typo in the name of the organization, between 'UN FAO (in the in-text citation)' and 'FAO (in the References).	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1185	124	37	124	38	The sentence needs to be changed to reflet research suggesting that at least in some cases SFM may help control deforestation. I suggest changing the sentence to "In some cases, forest certification appears to help reduce deforestation while in others it does not. " as references use Blackman et. al. 2018 (the current citation) and Villalobos, L. et al. (2018) Has Forest Certification Reduced Forest Degradation in Sweden?, Land Economics, August 2018 , 93 (3): 390–112 ISSN 0023-7639; E-ISSN 1543-8325 and Tritsch, I. et al. (2020) Do forest-management plans and FSC certification help avoid deforestation in the Congo Basin? Ecological Economics, Volume 175, 2020, 106660, ISSN 0921-8009, https://doi.org/10.1016/j.ecolecon.2020.106660.	Thanks. revised statement. Have included the Tritsch article because it has a good literature reivew on the topic. Did not include Villalobos since their conclusions were basically the same as Blackman.	Reid Miner	Private Consultant	United States of America
73807	124	37			The work 'Ellis et al., 2014' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8761	124	42	124	42	There are more up-to-date data on supply-chain commitments available. Check the NYDF Goal 2 assessments, including for references and data. Forestdeclaration.org – Goal 2 update 2020.	thanks.	Charlotte Streck	University of Potsdam	Germany
73809	124	42			The work 'Donofrio et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8763	125	1	125	12	For evidence on leakage from the Amazon to the Cerrado biomes: Mofette & Gibbs (2020) Agricultural Displacement and Deforestation Leakage in the Brazilian Legal Amazon, Land Economics, 97:1	adjusted text and included cite.	Charlotte Streck	University of Potsdam	Germany
73811	125	3			The work 'Gibbs et al. 2015' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
79825	125	4	125	5	The text "However, remote sensing monitoring shows that the new agricultural frontier of soy is no longer in the Amazon but in the Cerrado's (Brazilian savannas) last continuous areas of native vegetation" is not correct. Cerrado region in Mato Grosso and Mato Grosso do Sul States have being cultivated with soybean even before the states of Rondonia and Roraima States (Amazon). The new frontier in the Cerrado is known as Matopiba (https://www.embrapa.br/tema-matopiba).	adjusted text and included cite by Moffette and Gibbs (2021)	Lucia Helena ANJOS	UFRRJ	Brazil
73813	125	8			The work 'Lima et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73815	125	18			The source of 'http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73817	125	25	125	27	The source of 'the Action Plan for Prevention and Control of 26 Deforestation in the Legal Amazon (PPCDAm)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73819	125	41	125	42	The source of 'MMA, 2013' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73821	126	10			The source of 'Brazilian Central Bank (2008)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73823	126	10			The source of 'MMA, 2013' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

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86281	126	13	126	16	Where it reads "...However, the country's political polarisation has gradually eroded environmental governance, especially after the Brazilian Forest Code changes in 2012 (major environmental law in Brazil), the presidential impeachment in 2016, presidential elections in 2018, and the start of the new federal administration in 2019..." I would suggest to be read as "...The Paris Agreement on climate change recognises the central role of forests in achieving the well-below 2 degrees C goal through mitigation options covered by the REDD+ mechanism. In this context, Brazil included REDD+ in its NDC submitted to the UNFCCC and the enforcement of Brazil's Forest Code (BFC) is a key mitigation measure. The BFC could contribute up to 1.03 PgCO2e to the GHG emissions reduction target set for 2030 despite concerns about its succesful implementation (Gallo and Albrecht, 2018, Soterroni et al., 2018, Soares-Filho et al, 2014)..."	Rejected. Thanks for comment but this part of the text is related to changes in governance that are not mentioned in the alternative text suggested.	Pedro Luiz Oliveira Almeida Machado	Embrapa - Brazilian Agricultural Research Corporation	Brazil
86283	126	16	126	19	Where it reads "...Successful deforestation control policies are being negatively affected by critical changes in the political context, and weakening the environmental rule of law, forest conservation, and sustainable development programs (for example, changes in the Amazon Fund governance in disagreement with the main donors)..." I would suggest to be read as "...Although annual deforestation rates in the Brazilian Amazon fell by 77% between 2004 and 2011, after 2009 it had stabilized at 5,000 – 7,000 km2 due to the difficulties of the deforestation policies, specially in monitoring to detect small-scale deforestation (Godar et al. 2014). However, after 2019, with the new federal administration, environmental governance including deforestation control policies were severely affected by weakening the environmental rule of law, forest conservation, and financial instruments for addressing climate change, particularly regarding the controversial issue of performance indicators in the Amazon Fund (van der Hof et al. 2018). In 2019, the annual deforestation..."	Rejected. Thanks for comment but the difficulties to monitor small-scale deforestation does not explain the increasing deforestation rates, especially after 2019.	Pedro Luiz Oliveira Almeida Machado	Embrapa - Brazilian Agricultural Research Corporation	Brazil
19787	126	20	126	20	the annual rate of deforestation due the burning ant forest fires only in year 2019 and only in Brasil reached 10.1 Mha and FAO report for all the world 10Mha and for latein america on average 3.6 Mha disappear ,are differents concept involved?	The FRA is based on data collected for 2015. This will be added to the text.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
61411	126	20	126	20	The finger in '10,000 km2' should be subscripted.	Noted and thank you. This was corrected.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
73825	126	21			The source of 'http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21567	126	24	126	35	The diagnosis of deforestation reduction is well documented. However, the regrowth of deforestation after 2013 is not explained. This need to be notified here. Authors found contrasted spatial patterns between two periods, suggesting that new drivers are growing.	The case points out to changes in governance and in the implementation of public policies.	Government of France	Ministère de la Transition écologique et solidaire	France
73827	126	30			It seems to be a difference between 'Souza Jr. et al. (in the in-text citation)' and 'Souza (in the References)'.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
83889	127	4	127	4	Possible ref for increased precipitation promoting woody vegetation in the Sahel (Brandt et al., 2019) https://doi.org/10.1038/s42003-019-0383-9	Thank you. The reference is now included	Daniel Ortiz Gonzalo	University of Copenhagen	Denmark
21569	127	6	127	7	Checking the ref Garrity & bayala 2020 shows that the finding is not correct. The ref cited (not a peer reviewed article) is not a review of litterature establishing that that most authors consider "deregulation of forest regulation as a critical event" in favor of regreening of Sahel.	Accepted. The text was revised and the citation changed to a peer reviewed paper.	Government of France	Ministère de la Transition écologique et solidaire	France
73829	127	7			The source of 'Garrity and Bayala, 2020' cannot be found in the References.	Thank you. The references have now been harmonized.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8507	127	11		19	(Sendzimir, Reij and Magnuszewski, 2011). For three authors use first author and et al eg. (Sendzimir et al., 2011)	Thanks, reference was revised	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10263	127	11	127	19	(Sendzimir, Reij and Magnuszewski, 2011). For three authors use first author and et al eg. (Sendzimir et al., 2011)	Thanks, reference was revised	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
73831	127	11			Please distinguish which source it is between the ones by 'Sendzimir, Reij and Magnuszewski' in 2011.	Thanks, reference was revised	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77021	127	21	127	23	The example is interesting, but hardly the only example where the elimination of regulation increased removals. There are plenty of examples where the elimination of requirements (e.g., to keep meadows harvested or to control vegetation in areas such as floodplains) led to increased vegetation growth.	Thank you. We have deleted the word 'unique' to illustrate that this is an example.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
71881	127	23	127	23	carbon dioxide removal	Noted and revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
77023	127	25	129	2	"7.6.2.4 Mitigation Effectiveness: Additionality, Permanence and Leakage": The issues are important, but the does not reflect the contents, as the section is not about "mitigation" but about offsets only. The title should reflect this and refer to the credibility or effectiveness of offsets. Moreover, it would be useful to include a discussion on when (or in what sense) offsets can be considered "mitigation". That issue is not specific to Chapter 7, but there are certain considerations that would be specific to land use. One important asymmetry is that the section only considers land use as a source of offsets to meet obligation is other sectors, but it does not consider the use of offsets (perhaps from other sectors) to meet mitigation objectives/commitments in the AFOLU sector.	We have revised slightly to illustrate that that these same issues apply broadly to the effectiveness of mitigation implementation. The term offsets has been used more specifically here where the literature refers to offsets, but many of the studies cited did not so refer to offsets.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
51755	127	31	127	38	This mixes different things in a highly misleading way. "Additionality" is usually a requirement for project-level interventions. Biennial reports, on the other side, provide information at the national level, and in most cases in form of a GHG inventory that is compared to previous inventories, but without an additionality requirement, which simply doesn't exist in relevant reporting guidelines. It remains unclear where the approach should have been used, as biennial reports are only submitted by developed countries, which largely have little emission reductions from reduced deforestation. In case this should refer to biennial update reports instead, the REDD+ efforts are clearly compared to a reference level that is independently set and assessed in line with decision 13/CP19, and for which historic data could provide a reasonable basis for a BAU scenario, but other approaches are also being used, depending on country circumstances. Suggest to delete the whole section, as it makes little sense in its current form.	have revised this section. specfically, revised to "Biennial Update Reports" which have been submitted by numerous countries. Provided two examples, Brazil and Indonesia in parentheses.	Florin Vladu	UNFCCC Secretariat	Germany
56151	127	37	127	38	Add example countries that used this method.	added Brazil and Indonesia	Government of United States of America	U.S. Department of State	United States of America
73833	127	41			The source of 'Sills et al. 2015' cannot be found in the References.	thanks have ensured it is added.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
19789	128	5	128	48	excelent	thanks.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
51757	128	14	128	31	The section completely lacks any discussion of the temporary CER approach applied for A/R projects under the CDM. Given that this is an agreed approach, it would be useful to describe this here as well, including resulting difficulties.There is also a significant difference between non-permanence under the responsibility of a project owner and under the responsibility of a country government.	have revised text.	Florin Vladu	UNFCCC Secretariat	Germany
1525	128	17	128	17	Change the word "alternatively" as it implies that CAR has a 100-year permanence requirement instead of using a buffer pool like Verra. Both Verra and CAR both have permanence requirements (though Verra is less than 100 years) and they both use buffer pools.	have revised text.	Kelley Hamrick	The Nature Conservancy	United States of America
3923	128	20			Is the syntax correct ? ...have the relinquished...	thanks. revised.	Rosa M Poch	ITPS and UdL	Spain
50851	128	20	128	20	"the credits for the site have the relinquished", the phrase needs revision	thanks revised.	Wen Zhang	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
20447	128	22	128	31	Additional to the van Kooten paper cited in the text, Ekholm (https://doi.org/10.1016/j.forpol.2020.102131) expressed that similar payments could be made from carbon released due to natural disturbances. This would create the incentive for disturbance risk management, while the remaining risk could be easily insured. As a result, there would be no external risk from permanence anymore.	Thanks. Implicit in van Kooten cite already provided.	Tommi Ekholm	Finnish Meteorological Institute	Finland
51759	128	32	129	2	The leakage discussion is too project-oriented, and misses major UNFCCC agreements. Already in 2010 Parties agreed that REDD+ implementation should be at the national level! That means, leakage basically is taken care of. In a similar manner, the Paris Agreement, adopted in 2015, sets economy-wide remission reduction targets as the goal (Article 4.4)	Leakage across international borders is likely in forestry and agriculture given that the products are traded internationally. Many policies are leading to project like implementation, thus it is critically important for countries to understand this literature so they understand the limitations of policies they may implement.	Florin Vladu	UNFCCC Secretariat	Germany
71883	128	37	129	2	The leakage concept needs to be defined before it is discussed. Presumably it is when forest-related mitigation leads to emissions elsewhere. The leakage referred to seems to focus on the landscape scale or smaller regions. Does it also cover leakage occurring at national or supra-national scales?	revised. thanks.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73835	128	40			The source of 'Murray et al. 2004b' cannot be found in the References.	thanks. now included.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73837	128	41			The source of 'Sohngen and Brown 2004b' cannot be found in the References.	thanks. now included.	Raehyun KIM	National Institute of Forest Science	Republic of Korea

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77025	128	47	128	48	"A key design feature for any program to reduce leakage is to encompass more area in the program.": This is a very strong statement that is easy to disprove. Much depends on the activity being displaced, the elasticity of demand for it and the comparative advantages of the project area. E.g., if a programme achieves emission reductions through reducing food production or access to water, then including more areas may do nothing to reduce leakage and may even increase it, especially if alternative sources of food or water are more damaging or less efficient.	Thanks. have revised the statement.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
46021	129	4	130	48	It seems appropriate to present the concept of nature-based solutions as an emerging and holistic concept and potential future approach in chapter 7.6.3, which might play an important role in the AFOLU sector by bridging biodiversity and climate protection (see: Seddon et al. 2020; Dasgupta Review 2021).	agreed. have tried to elevate this language in revision.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
61351	129	4	131	2	Mention should be made of Land Degradation Neutrality and the extent of country parties commitment to reaching this SDG and UNCCD goal.	policy section has been thoroughly revised. we cannot deal with all global policies in detail. but also thoroughly assess the options of measures against SDGs. e.g. in 7.4. and in overview figure 7.11	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
81299	129	4			Similar to my comment on the executive summary, I don't feel this section makes clear enough that unless and until policies bring implicit carbon prices to bear with comprehensive coverage, most of the mitigation potential identified in this chapter will remain unrealised. This is a very important message - yes there are many good reasons and ways to incentivise actions through marginal changes and co-benefits, but a large part of the mitigation potential requires clearer (implicit or explicit) price signals for this mitigation to be realised. This does not imply who should bear the cost of such mitigation, but voluntary offsets or policies driven largely by co-benefits won't deliver this.	Thanks. we have tried to be clear on this point in this section.	Andy Reisinger	Ministry for the Environment	New Zealand
51761	129	5	129	7	Misleading, as this reads as if sustainable forest management was individually recognized. This is not the case. Article 5 of the PA makes reference to the whole legal text that comprises REDD+. Since acronyms are not used in official legal text, the whole REDD+ text was repeated, including all 5 activities listed in decision 1/CP.16, para 70, and including sustainable management of forests. "Sustainable development" is not mentioned in Article 5. Requires correction.	thanks. changed "sustainable forest management" to "sustainable management of forests" which is in the Paris Agreement text.	Florin Vladu	UNFCCC Secretariat	Germany
56153	129	5	129	7	The Paris agreement does not endorse any particular policy approach. "endorses" should be replaced by "specifically mentions".	changed to "encourages" which is what the text states.	Government of United States of America	U.S. Department of State	United States of America
51763	129	7	129	8	As discussed in relation to table 7.9, this is wrong, as the table includes many emission reduction efforts that are explicitly not offsets. The AR6 should be carefully written to not mix up the different concepts of offsets and emission reductions.	offsets are a form of emission reductions, although as discussed throughout the text, emission reducions can be accomplished with many approaches and policies, in addition to offsets.	Florin Vladu	UNFCCC Secretariat	Germany
66345	129	26	129	26	"to be the lack of available of financing" does not make sense	we believe it is an important factor limiting implementation of agricultural mitigation practices (as well as forestry practices, although there appears to be more investment in forestry)	Alex Osborne-Saponja	Sustainalytics	Canada
21601	129	28	129	30	More references and exemples could be added to illustrate this assertion.	we are relying on section 7.2 of chapter.	Government of France	Ministère de la Transition écologique et solidaire	France
71885	129	28	129	38	It would be good to mention the 4p1000 initiative	Thanks. we have tried mainly to include references to programs that have been evaluated in this section.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
86285	129	43	129	44	Where it reads "...However, the investments in low-carbon agriculture in Brazil amounted only 2% of the total funds for...in 2019 (Brasil, 2019)..." I would suggest to be read as "...However, in Brazil, the investments in low-carbon agriculture amounted less than 1.4% of the total funds for conventional agriculture between 2013 and 2018 (Assad et al., 2019)..."	cannot find Assad et al reference to verify this.	Pedro Luiz Oliveira Almeida Machado	Embrapa - Brazilian Agricultural Research Corporation	Brazil
9917	129	45		47	Reference is made to the statement says: 'Indonesia has engaged in a wide range of programs in the REDD+ space, including a moratorium implemented in 2011 to prevent the conversion of primary forests and peatlands to oil palm and logging concessions --- '. More information on the moratorium program from the Indonesian Government. A moratorium on primary forest clearance and peatland conversion was first declared in 2011 under the Presidential Instruction (INPRES No.10/2011) and has since been renewed every two years (INPRES No. 6/2013, No. 8/2015, No. 6/2017). Furthermore, a permanent moratorium on primary forest clearance and peatland conversion has been declared in 2019 by The Government of Indonesia (INPRES No.5/2019).	Thanks.	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
73839	129	47			The source of 'Henderson et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73841	130	1			The source of 'Tacconi and Muttaqin, 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73843	130	1			The source of 'Wijaya et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
74887	130	4	130	10	Although it is noted that there are fewer policy examples from Africa related to GHG management in agriculture and forestry, it would be worthwhile to still include one or two examples to give Africa better coverage within the chapter. As it is now, there is quite little information related to specific African countries. This paragraph provides a good opportunity to highlight efforts in one of the 10 countries mentioned by Henderson et al. (2020).	Thanks. We have tried to increase discussion about African countries through our Box 7.14.	Government of Kenya	Kenya Meteorological Service	Kenya
73845	130	5			The source of 'Henderson et al. (2020)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
51765	130	22	130	22	What are "natural climate solutions"? Not defined in the Glossary. Difference to "nature-based solutions" remains also unclear. Suggest to strive for very clear use of defined terminology.	the glossary has been updated.	Florin Vladu	UNFCCC Secretariat	Germany
56155	130	22	130	48	This section offers a valuable and balanced biomass discussion as an example of how policies can and should be evaluated in concert to avoid potential negative outcomes. This discussion should be reflected in the Executive Summary.	thanks.	Government of United States of America	U.S. Department of State	United States of America
77691	130	22	130	37	Funding mechanisms to facilitate: improvements to the conservation management of Protected Areas; 'connectivity'based restoration, to improve resilience, ecosystem integrity and stability; and to support rights based culturally appropriate management of indigenous territories and livelihoods are urgently needed to protect our most stable forest carbon stocks (Nexus Report cited above) The information system developed by UNSEA-EA and explored by Keith et al is directly relevant to this section (Keith H, Vardon M, Obst C, Young V, Houghton RA, Mackey B. 2021 Evaluating nature-based solutions for climate mitigation and conservation requires comprehensive carbon accounting. Science of the Total Environment 769:144341). Note the only 'official' definition of NBS is that developed by IUCN, namely "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits." If this definition was adopted, mere scaling up of BAU forestry or biomass activities would be excluded.	thanks.	Virginia Young	Australian Rainforest Conservation Society	Australia

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
1187	130	30	130	37	These sentences oversimplify the research into the effects of wood demand on forest area and forest carbon stocks. For instance, Favero, et al. 2020, cited in this paragraph, found that "Increased bioenergy demand increases forest carbon stocks thanks to afforestation activities and more intensive management relative to a no-bioenergy case" resulting in "net carbon benefits." (not net carbon emissions, as stated in the current text). The Favero study also noted, however that some of the storage shifts from natural to more intensively managed forests, indicating the need for "an efficient policy ... to regulate forest carbon sequestration." Others have come to similar conclusions. In addition, I can find nothing in Nabuurs et al 2017 that ties demand for bioenergy to a need for "policies aiming at sustainable forest management and protection of forest carbon stocks" I suggest a more balanced description of the research into these issues - as follows. "Several studies indicate, for instance, that efforts to ramp up biomass energy production without considering how those policies would affect forests could negatively impact natural forest ecosystems and cause a decline in carbon stocks resulting in net emissions from biomass energy (Searchinger et al. 2009; Buchholtz et al. 2016; Khanna et al. 2017; DeCicco and Schlesinger 2018. Other studies have come to the opposite conclusion about likely impacts of bioenergy on forest carbon stocks and net emissions (Abt et al 2012, Daigneault et al 2012, Baker et al. 2019, Favero et al 2020)). Nonetheless, there is general agreement that greatly increased demand for forest-based bioenergy will impact forest management, likely resulting in increased conversion of natural to managed forest types (high confidence). Because of the potential for impacts to forest ecosystems, biomass energy policies should be combined with policies on sustainable forest management practices (high confidence). " additional citations Abt, K., R. Abt and C. Galik, Effect of Bioenergy Demands and Supply Response on Markets, Carbon, and Land Use, Forest Science 58(5) 2012 Baker, J. et al. (2019) Potential complementarity between forest carbon sequestration incentives and biomass energy expansion, Energy Policy 126 (2019) 391–401, https://doi.org/10.1016/j.enpol.2018.10.009 Daigneault et al 2012, Economic Approach to Assess the Forest Carbon Implications of Biomass Energy Environ. Sci. Technol. 2012, 46, 5664-5671 dx.doi.org/10.1021/es2030142 Favero et al., "Forests: Carbon sequestration, biomass energy, or both?", Science Advances. 2020; 6 : eaay6792 25 March 2020	Thanks. we have revised this section to reflectd this comment and others.	Reid Miner	Private Consultant	United States of America
77027	130	30	130	33	"For instance efforts to ramp up biomass energy production without considering how those policies would affect carbon stocks on the land base could cause environmental damages in natural forests, including causing biomass energy to be a net source of carbon emissions(Searchinger et al. 2009; Buchholtz et al. 2016; Khanna et al. 2017; DeCicco and Schlesinger 2018; Favero et al. 2020)..": Replace "causing bioenergy to be a net source of carbon emissions" with "causing bioenergy to increase emissions compared with the alternatives". Bioenergy is a net source of carbon emissions in the vast majority of cases, as shown in Fig 1 of Box 7.10. The issue is whether it can replace an alternative energy source with lower emissions, or it would increase emission for a long time to come.	A number of these studies have shown that biomass produced from wood is carbon neutral in the absence of any substitution benefits. We have rewritten this section to be more clear.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73847	130	33			The source of 'Buchholtz et al. 2016' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73849	130	33			The source of 'Khanna et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73851	130	33			The source of 'DeCicco and Schlesinger 2018' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73853	130	33			The work 'Favero et al 2020' cannot be found in the Refernces.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73855	130	36			The work 'Favero et al 2020' cannot be found in the Refernces.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77029	130	38	130	40	"If biomass energy production expands and shifts to carbon capture and storage (e.g. BECCS) during the century, there could be a significant increase in the area of crop and forestland used for biomass energy production (Section 7.4).": The increased use of forest for bioenergy is indeed an important issue. However, Section 7.4 does not address it in detail. It mostly assumes that biomass would come from residues or dedicated crops. It would be important to include appropriate analysis in Section 7.4 and reference that particular section here.	We have referenced studies here that address the issue.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
83255	130	38	130	48	Additional literature on the CDR strand of emerging AFOLU would be Fridahl/Lehtveer 2019 for the role of limited role of large-scale BECCS in international climate policymaking (https://www.sciencedirect.com/science/article/pii/S2214629618302998) and Schenuit et al. 2021 for emerging CDR policymaking in OECD countries, across all approaches, but already starting withg land-based CDR (https://www.frontiersin.org/articles/10.3389/fclim.2021.638805/full). See also Chapter 12.7	thanks.	Geden Oliver	German Institute for International and Security Affairs	Germany
73857	130	45			The work 'Favero et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73859	130	45			The work 'Baker et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
83249	130	46	130	46	delete "warming"	thanks.	Geden Oliver	German Institute for International and Security Affairs	Germany
1189	130	47	130	47	remove "substantially". It is not needed.	maintain 'substantially' because it is clear that we already value, but the values are too low to incentize the large scale of carbon mitigation that is possible.	Reid Miner	Private Consultant	United States of America
1191	130	47	130	47	After the word "stocks" add "and ecosystems".	thanks.	Reid Miner	Private Consultant	United States of America
84813	131	2	131	14	Suggest land tenure be emphasised in the introductory paragraph to section 7.6.4 (as it is clearly a significant barrier, as per other content in this and other chapters of the second order draft report	thanks. is included in 7.6.4.2	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
77693	131	3	133	22	The three pillar approach developed by Morgan et al is relevant as it deals with the complex challenges of meeting multiple objectives of affected communities, governance requirements, tenure and rights issues and institutional capacity. (Integrating forest management across the landscape: a three pillar framework, Morgan E, Cadman T, Mackey B, Journal of Environmental Planning and management 2020).	thanks.	Virginia Young	Australian Rainforest Conservation Society	Australia
51767	131	32	131	32	Wrong terminology. What is meant are likely not small-scale REDD+ projects, but larger-scale REDD+ programmes or initiatives at national or jurisdictional level.	thanks	Florin Vladu	UNFCCC Secretariat	Germany
71887	131	35	131	41	It is questionable whether investments in agricultural mitigation alone are such a good idea as this can lead to perverse incentives. A borader focus addressing the FEW nexus to maximize synergies and minimize externalities for a larger number of SDGs seems to be a more appropriate approach	not our intention. have adjusted text.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73861	131	40	131	41	The source of 'Henderson et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
21571	132	1	132	8	General thinking here again is centered on farmers each harvesting large amounts of land, as now in most OECD countries, where these farmers do not represent more than 3% of the labour force. There is only one sentence in the report that reminds us that the majority of farmers in the world have less than 2 ha (p. 7-132). This micro-scale farming will remain in the future due to world land limits, population growth and "jobless growth" in non-farm sectors. But the perspectives and technologies considered in this report remain those of "large-scale industrial agriculture" (specialized in a few productions to take advantage of economies of scale, and very intensive in both capital and land to robotised the production of the latter ...with large quantities of fossil fuels!)	we agree with this point in believe the section in question is consistent with the idea.	Government of France	Ministère de la Transition écologique et solidaire	France
21573	132	1	132	8	We recommend to add that from the current estimations 80% of the poor population in rural areas depend on livestock activity. Alary V., Aboul-Naga A., El Shafie M., Abdelkrim N., Hamdon H., Metawi H., 2015. Roles of small ruminants in rural livelihood improvement – Comparative analysis in Egypt. Rev. Elev. Med. Vet. Pays Trop., 68 (2-3): 79-85 . McDermott JJ, Staal SJ, Freeman HA, Herrero M, Van de Steeg JA. 2010 Sustaining intensification of smallholder livestock systems in the tropics. Livest. Sci. 130, 95 – 109. (doi:10.1016/j.livsci.2010.02.014)	have adjusted the text to address the issue of rural poverty more clearly but have not included those citations.	Government of France	Ministère de la Transition écologique et solidaire	France
31403	132	4	132	6	The figures could be updated according to the latest Food Security and Nutrition in the World (SOFI 2020) report as well as inclusion of projections taking into account COVID-19 impact: estimates for 2019 show that prior to the COVID-19 pandemic, almost 690 million people, or 8.9 percent of the global population, were undernourished. If this trend continues, the number of undernourished people will exceed 840 million by 2030. Furthermore, based on the preliminary projections and outlooks, it is estimated that the COVID-19 pandemic may add an additional 83 to 132 million people to this figure in 2020.	Thanks.	tamara van 't Wout	Food and Agriculture Organization of the United Nations (FAO)	Qatar

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21575	132	12	132	15	Well beyond the weight of individual work routines and habits, social science research has shown that the choice of technical orientations for farms must be seen in the context of a set of economic and social relationships: relationships of economic dependence on downstream industries (cooperatives, food processing industries) and upstream industries (agricultural machinery, fertilizers and pesticides, seeds), prescriptions issued by technicians and advisers from public and private organizations, promotion of intensive production models by the dominant trade unions and agricultural administrations. In parallel with the increase in the total amount of subsidies aimed at transforming practices, it seems necessary to question the modalities of allocation of these subsidies, since the farmers best integrated into the agro-industrial model may paradoxically be the most likely to benefit from them, which would have the effect of reinforcing the mistrust of some farmers with regard to agri-environmental policies.	noted.	Government of France	Ministère de la Transition écologique et solidaire	France
21603	132	12	132	12	The difficulty to bring about a change of practices is largely presented as having a culturalist explanation. It could be complemented by litterature on the techonological lock-in which show how agricultural practices are constrained by both sides of the production and distribution chains.	noted. We do not use technological lock-in, but the first sentence of the section is consistent with that framework.	Government of France	Ministère de la Transition écologique et solidaire	France
66347	132	12	132	15	How likely is it that historical practices will benefit greatly, or require mitigation? The industrialised scale of agriculture requires mitigation, not smaller scale production methods which utilise culturall/ historically sensitve practices, This would not be a real blocker to mitigation due to scale/ production capacity	We have attempted to write about cultural barrieris and opportunities across scale and context in farming, not just in industrial or small-scale situations.	Alex Osborne-Saponja	Sustainalytics	Canada
25005	132	17		18	"given long-standing dietary traditions within most cultures, some of the strongest barriers exist for efforts to change diets (medium confidence)." Remove: There is significant evidence to suggest that dietary change will not face insurmountable barriers	Noted, however, there are large barriers for most subsantive changes in technologies or diets to become norms, especially when there are only external benefits and not economic benefits (e.g., there are no obvious price or nutritional advantages associated with many suggested approaches to decarbonize the food chain). The evidence on this in the sociological and economic literature is strong.	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
25007	132	23		24	Replace: "where most of the food waste occurs after consumers have purchased food (FAO 2019)." With: "where increased food waste volumes occurs with consumers and significant food waste occurs along the whole supply chain due to socio-economic factors such as cosmetic outgrading and unfair trading practices (FAO 2019)." Explanation: There is considerable evidence that large volumes of food waste occur intentionally due to socio-economic causes at primary production level in developed countries, including pre-harvest, harvest and post-harvest levels (FAO, 2011; Hartikainen, 2017; Redlingshöfer, Coudurier and Georget, 2017; Devin and Richards, 2018; Garcia-Herrero et al., 2018; Hartikainen et al., 2018; Johnson, 2018; Johnson et al., 2018; Porter et al., 2018; WRAP, 2019; Messner, Johnson and Richards, 2021). There is considerable evidence that large volumes of food waste occur intentionally due to socio-economic factors rather than technical and infrastructural limitations at manufacturing level in developed countries (FUSIONS, 2016; Sheppard and Rahimifard, 2019; WRAP, 2020). There is insufficient evidence to show that the majority of food waste in developed countries occurs after consumers have purchased food. Numerous studies conclude that the majority of food loss and waste occurs pre-consumer in developed countries – for instance, in the FAO's 2011 study which does not exclude food loss and waste at harvest level, the FAO estimate that only 34% of Europe's and 39% of North America's food waste occurs at consumer level, with the remainder occurring at agricultural, post-harvest, processing and retail stages (FAO, 2011). The FAO's 2019 study cited here excludes harvest level food loss and waste, and thus cannot form an accurate impression of how much food is wasted pre-consumer (FAO, 2019). NRDC estimate that 43% of food loss and waste in the United States occurs in households, with the majority occurring in farms, manufacturing, grocery and distribution, restaurants and institutional food service (Gunders, 2017). EU FUSIONS estimate that a narrow majority of the EU's waste occurs at household level (53%) – however, the figures used for primary production food loss and waste are implausibly low at around 1% of production (FUSIONS, 2016), which does not reflect the far higher levels of food waste found in the most reliable studies of primary production food waste in European countries (Segrè and Falasconi, 2011; ADEME, 2016; Hartikainen, 2017; Hartikainen et al., 2018; WRAP, 2019).	changed to " .. where much of the food waste..." rather than "most of the food waste". We have adjusted some of the language in the section to reflect broader uncertainty.	Carina Millstone	Feedback Global	United Kingdom (of Great Britain and Northern Ireland)
31405	132	24	132	26	The term 'food waste' should be replaced by 'food losses' as these occur at production, post-harvest and processing stages in the food supply chain (Parfitt et al. 2010) and adopted by FAO (2011) in its report entitled: Global food losses and food waste - Extent, causes and prevention. Rome	thanks. done.	tamara van 't Wout	Food and Agriculture Organization of the United Nations (FAO)	Qatar
71889	132	24	132	29	This should be food loss not food waste	thanks. done.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
74889	132	24	132	29	These sentences refer to food waste in developing countries and acknowledge that it mostly occurs at the production stage. We recommend you instead use the terms 'post harvest losses' and 'food loss' instead of 'food waste' as this would be more accurate.	thanks. done.	Government of Kenya	Kenya Meteorological Service	Kenya
8509	132	28			systems. (FAO, 2019) remove dot before bracket. Systems (FAO, 2019).	Thanks, references were revised.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10265	132	28	132	28	systems. (FAO, 2019) remove dot before bracket. Systems (FAO, 2019).	Thanks, references were revised.	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
71891	132	30	133	22	Section 7.6.4.2 is quite slim and would benefit from a more in-depth analysis of the governance literature. Important topics to address are horizontal and vertical integration, participation, accountability, and power. The institutional capacity subsection needs significantly more work.	Agree these are important barriers, but we can only highlight them in general, not discuss them in detail as suggested. see alos other chapterrs on inernational cooperation etc.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21605	132	31	132	31	Political science references on the governance of agriculture and the inflence of corporatism could be mobilized in order to explain some of the obstacles to an increased transparency	this is an interesting point. We have incorporated discussion about the lack of a price on carbon (or regulations) which would encourage corporations to value nature based solutions and develop them within their supply chains in section 7.6.4.1. Ag corporations only resist carbon farming now because the benefits are small.	Government of France	Ministère de la Transition écologique et solidaire	France
3925	132	38			The Global Soil Partnership released last year the MRV protocol for Soil Organic Carbon, as part of the RECSOIL initiative to account for soil organic carbon storage: http://www.fao.org/global-soil-partnership/resources/highlights/detail/en/c/1308261/	Noted, thank you for the reference.	Rosa M Poch	ITPS and UdL	Spain
12473	133	6	133	9	In Africa, increase in Population density has led to expansion of small holder agriculture.Agricultural expansion, primarily of smallholder farms, accounted for approximately 70% of forest loss between 2000 and 2010 (African Progress Panel, 2015).	this is captured in the first sentence of the section on land tenure, although we do not refer directly to this trend. We have noted elsewhere the difficulties associated with changing practices where there are lots of smallholder farmers.	Nelly Bore	University of Nairobi	Kenya
12475	133	6	133	9	Increasingly, in developing Pastoral communities are diversifying their livelihood strategies and unclear tenure rights creates risk of land grabbing and expropriation and acts as a significant disincentive to sustainable land management (Byamugisha, 2013).	have tried to be clear about the important role of land tenure, although we do not discuss "land grabbing" in particular.	Nelly Bore	University of Nairobi	Kenya
12477	133	6	133	9	Land use change has an impact on the carbon assets, Guo and Gifford (2002) found that cultivation of grasslands leads to an average soil C loss of 59%.	captured in sections 7.2 to 7.5	Nelly Bore	University of Nairobi	Kenya
12479	133	6	133	9	Clear institutional arrangements and formalization can lead to access to carbon finance. if carried out in a pro-poor manner, it can grant rural poor greater access to natural resources (UN-HABITAT, 2008).	have discussed this in section 7.6.5 on SDG linkages.	Nelly Bore	University of Nairobi	Kenya
21577	133	7	133	9	It is not only about property rights but also the relationship between the State and the communities, in terms of legitimation	Accepted, the text will be revised.	Government of France	Ministère de la Transition écologique et solidaire	France
71893	133	7	133	9	Is it really property rights or access/use rights? Given the very significant area mentioned (more than 12% of globalforest cover), more detail would seem to be warranted.	Accepted, the text will be revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
73863	133	8			The source 'RRI, 2018' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1467	133	20	133	20	Add Kongsager et al. 2016 to the cited reference: "landscape scale (Duguma et al. 2014; Kongsager et al. 2016). Another aspect" •Kongsager, R., Locatelli, B. & Chazarin, F. (2016). Addressing climate change mitigation and adaptation together: a global assessment of agriculture and forestry projects. Journal: Environmental Management 57 (2), pp 271-282. http://dx.doi.org/10.1007/s00267-015-0605-y	Accepted, editorial.	RICO KONGSAGER	University College Copenhagen	Denmark
1461	133	22	133	22	Add Kongsager and Corbera 2015 to the cited reference "(Kongsager and Corbera 2015; Zelli et al. 2017). •Kongsager, R. & Corbera, E. (2015). Linking Mitigation and Adaptation in Carbon Forestry Projects: Evidence from Belize. Journal: World Development 76, pp. 132-146. http://dx.doi.org/10.1016/j.worlddev.2015.07.003	Accepted, editorial.	RICO KONGSAGER	University College Copenhagen	Denmark
46023	133	23	133	42	Please make sure to use the term "nature-based solutions" as defined in the glossary and WG II throughout the whole chapter/report. In the first paragraph (l. 23-34) it can be understood that BECCS is considered a nature-based solution. Following definitions from the glossary it should be clearly stated that BECCS cannot be considered a nature-based solution. To avoid misunderstanding, please do not use the term NbS in this context. The second paragraph (l. 35-42) refers to negative consequences of afforestation as a nature-based solution (e.g. higher evapotranspiration, soil acidification); this is certainly true for the afforestation of non-forested land with (often exotic) timber species, where forest would not occur naturally or monoculture plantations; however, this would not qualify as nature-based solutions as defined in the glossary.	Accepted, the text will be revised.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
71895	133	23	135	6	There is a sense that much of this has been covered well elsewhere	Thanks. have tried to revise and reduce this section.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
72675	133	23	133	42	This section is missing the potential water impacts of bioenergy and CCS. Bioenergy example: Stenzel, F., D. Gerten, C. werner, J Jagermeyr (2019). Freshwater requirements of large-scale bioenergy plantations for limiting global warming to 1.5C. Environmental Research Letters, 14:084001. CCS example: Rosa, L., J.A. Reimer, M.S. went, P. D'Orico (2020). Hydrological limits to carbon capture and storage. Nature sustatinability, 3:658-666.	have made some revisions in the section to try to be clear that water supply is also an issue.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
21579	133	30	133	34	Taking into account the relations between rural areas and cities would be important both to understand the decrease of arable land amid certain modes of urbanization, and also the possibilities of crop choicies and land use.	noted.	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
71897	133	35	133	42	Look at Seddon et al (2020) Understanding the value and limits of nature-based solutions to climate change and other global challenges. Phil. Trans. R. Soc. B 375: 20190120.	Noted. have incorporated this citation elsehwere.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
21581	133	38	133	38	Conversely, when afforestation consists in tree plantations with removal of the understorey though fire or herbicides, runoff can be doubled and soil erosion multiplied by six (Ribolzi et al., 2017; Neyert et al., 2020).	noted. have included more discussion on water availability.	Government of France	Ministère de la Transition écologique et solidaire	France
73865	133	42			The source 'Milkovic et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73867	133	42			The source 'Azarnivand et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
63733	133	44	133	44	Cook-Patton et al 2020 is not in the References. The citation is probably doi.org/10.1038/s41586-020-2686-x	thanks.	Government of Canada	Environment and Climate Change Canada	Canada
73869	133	44			The source 'Cook-Patton et al. (2020)' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73871	134	14			The source 'Nelson et al. 2014' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77031	134	17	134	18	"It is suggested that climate change will lead to an increase in carbon stocks of most forests around the world, with the greatest gains in tropical forest regions (Kim et al. 2017)." This statement seems overly simplistic and not appropriate as stated. Models indicate that changes in average climatic conditions would lead to an overall increase in growth on average. However, increased growth does not directly translate to increased stocks, as the level of stocks depends also on factors other than growth, such as harvesting and disturbances. Harvesting is likely to increase, not the least for bioenergy. In addition, disturbances are expected to increase due to extreme events, and biotic factors.	this comment mixes factors affecting stocks. Kim et al used a DGVM, which is consistent with other DGVMs. Under most GCM future conditions, forest stocks are predicted to increase, accounting for dieback, disease, climate change and CO2 fertilization. Biomass demand is not included in DGVMs, because it's an economic and policy phenomenon, but many studies also suggest that with biomass demand there will be more forest stock.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
77695	134	17	134	37	This discussion on forests misses the importance of differences in forest condition including the evidence of increased risk of fire and increased fire severity in young regrowth forests compared to long unlogged and primary forests– see comments and citations above.	The Kim citation does include changes in disturbances. It uses a DGVM which explicitly models disturbances	Virginia Young	Australian Rainforest Conservation Society	Australia
73873	134	18			Please distinguish which work it is between the ones by 'Kim et al.' in 2017.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
63735	134	26	134	37	Consider addressing the point raised by Duffy et al. 2021. How close are we to the temperature tipping point of the terrestrial biosphere? Science Advances.	thanks. will consider this article	Government of Canada	Environment and Climate Change Canada	Canada
8137	134	31	134	34	Please revise the text. The sink only saturates in situ, but not if e.g. substitution effects of timber usage are also considered (--> forest management).	will incorporate forest management into revision.	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
73875	134	33			The source of 'Nabuurs et al. 2013' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73877	134	33			The source of 'Coulston et al. 2015' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73879	134	36			The source of 'Sohngen and Mendelsohn 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
80673	134	38	134	46	BECCS is further complicated by the fact that it is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.").	We have revised the discussion of BECCS, but note that most projections of BECCS in this chapter show large future growth of demand for biomass, not large current demand, so the payback period would be negigible or 0.	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80817	134	38	134	46	BECCS is further complicated by the fact that it is not carbon neutral in the near-term—with a carbon deficit for many years, generally several decades to a century—that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels.").	We have revised the discussion of BECCS, but note that most projections of BECCS in this chapter show large future growth of demand for biomass, not large current demand, so the payback period would be negigible or 0.	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
61415	134	39	134	41	The form of the list('{1}' here and '(i)' in lin27, page 107) should be uniformed.	thanks.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
73881	134	44			The source of 'Favero et al. 2017' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73883	134	44			The source of 'Baker et al. 2019' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77697	134	47	135	6	Biodiversity plays an important functional role in ecosystem integrity and stability…the closer to natural patterns the greater the potential for adaptation. Strategies to facilitate species shifts in response to climate change largely focus on connectivity conservation and improving landscape scale ecological integrity and function. Active regeneration and other forms of restoration are fundamental tools in such initiatives. Increasingly, Connectivity conservation initiatives are also understood to be important integration tools for climate adaption, long-lived mitigation and biodiversity protection (The Nexus Report cited above).	have revised text.	Virginia Young	Australian Rainforest Conservation Society	Australia
53731	135	1	135	1	"losses in ecosystem functions due species shifts or reduction" should be "losses in ecosystem functions due to species shifts or reduction".	thanks.	ZHENG XINZHU	China University of Petroleum (Beijing)	China
64295	135	7	135	17	In order to achieve its full potential, AFOLU mitigation requires accurate and transparent data that lead to high-quality carbon offset that, in turn, attract capital on the scale required. Satellite technology can be used to measure the canopy, phenology and vegetation density of forests as an input to the calculation of above-ground carbon stocks. Remote sensing provides additional advantages including broad coverage inclusive of remote areas, low operating costs and environmental co-benefits (i.e. measure leakage, track biodiversity, etc.).	Thanks. Will address	Christian Lelong	Kayrros	United Kingdom (of Great Britain and Northern Ireland)
71899	135	7	135	29	why is the discussion of MRV limited to forests, which are already much better covered than other AFOLU emissions/removals?	Thanks. Will address	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
28821	135	8	135	17	1. This section fails to talk to the great deal of progress in countries capacities for forest monitopring built because of REDD+ that have resulted in over 42 countries having submitted their reference levels to UNFCCC.The Hansen data does not constitute a national MRV. It is an academic execrcise that has provebn a concept that then countries have in many cases incorporated and adde value to. In many cases the added value has gone well beyong what the authors concieved (e.g. Colombia). Part of that adde value consists in translatig the remote sensing data into something that informs the forest as per the national definitions (this is related to the comment made on the data by Hansen et al bieng tree cover and not forest - however that is not in essence a limitation of the data per se, its just that it needs post-processing). 2. It is clear there are remaining challenges egading attribution of change. Thes could be highlighted by the difficulties in moving from Land Cover to Land use (which also affect e.g. models vs nationa GHGis). This has underlying problems due to the fact Remote Sensing data products constitute cricumstantial evidence and the time frames used for countries to report (yearly vs in some instances a need for a time lag for ascertaining attribution correctly). 3. Major barriers to carbon densities monitoring include: a. A lack of pupose made network od calibratuion plots (in ost cases Remote Sensing scientists have to scavenge available data and complain of the inadquacies of those (yet are not able to pay for the acquisition of the data: basically observation platforms and systems fail to incorporate plots as part of the package). This is getting better as countrie are embarking in their NFI but these remain imperfect as in most cases designs are made without conbsidering linkages to the remote sensing platforms.	agreed. we have revised the section modestly to try to highlight the significant difficulties of MMRV with existing data, as well as promoting transparency.	naikoa aguilar-amuchastegui	WWF-US	United States of America
73885	135	11			The source of 'Ceccherini et al. 2020' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73887	135	11			The source of 'Palahi et al. 2021' cannot be found in the References.	Thanks, references were revised.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
85587	135	11	135	13	These losses could be due to many different factors, including natural disturbances like fires, climate change and traditional timber harvests in regions where forest management is significant. (Furhther research papers of mangrove species and mangrove forest and ecosystem degration are also better to be considered.)	have revised	San Win	Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation	Myanmar
8139	135	21	135	23	The NFI of most European States can be accessed through ENFIN (European National Forest Inventory Network, www.enfin.info). Please include this information in the text.	have revised	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
81659	135	24	135	24	This isn't quite right in regards to the online availability of New Zealand's forest inventory data. Most of New Zealand's natural forest inventory data is available online via request (https://nvs.landcareresearch.co.nz/Home/Index).	have revised	Government of New Zealand	Ministry for the Environment	New Zealand
85821	135	24	135	25	Please update for Australia: The statement that Australia does not have a forest inventory available online is incorrect. Australia's National Forest Inventory including all spatial and empirical data is available online at https://www.agriculture.gov.au/abares/forestsaustralia/forest-data-maps-and-tools. Additionally, Australia transparently publishes its software, the Full Carbon Accounting Model (FullCAM) used to model Australia's greenhouse gas emissions from the land sector including forests. Available at: https://www.industry.gov.au/data-and-publications/full-carbon-accounting-model-fullcam	have revised	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
71901	135	30	143	14	Section 7.6.5 needs a fundamental overhaul as it is more of a review than an assessment. However, the topics are important, but they are treated almost like an appendix as the perspectives raised in the section are not well integrated into the findings of the earlier sections of the chapter and find barely any reflection in the ES.	We don't agree with this. Isn't a review an essential part of an assessment. Wherever possible we have made a critical appraisal of the scientific evidences and findings. For instance while discussing the IPBES Global Assessment Report on Biodiversity and Ecosystem Services by Sandra Diaz et al. 2019 we have stated as follows: "The global trends reviewed above are based on data from 2,000 studies. It is not clear whether the assessment included a quality control check of the studies evaluated and suffer from aggregation bias. For instance, a recent meta-analysis of global forest valuation studies noted that quite a number of the studies reviewed had shortcomings such as failing to clearly mention the methodology and prices used to value the forest ecosystem services, double counting, data errors, etc (Ninan and Inoue 2013). Added to that the criticisms levelled against the paper by Costanza et al. (1997), such as ignoring ecological feedbacks and non-linearities that are central to the processes that link all species to each other and their habitats, ignoring substitution effects may also apply to the global assessment (Smith 1997; Bockstael et al. 2000; Loomis et al. 2000). Due to space constraints Figure 7.19 has been deleted with a brief discussion. Further in the section we have also referred to the discussion in the previous sections. For instance in the introductory paras of Section 7.6.5 we state as follows: As highlighted in section 7.3, land-use change is driven amongst other things, by agriculture, forestry (logging and fuelwood harvesting), infrastructural development and urbanisation, all of which may also generate localised air, water and soil pollution (Díaz et al. 2019). Again in another part we state as follows: "As reported in section 7.3, global forest area is estimated to have declined by roughly 178 Mha between 1990 and 2020 (FAO 2020), though the rate of net forest loss has decreased over the period, as a result of reduced deforestation in some countries and forest gains in others". Nevetheless the reviewer's comments are well taken and while revising the section (also keeping in view the space constraints) these comments will be taken note of and also the comment to highlight this in the executive summary.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
84815	135	30	138	9	Suggest that sections 7.6.5 (including 7.6.5.1) refer to indigenous peoples also (in the context of SDGs as well as other co-benefits that are identifiable and measurable (protection of cultural sites and territories, partnerships with indigenous peoples on their traditional territories etc). See https://ecos.csiro.au/finding-win-wins-carbon-offset-schemes-and-indigenous-co-benefits/	Section 7.6.5.3 already refers to indigenous communities in the text. we added a box on Menominee	Emily Gerrard	Comhar Group Pty Limited (law firm)	Australia
1757	135	36	135	38	This article is relevent to this issue. You can cite. Arfanuzzaman, M. and Dahiya, B. 2019. Sustainable Urbanization in Southeast Asia and Beyond: Challenges of Population Growth, Land Use Change and Environmental Health, Journal of Growth and Change, vol. 50 (2), doi:10.1111/grow.12297, John Wiley & Sons	Thanks. However due to space limitations we are unable to cite this article.	Md Arfan Uzzaman	FAO	Bangladesh
73889	135	43			Please distinguish between which source it is from the ones by 'UN Environment' in 2019.	This will be checked before finalising	Raehyun KIM	National Institute of Forest Science	Republic of Korea
61353	136	1	136	2	Mention grazing management	Suggestion rejected. Agriculture covers both crop lands and grazing lands. Grazing lands is explicitly referred to later.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
77699	136	10	136	18	Focus on forest cover alone is inappropriate. The review of SDG 15 noted the need to develop indicators of forest quality that factor in biodiversity. And, as noted above, forest condition matters for resilience to all threats. Clear prioritisation of forest mitigation action is needed to increase the focus on maintaining forest ecosystems in good condition and improving their long-term resilience (and resistance) to climate and non climate threats by ensuring good ecological principles guide forest restoration efforts…failure to do so will likely result in failure on all fronts (See IUCN Policy and guidance on primary forests including intact forest landscapes and Mackey et al 2020 cited above).	Suggested accepted. Due to space constraints we only refer to the decline in the forest quality in terms of the share of natural forests (which has high biodiversity value and provide a diverse range of ecosystem services) as compared to plantation forestry, as stated in the global forest resources assessment 2020.	Virginia Young	Australian Rainforest Conservation Society	Australia
73891	136	11			Please distinguish between which source it is from the ones by 'FAO' in 2020.	Noted and will be addressed while finalising the chapter	Raehyun KIM	National Institute of Forest Science	Republic of Korea
72677	136	14	136	14	south east where?	Thanks. This is now corrected to 'Southeast Asia	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
66349	136	24	134	31	Is there not a need to determine through the narrative that a decline in regulatiing ecosystem services will eventually reduce the capacity for provisional services in more detail if possible, as stated these are unsustainable in the long run, therefore should more of a causal link and narrative to support this be made i.e. mitigation and adaptation to support soil as a carbon sink not only aids in climate resilience but also creates sustainable long term outputs, this is key to wider financing going forward.	This point is noted and included in the text. Due to space constraints Figure 7.19 is deleted.	Alex Osborne-Saponja	Sustainalytics	Canada
46025	136	25			The term 'ecosystem services', here and elsewhere, extensive aquaculture such as the traditional 'fish farming of carp' in central Europe is capable to provide substantial ecosystem services in a sense of managing the associated wetlands and vegetation (biodiversity) (see also Ch 7 p136, l25). Please insert after "regions (Sumaila et al. 2017)." "However, extensive aquaculture such as the traditional fish farming of carp in central Europe can also contribute to landscape management and provide ecosystem services". References (can be translated if needed): (1) Barbara Färber, PILOTSTUDIE 4 –UMWELTDATEN DER AQUAKULTUR Endbericht Umweltbundesamt Universität für Bodenkultur WienKarl Franzens Universität Graz Veterinärmedizinische Universität Wien, Umweltbundesamt GmbH Spittelauer Lände 5, 1090 Wien/Österreich © Umweltbundesamt GmbH, Wien, 2020 ISBN 978-3-99004-535-0, (2) Seitel C und Oberle M, Ökosystemdienstleistungen der Karpfenteichwirtschaft, Fischer & Teichwirt 11/2019, 409	Suggestion accepted. Will insert these points after Sumaila et al. 2017. However instead of the two references (in German) suggested by the reviewer we have cited a recent European Commission report of 2021 to support the additional statements in the text.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
21583	136	35	133	36	Isn't it already the case? (see: SROCC – SPM point A5.4 - Ocean warming in the 20th century and beyond has contributed to an overall decrease in maximum catch potential (medium confidence), compounding the impacts from overfishing for some fish stocks (high confidence). In many regions, declines in the abundance of fish and shellfish stocks due to direct and indirect effects of global warming and biogeochemical changes have already contributed to reduced fish-eries catches (high confidence))	Sugestion accepted. This additional citation (SROCC) will be incorporated in the revised text.	Government of France	Ministère de la Transition écologique et solidaire	France
8141	136	41	136	45	Please rephrase or delete this sentence. FSC is not the only certification scheme, nor does not being certified by FSC mean that the forests are managed unsustainably. In fact, since requirements for FSC certification vary between countries, forests in one country with high standards can not qualify for a certificate (or do not want to get certified), but be more sustainably managed than "certified" forests in countries with lower overall standards.	Comment redundant following revision and reducing section size due to space constraints	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
63737	136	45	136	46	The statement "Regulating contributions, such as soil organic carbon … have decline" needs citation and better context. The paragraph discusses forest certification, is this statement about forest management or LUC? If the sentence concerns forest management, the text should refer to IPCC guidelines (2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories) indicating the lack of evidence for a general loss of organic matter with forest management. See BOX 4.3A (new guidance) Developing Tier 2 Stock Change factores for forest land, Chapter 4 AFOLU).	Citation to Diaz et al. 2019 is added. Comment relating to forest certification is now redundant since the section size was reduced due to space constraints	Government of Canada	Environment and Climate Change Canada	Canada
72679	136	47	137	26	It isn't clear what the point of this paragraph is, and it is doesn't seem to cover a consistent topic. Maybe ecosystem health? The topic sentence is unclear, and the content ranges from forest to crops to land degredation to soil carbon to animals to permafrost. What does "productivity" refer to in the various places? Is it like NPP, or crop yield?	As you may note from the section title it focuses on ecosystem services (ES). It covers the different ecosystem services such as provisioning and regulating services, etc. It discusses the changes in ecosystem services based on the recent IPBES global assessment of biodiversity and ecosystem services and other evidences such as the Living Planet Index Report. Changes in biodiversity and ecosystem services can be used as a measure to gauge ecosystem health (e.g. using a species-based approach or a habitat-based approach or a combination of the two approaches).As regards productivity the para discusses both NPP as well as assess the changes in yields or production of the services which recorded an increase as per the global assessment cited earlier.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
73893	137	6			Text corrected. There is only one source by 'Ninan and Inoue' in 2013 in the References.	Noted. There is only one Ninan and Inoue 2013.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73895	137	9			The source of 'Smith 1997' cannot be found in the References.	Will be added in the revised chapter	Raehyun KIM	National Institute of Forest Science	Republic of Korea
77033	137	14	137	15	The 8% loss of soil organic carbon over two centuries seems rather small. Reference is made to a single source. It would be good to accompany it with a confidence statement or perhaps with more detail. Crucially, it should be clarified whether the quantity quoted (176 GtC) refers to the loss of soil C stock or the amount believed to have been emitted to the atmosphere. Given that much of the soil loss is in the form of erosion and its fate is often uncertain, there is likely to be a very big difference between the two figures. It should also be clarified whether this includes losses of peat and, if so, what would be their share.	These statements are drawn from the IPBES Assessment Report on Land degradation and Restoration (2018) by Bob Scholes et al. The reviewer has not furnished any scientific evidence or literature to backup his opinions and hence we are unable to accept the suggestion.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
84575	137	21	137	22	Please add after "...options.": "Karlsson, M., Alfredsson E. & Westling N. (2020) Climate policy co-benefits: a review, Climate Policy 20, 292-316. DOI: 10.1080/14693062.2020.1724070".	Thanks. However due to space constraints , we are unable to include cite this reference. The reviewer has not given any justification as to why his/her article should be cited.	Mikael Karlsson	KTH Royal Institute of Technology	Sweden
66351	137	27	137	31	Most ecosystem service valuation is based upon forward looking models that speak to NPV and wider natural capital accounting, has this been considered. As pointed out there is a loss assocatied with land use change, but wider modelling is available at Government level that assesses losses going forware see HM Gov Natural Capital Committee outputs. Further to this there has been significant work done at catchment level relating to flooding and wider impacts on insurance, therefore the impacts must be quatified in some way?	Most ecosystem valuation studies are done at a single point of time and don't need the use of NPVs. Due to space constraints the studies and discussion based on Costanza et al 2014 and Kubiszewski et al 2017 (cited in the SOD) that use time series data to estimate ecosystem services values expressed in Net Present Value (NPV) terms have been deleted.. Due to space constraints we are unable to discuss in detail the losses due to flooding etc.	Alex Osborne-Saponja	Sustainalytics	Canada
72681	137	34	137	35	30% of what losses, and from what causes?	Comment redundant following revision and reducing section size due to space constraints	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
72689	137	45	138	9	figure 7.19 generally shows a negative impact on ecosystem services and biodiversity, even in a sustainability scenario, except for those related to production for human consumption. This is not coherently reflected in the indicated and other related text.	Thanks. Suggestion accepted and will modify the text accordingly	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
63739	137	46	137	48	Actually, this applies to most, if not all ecosystems	Agree that this applies to most, if not all ecosystems. Here our focus is on the importance of land use and land cover changes as a major driver behind loss of biodiversity and ecosystem services. This chapter deals with agriculture, forest and other land uses.	Government of Canada	Environment and Climate Change Canada	Canada
19791	138	10	138	10	ecosystem services,adaptation and mitigation sinergy options	Not clear as to what point the reviewer is making	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
54351	138	10	138	48	There is a lot more literature out there (especially post-2019) looking at ecosystems services and mitigation options. Especially when generalizing numbers, there should either be more references or an indication that there is no further evidence. Also recommend to cross-reference WG2 for interactions between (ecosystem-based) adaptation and mitigation, where the main reference here is a 2009 CBD report...	Comment redundant following revision and deletion of this section due to space constraints	Sabine Fuss	MCC Berlin	Germany
19793	138	11	138	11	an adaptation based ecosystem approach (AbE)	Comment redundant following revision and deletion of this section due to space constraints	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
73897	138	16			It seems there is a difference between 'Royal Society (in the in-text citation)' and 'The Royal Society Science Policy Centre (in the References)'.	The citation in the text is corrected to 'The Royal Society'.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
1463	138	21	138	21	Add Kongsager 2018 here: "mitigation options (Kongsager 2018). Different" • Kongsager, R. (2018). Linking Climate Change Adaptation and Mitigation: A Review with Evidence from the Land-Use Sectors. Journal: Land (7)4, 158. https://doi.org/10.3390/land7040158	Thanks. However due to space constraints we are unable to cite this artice. The reviewer has not given any justification as to why it is essential to cite his/her article in the text.	RICO KONGSAGER	University College Copenhagen	Denmark
21585	138	22	132	22	A study by (Assouma et al., 2019) addresses the carbon balance of a sahelian pastoral landscape by using an ecosystem approach that takes account of all ecological functions. The research shows that the carbon balance of the landscape is neutral, even if it varies according to the place and the season. It means that, in the Sahel, storage of carbon in trees, shrubs and soils offsets the greenhouse gas emissions produced by pastoral livestock through their feeding and their faeces. This approach help to identify operational mitigation options at the local level. In addition to the recognised option of efficient use of natural resources in livestock feeding (for example by storing fodder when it is abundant and high quality), three techniques are suited to pastoralism: developing watering points, making use of animal waste through anaerobic digestion, and tree planting, such as the Great Green Wall initiative in Africa. Assouma, M.H., Lecomte, P., Corniaux, C., Hiernaux, P., Ickowicz, A., Vayssières, J., 2019. Pastoral landscapes in the Sahel: a carbon balance with unexpected potential for climate change mitigation. Perspective, 1-4. http://agritrop.cirad.fr/594230/	Thanks. However due to space limitations and the need to adhere to the word count limit we are unable to include these details in the text.	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
60297	138	27	138	29	The mention to afforestation, including the reference to monocultures such as eucalyptus, seems to be inadequate or substantially unbalanced. The sentence currently says "cultivation of monocultures such as eucalyptus WILL BE detrimental to..." In certain circumstances, based on poor management, detrimental impact might occur. However, in most cases, when proper management is applied, eucalyptus and other monocultures are not detrimental and are also likely to generate more positive than negative impacts to sustainable development, including biodiversity (e.g. adopting fauna corridors), food security and water availability, let alone positive economic impact and avoiding pressure on native trees. This is widely known, especially through forest certification schemes, such as FSC (Forest Stewardship Council) or PEEF, which result from decades of multi-governance schemes supported by hundreds of NGOs, private companies and other relevant stakeholders. Also, a vast body of literature corroborate that tree monocultures, including but not limited to eucalyptus, are not detrimental and may also generate positive impacts (Sparovek et al 2016 + full list of references below, mostly available online). In short, it all depends on the quality of the overall forest management scheme. Hence I suggest this sentence be changed to: "Afforestation and reforestation can help carbon sequestration and making productive use of degraded or non-forested lands. Nonetheless, the impacts on sustainable development, including biodiversity, food security and water availability may be positive, neutral or negative, depending on the quality of social and environmental management practices. There is evidence of positive and negative impacts in the literature and a wide range of certification schemes to ensure proper management" (see references below for the positive cases, whereas the current text present only references of negative impacts). References: (see also www.newgenerationplantations.org) 1) Sparovek, G., Antoniazzi, L. B., Barretto, A., Barros, A. C., Benevides, M., Berndes, G., do Prado Braga, E., Calmon, M., Groke, P. H., de Avelar Marques, F. N., Nogueira, M. P., Guedes Pinto, L. F. and Precioso, V. (2016), Sustainable bioproducts in Brazil: disputes and agreements on a common ground agenda for agriculture and nature protection. Biofuels, Bioprod. Bioref.. doi:10.1002/bbb.1636 avaliable at http://onlinelibrary.wiley.com/doi/10.1002/bbb.1636/full 2) Amazonas, N. T., Forrester, D. I., Oliveira, R. S., Brancalion, P. H. S. 2018. Combining Eucalyptus wood production with the recovery of native treediversity in mixed plantings: Implications for water use and availability. Forest Ecology and Management 34:40-418 3) Tavares, A., Beiroz, W., Fialho, A., Frazão, F., Macedo, R., Louzada, J., Audino, L. Eucalyptus plantations as hybrid ecosystems: Implications for speciesconservation in the Brazilian Atlantic forest. 2019. Forest Ecology and Management 131:139-433 4) Bosi, C., Pezzopane, J. R. M., Sentelhas, P. C. Soil water availability in a full sun pastureand in a silvopastoral system with eucalyptus. 2020. Agroforest Syst 94:429–440 5) Carrilho, M., Teixeira, D., Santos-Reis, M. , Rosalino, L. M. 2017. Small mammal abundance in Mediterranean Eucalyptus plantations:how shrub cover can really make a difference. Forest Ecology and Management 256:263-391 6) Silva, V. E., Nogueira, T. A. R. N., Abreu-Junior, A. H., He, Z., Buzetti, S., Laclau, J. L., Filho, M. C. M. T., Grilli, E., Murgia, I.Carpa, G. F. Influences of edaphoclimatic conditions on deep rooting and soil wateravailability in Brazilian Eucalyptus plantations. 2020. Forest Ecology and Management 673:684-445 7) Lana, A.M. Q., Lana, R.M.Q., Lemes, E. M., Reis, G.L., Moreira, G. H. F. A. Influence of native or exotic trees on soil fertility in decadesof silvopastoral system at the Brazilian savannah biome. 2018. Agroforest Syst 415:424 - 92 8) Boeno, D., Silva, R. F., Almeida H. S., Rodrigues, A. C., Vanzan, M. ,Andreazza, R. 2020. Influence of eucalyptus development under soil fauna. Braz. J. Biol. 345:353-80 9) Gabriel, V.A., Vasconcelos, A. A, Lima, E. F., Cassola, H., Barretto, K.D., Brito, M.C.2013. The importance of Eucalyptus plantations for biodiversity conservation. Pesq. flor. bras.,	Comment redundant as this section has been deleted due to space constraints	FABIO MARQUES	Brazilian Forestry Industry / Plantar Carbon Consulting	Brazil
60299	138	27	138	29	References for the comments in previous and next cells: 1) Sparovek, G., Antoniazzi, L. B., Barretto, A., Barros, A. C., Benevides, M., Berndes, G., do Prado Braga, E., Calmon, M., Groke, P. H., de Avelar Marques, F. N., Nogueira, M. P., Guedes Pinto, L. F. and Precioso, V. (2016), Sustainable bioproducts in Brazil: disputes and agreements on a common ground agenda for agriculture and nature protection. Biofuels, Bioprod. Bioref.. doi:10.1002/bbb.1636 avaliable at http://onlinelibrary.wiley.com/doi/10.1002/bbb.1636/full 2) Amazonas, N. T., Forrester, D. I., Oliveira, R. S., Brancalion, P. H. S. 2018. Combining Eucalyptus wood production with the recovery of native treediversity in mixed plantings: Implications for water use and availability. Forest Ecology and Management 34:40-418 3) Tavares, A., Beiroz, W., Fialho, A., Frazão, F., Macedo, R., Louzada, J., Audino, L. Eucalyptus plantations as hybrid ecosystems: Implications for speciesconservation in the Brazilian Atlantic forest. 2019. Forest Ecology and Management 131:139-433 4) Bosi, C., Pezzopane, J. R. M., Sentelhas, P. C. Soil water availability in a full sun pastureand in a silvopastoral system with eucalyptus. 2020. Agroforest Syst 94:429–440 5) Diversidade 2: Carrilho, M., Teixeira, D., Santos-Reis, M. , Rosalino, L. M. 2017. Small mammal abundance in Mediterranean Eucalyptus plantations:how shrub cover can really make a difference. Forest Ecology and Management 256:263-391 6) Silva, V. E., Nogueira, T. A. R. N., Abreu-Junior, A. H., He, Z., Buzetti, S., Laclau, J. L., Filho, M. C. M. T., Grilli, E., Murgia, I.Carpa, G. F. Influences of edaphoclimatic conditions on deep rooting and soil wateravailability in Brazilian Eucalyptus plantations. 2020. Forest Ecology and Management 673:684-445 7) Lana, A.M. Q., Lana, R.M.Q., Lemes, E. M., Reis, G.L., Moreira, G. H. F. A. Influence of native or exotic trees on soil fertility in decadesof silvopastoral system at the Brazilian savannah biome. 2018. Agroforest Syst 415:424 - 92 8) Boeno, D., Silva, R. F., Almeida H. S., Rodrigues, A. C., Vanzan, M. ,Andreazza, R. 2020. Influence of eucalyptus development under soil fauna. Braz. J. Biol. 345:353-80 9) Gabriel, V.A., Vasconcelos, A. A, Lima, E. F., Cassola, H., Barretto, K.D., Brito, M.C.2013. The importance of Eucalyptus plantations for biodiversity conservation. Pesq. flor. bras., Colombo, v. 33, n. 74, p. 203:213. 10) WORLD BANK. BioCarbon fund experience: insights from afforestation and reforestation clean development mechanism projects. Washington: World Bank, 2011. Available at: https://openknowledge.worldbank.org/handle/10986/27108 11) MARQUES, Fabio N.A.. "Forestry CDM in Brazil: Fundamentals, Legacy and Elements for the Futures". In: Legacy of the CDM: lessons learned and impacts from the Clean Development Mechanism in Brazil as insights for new mechanisms / editors: Flavia Witkowski Frangetto, Ana Paula Beber Veiga, Gustavo Luedemann. – Brasília: IPEA, 2019. 417 p. Avaliable at: http://repositorio.ipea.gov.br/bitstream/11058/9574/1/Forest%20CDM%20in%20Brazil.pdf	Regrettably, it is not clear what the reviewer suggests.	FABIO MARQUES	Brazilian Forestry Industry / Plantar Carbon Consulting	Brazil
21587	138	28	138	28	We suggest to mention rubber tree and teaks as well	Comment redundant as this sub-section has been deleted due to space constraints	Government of France	Ministère de la Transition écologique et solidaire	France
60301	138	30	138	31	This sentence also seems to be unbalance since it only depicts on side of the potential impacts, by stating that afforestation may have high opportunity costs to large requirements of land for implementing afforestation projects. Yes, that may be the case in certain circumstances especially in countries/regions with land availability constraints, but it may also be the opposite in countries/regions with land availability. Thus, the sentence should be balanced to reflect both situations. The rationale of this comment is the same as the previous one. It depends on local contexts; hence the current sentence seems to overlook that opportunity costs may also be favourable, including when there are large requirements of land (see references in the previous comments, Sparovek et al 2016, etc.)	Suggestion accepted and text revised accordingly.	FABIO MARQUES	Brazilian Forestry Industry / Plantar Carbon Consulting	Brazil

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
80675	138	34	138	48	Because use of biomass for bioenergy results in a carbon deficit of decades to a century, bioenergy is in fact, not carbon neutral in the near-term period that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, NATURE SCIENTIFIC REPORTS 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, ENVIRON. RES. LETT. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, ENVTL. RESEARCH LETTERS 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack	Bioenergy or BECCS is dealt with in detail another section, and also in the chapter on energy in WGIII report. Due to space constraints including limits imposed on different sub-sections we are unable to address these issues here.	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80819	138	34	138	48	Because use of biomass for bioenergy results in a carbon deficit of decades to a century, bioenergy is in fact, not carbon neutral in the near-term period that is crucial for mitigating emissions and avoiding hitting the 1.5°C mark. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, NATURE SCIENTIFIC REPORTS 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, ENVIRON. RES. LETT. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, ENVTL. RESEARCH LETTERS 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack	Due to space constraints we are unable to include these details in this section. There is a dedicated sub-section in this chapter on Bioenergy or BECCS and in the other chapters of WGIII which will consider these.	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
19795	138	46	138	46	add restoration	Suggestion accepted.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
1469	138	47	138	48	Add Kongsager 2018 to the cited reference: "(Duguma et al. 2014, Kongsager 2018)." • Kongsager, R. (2018). Linking Climate Change Adaptation and Mitigation: A Review with Evidence from the Land-Use Sectors. Journal: Land (7)4, 158. https://doi.org/10.3390/land7040158	Thanks. However due to space constraints we are unable to cite this article. The reviewer has not given any justification as to why his/her article should be cited.	RICO KONGSAGER	University College Copenhagen	Denmark
74891	138	48	139	5	Writing that "experience with climate smart agriculture in Africa has not been encouraging" gives the impression that CSA as an approach in Africa should be written off because it has not been successful. Instead, we suggest acknowledging that there have been shortcomings (particularly around gender inclusion and equity) but also recognizing the constraints and barriers that have precluded greater success, such as limited extension systems and weak policy implementation, while pointing to some bright spots and calling for more efforts to realize the potential. A useful resource might be Makate et al. (2019) https://doi-org.ezproxy.library.wur.nl/10.1016/j.jenvman.2018.10.069	Thanks. Suggestion accepted and will modify the text accordingly	Government of Kenya	Kenya Meteorological Service	Kenya
72683	139	1	140	14	The box does not explain how the goals were not met, although this is a main point of the statement preceding the box.	The box spells out the enablers and barriers that resulted in the projected benefits of climate smart cocoa production in Ghana not being realised. The statements preceding the box clearly spell out the reasons such as institutional constraints, lack of tenure rights on trees, bureaucratic and legal hurdles etc.which resulted in the projected benefits of CSA not being realised	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
1471	139	5	139	5	Add text after reference: "expectations (Arakelyan et al. 2017), and lessons from Belize highlight that cultural and economic barriers of proximate and indirect nature, existing at different spatial scales, which can make climate-smart agriculture difficult to implement (Kongsager 2017)" (Kongsager, R. (2017). Barriers to the adoption of alley cropping as a climate-smart agriculture practice: lessons from maize cultivation among the Maya in southern Belize. Journal: Forests 8(7), 260. http://www.mdpi.com/1999-4907/8/7/260/pdf	Suggestion accepted. Text modified accordingly	RICO KONGSAGER	University College Copenhagen	Denmark
8823	139	7	140	14	Informative case study. The critical enablers and barriers section may benefit from reference to the work of Thornton et al 2018 - A framework for priority-setting in climate smart agriculture research.	Thanks. Due to space constraints we are unable to cite this article.	Eamon Haughey	Galway-Mayo Institute of Technology	Ireland
19797	139	7	139	7	box 7.14 not included lessons learned	The statements preceding the box spell out the weaknesses or failures that led to the projected benefits of CSA not being realised or below expectations. The revised text also cites how economic, social and cultural barriers hindered the successful implementation of CSA in some countries. The lessons emanating from these are obvious such as the need for market and institutional reforms, factoring in local and cultural contexts, etc.for better implementation of CSA	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
71903	139	7	140	14	The box needs further work and is currently too narrow in ist perspective. Currently there is little justification for keeping it.	Reject. Reviewer's comment that the box is too narrow in perspective is vague and incorrect. The box has been prepared as an input from Chapter 7 to the policy chapter (Chapter 13) and the criteria mentioned in the box are as per that required by the policy chapter which focuses on the barriers and enablers of the policy intervention (CSA here). We also have general instructions to limit the size of a box to half a page. Besides there is a view that the case studies/boxes in the IPCC assessment reports are mostly drawn from North America and Europe whereas Africa has been almost neglected. So the reviewer's penultimate suggestion to even consider deleting the box (a case study from Ghana) cannot be accepted. None of the other reviewers who reviewed this box have made such a suggestion	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
3927	140	16		22	This paragraph is not clear. SDG others than 14 and 15 are also directly or indirectly related to nature?? Or rather are directly related to humanity? I advise to delete the whole paragraph.	Reject. Many of the other SDGs are either directly or indirectly related to nature as well as quality of life and human well-being. For example, an increase in agricultural production (a provisioning service of nature) will contribute to poverty reduction and thus improve human well-being. Similary water provision by nature which is a life giving service (hydrological benefits of forests) will contribute to quality of life and human well-being. The scientific literature has been cited to justify these statements in the text	Rosa M Poch	ITPS and UdL	Spain
4455	140	16	141	17	Add Reference: Pandey R.U, A Bharat ,Yogesh K. Garg (2013), Understanding Qualitative Conceptions of Livability: An Indian Perspective, International Journal of Research in Engineering and Technology, Vol. 2, no.-12, Dec. 2013, Page no. 374-380, ISSN: 2321– 730	Reject. Authors have not given any justification as to why it is essential to add this reference	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
84577	140	20	140	21	Please add after "…goals.": "Karlsson, M., Alfredsson E. & Westling N. (2020) Climate policy co-benefits: a review, Climate Policy 20, 292-316. DOI: 10.1080/14693062.2020.1724070".	Thanks. However due to space constraints we are unable to cite this article by the reviewer.	Mikael Karlsson	KTH Royal Institute of Technology	Sweden
3929	140	28		33	I suggest to remove this part (starting with Nature at the end of line 28, to the end of the paragraph) since it is too general and does not provide with anything new to the report.	Suggestion rejected.	Rosa M Poch	ITPS and UdL	Spain
46027	140	28	140	28	After "… and well-being", please insert a reference to the IPBES global assessment (2019): https://ipbes.net/sites/default/files/2020-02/ipbes_global_assessment_report_summary_for_policymakers_en.pdf.	Reject. In comments to the FOD of this chapter some reviewers had commented that there were too many references to the IPBES Global Assessment report (Sandra Diaz et al, 2019) in the previous draft of this section. Moreover this sentence is not drawn from the SPM report of the IPBES Global assessment.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
31407	140	31	140	33	Suggest to replace the word 'nature' with 'healthy and diverse ecosystems' to better withstand the adverse impacts of disasters and extreme weather events	Suggestion accepted	tamara van 't Wout	Food and Agriculture Organization of the United Nations (FAO)	Qatar
71905	140	36	140	36	The ocean - singular form is better suited.	The IPBES global assessment report uses the plural term 'Oceans'	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
63741	140	41	140	41	Note that there are 169 targets, not 150 targets	Thanks. Corrected to 169 targets	Government of Canada	Environment and Climate Change Canada	Canada
46029	140	48	141	3	With regard to the "inadequacies of traditional GDP as an indicator of well-being" it would be good to include the findings of the recently published Dasgupta Review including reference to concepts like "inclusive wealth".	Thanks.Suggestion accepted and will note the findings of the Dasgupta Biodiversity Review in the revised draft including citing the inclusive wealth approach to measure economic progress and well-being, apart from traditional GDP	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
72685	141	4	141	6	Does this mean that dependent communities received the most benefits? Or that among thes communities some received benefits and others did not?	Comment redundant as this discussion in the section has been deleted due to severe space constraints	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
4453	141	17	141	17	Add contents on 'Zonotic diseases' threat' and bio-terrorism	Suggestion rejected.	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
4457	141	19	142	13	Add reference: Bharat, A (2017), Is an unbuilt area of land available for development,https://www.acccrn.net/sites/default/files/publication/attach/is_an_unbuilt_area_of_land_available_for_development.pdf	Thanks. However due to space constraints and instructions given to adhere to the chapter size limit imposed by the IPCC we are unable to cite this article. The reviewer has not given any justification as to why his/her article should be cited	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
4459	141	19	142	13	Add reference: Nair Rekha .S ,Bharat A, Manu G. Nair (2012), Framework for Integrating adaptation policies for climate change in development plan, International Journal of Environmental Engineering and Management, Vol. 3 , No. 3 ,2012 , pp 235-249, ISSN 2231-1319	Thanks. However due to space constraints and instructions given to adhere to the chapter size limit imposed by the IPCC we are unable to cite this article. The reviewer has not given any justification as to why his/her article should be cited	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
20399	141	19	141	20	Please clarify explicitly what is meant by "land-based mitigation". Production of biomass? Increasing carbon stocks? Please also clarify the sentence, as it has an odd structure.	The IPCC special reports indicate four categories of land-based mitigation measures such as: BECCS; Reforestation and forest restoration; Afforestation and: Biochar addition to soil. Many other scientific literature explain as to what land-based mitigation refers to. Due to space constraints we cannot elaborate this is in detail in the text.	Tommi Ekholm	Finnish Meteorological Institute	Finland
72687	141	30	141	32	I expect that this depends largely on how the carbon accounting scope is defined. In some regions wildfire challenges landscape carbon neutrality, and climate change may push ecosystems more towards sources rather than sinks.	Yes this may be so.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
19799	141	31	141	31	add decade of ecosystem restoration 2021-2030	Reject	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
46031	141	32	141	33	Here, the following source is quoted: "Díaz, S., J. Settele, and E. Brondizio, 2019: Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). J. Rural Plan. Assoc., 36, https://doi.org/10.2750/arp.36.13.". However, the original source for the mitigation potential of 37% of NbS is derived from Griscom et al. (2017), which is therefore the more appropriate source. Further limitations of this study and more recent literature should be conveyed in this section. We would also recommend to use a more careful formulation of the mitigation potential, as the current sentence could be misinterpreted and stimulate reduced efforts in phasing out fossil fuels (e.g.: "NbS are estimated to have the potential to contribute..."). See e.g. Getting the message right on nature-based solutions to climate change, Seddon et al. 2020, GLOBAL CHANGE BIOLOGY, DOI: 10.1111/gcb.15513 and references therein.	Accept. Citation corrected to Griscom et al. 2017. The limitations of the 37% mitigation potential of NbS as suggested by Griscom et al. 2017 and other suggestions are also included in the revised text.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
51769	141	32	141	34	Even the data given in this chapter above suggets that the value of 37% is highly questionable. Suggest to remain consistent with the more complex assessment provided in AR6, which should using this value unreflected prohibitive.	Accept. Some of the limitations of the Griscom et al 2017 paper's estimate of 37% mitigation potential are included in the revised text.	Florin Vladu	UNFCCC Secretariat	Germany
73899	142	4			The source 'Sutton et al. (2016)' cannot be found in the References.	Comment redundant as this sentence has been deleted in the revised draft due to severe space constraints	Raehyun KIM	National Institute of Forest Science	Republic of Korea
8767	142	6	142	13	This section discusses the potential unintended consequences of land-based climate mitigation strategies. It identifies potential impacts on biodiversity and ecosystem services. But there is also a risk of negative social impacts which has not been discussed. Negative social impacts could include green grabbing and the dispossession of the rural poor (Borras & Franco 2018). Borras Jr, S. M., & Franco, J. C. (2018). The challenge of locating land-based climate change mitigation and adaptation politics within a social justice perspective: towards an idea of agrarian climate justice. Third World Quarterly, 39(7), 1308-1325.	Due to space constraints we are unable to include this reference.	Billy Jones	Lund University	Sweden
19801	142	11	142	11	soil organic carbon (soc)	Reject. This sentence is cited from Scholes et al 2018 where they use the statement 'soil carbon content'.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
46033	142	13	142	13	After (Scholes et al. 2018), it is suggested to insert a reference to: J.L. Chotte, E. Aynekulu, A. Cowie, E. Campbell, P. Vlek, R. Lal, M. Kapović-Solomun, G. von Maltitz, G. Kust, N. Barger, R. Vargas and S. Gastrow. 2019. Realising the Carbon Benefits of Sustainable Land Management Practices: Guidelines for Estimation of Soil Organic Carbon in the Context of Land Degradation Neutrality Planning and Monitoring. A report of the Science-Policy Interface. United Nations Convention to Combat Desertification (UNCCD), Bonn, Germany.	Thanks for the suggestion. However, due to space constraints we are unable to cite this reference.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
8143	143	1	143	14	Figure 7.19: Please explain what NCP means."Natures contribution to people" is flawed - do you mean e.g. "peoples' wellbeing"?	This term NCP (nature's contributions to people) is widely used to describe the benefits that people derive from nature. See the IPBES global assessment report on biodiversity and ecosystem services by Sandra Diaz et al . 2019; and many research articles that use the term NCP. See also Unai Pascual et al. Valuing nature's contributions to people-the IPBES approach, Current Opinions in Environmental Sustainability, 26-27, June 2017.	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
66353	143	1	143	1	In many cases material contributions increase despite species richness and regulating contributions decline, how can this be considering the regulating elements underpin the material contributions, this is not sustainable as discussed in an earlier section of the report, therefore should there be an amendement to demsntrate decline in quality, or abaility to maintain contribution as a proxy to the underlying contributions. It seems unlikely that there would be an increase in material contribution to 2050 whilst there is a steady decline in regulating contributions.	Suggestion accepted and text revised accordingly	Alex Osborne-Saponja	Sustainalytics	Canada
8511	143	5			emissions ((SSP1, RCP2.6: top rows in each panel. Remove one bracket	Comment redundant as the figure has been deleted in the revised draft due to severe space constraints	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10267	143	5	143	5	emissions ((SSP1, RCP2.6: top rows in each panel. Remove one bracket	Comment redundant as the figure has been deleted in the revised draft due to severe space constraints	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
80677	143	12	143	16	Bioenergy, even using residues, and BECCS are not carbon neutral in the near term. Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack of suitable long-distance biomass and CO2 transport. Baik E. et al., Geospatial Analysis of Near-term Potential for Carbon-negative Bioenergy in the United States, Proc. Nat'l. Acad. Sci. 115(13):3290–3295 (2018) ("Previous BECCS deployment assessments have largely overlooked the potential lack of spatial colocation of suitable storage basins and biomass availability, in	there is an extensive section on bioenergy (7.4..4) that displays a nuanced message about bioenergy, with all pros and cons and risks	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80821	143	12	143	16	Bioenergy, even using residues, and BECCS are not carbon neutral in the near term. Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack of suitable long-distance biomass and CO2 transport. Baik E. et al., Geospatial Analysis of Near-term Potential for Carbon-negative Bioenergy in the United States, Proc. Nat'l. Acad. Sci. 115(13):3290–3295 (2018) ("Previous BECCS deployment assessments have largely overlooked the potential lack of spatial colocation of suitable storage basins and biomass availability, in	Duplicate comment-there is an extensive section on bioenergy (7.4..4) that displays a nuanced message about bioenergy, with all pros and cons and risks	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
71907	144	2	145	17	Section 7.6.6 currently reads like an add-on and needs a lot more work.	Noted. Section 7.6.6 has been removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
77035	144	2	145	17	7.6.6. Either this section, or some other part of Chapter 7 shoudl include an assessment of the implications for AFOLU of mitigation options not assessed in the Chapter. First among them is bioenergy without CCS, which is not discussed in detail in this chapter because it is not considered part of AFOLU, but its impacts are mostly in the land sector, including trade-offs with other options. In addition, other renewable energy sources will put considerable demand on land when scaled up. These include wind and solar, but also hydro and extractive industries that may need to be scaled up to supply raw materials for renewable energy systems, including transmission and storage. The combined impacts are likely to be significant and shoudl be considered, including the trade-offs and opportunities.	Noted. Section 7.6.6 has been removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
56157	144	3	144	16	It is important to clearly lay out what studies/models are being covered in Table 7.10. From this description, it sounds like estimates from both sectoral and IAM are being summarized. Is that correct? Make it crystal clear what these estimates include.	Noted. Section 7.6.6 has been removed.	Government of United States of America	U.S. Department of State	United States of America
77701	144	12	144	16	The mitigation measures identified should be strengthened viz, measure (4) to “restore natural forests and other ecosystems to improve landscape integrity and resilience” ; and measure (6) to “protect, improve conservation management and avoid conversion and degradation of natural forests and other ecosystems.	Noted. Section 7.6.6 has been removed.	Virginia Young	Australian Rainforest Conservation Society	Australia
77037	144	15	144	16	Number (7) "Sustainably manage forests and other ecosystems" does not fit the list as it does not imply change (improvement) but suggests BaU. It should be replaced with "improved management of forests and other ecosystems".	Noted. Section 7.6.6 has been removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
56159	144	16	144	16	It does not seem appropriate to label this strictly as 'bioenergy from material side streams' UNLESS every single model/modeling study used assumes only residues and wastes can be used for energy. Several of the models used/cited throughout this chapter did not employ this approach; therefore, the framing here should be changed to be more accurate. Suggest using 'biomass for energy' more broadly to fully reflect inputs.	Noted. Section 7.6.6 has been removed.	Government of United States of America	U.S. Department of State	United States of America
77039	144	16	12	16	It is unclear why the substitution of materials is not included, but the use of material side streams is. There is also a curious gap between bioenergy from sidestrems and BECCS, as they do not include key bioenergy pathways that are currently deployed. This suggest that they do not constitute a mitigation option or that they are irrelevant to AFOLU mitigation.	Noted. Section 7.6.6 has been removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
81301	144	26	144	27	If there are clear geophysical limits - what are they? The authors should take care to not pretend that the limit to BECCS deployment is a geophysical one, as it is far more likely to be reached on regional and local scales driven by choices around implementation. But if there are 'clear' geophysical limits, please spell out those limits.	Noted. Section 7.6.6 has been removed.	Andy Reisinger	Ministry for the Environment	New Zealand
56161	144	28	144	28	Suggest adding 'direct' in front of 'pressure' as indirect/market demands pressures for residues can affect land base and GHGs.	Noted. Section 7.6.6 has been removed.	Government of United States of America	U.S. Department of State	United States of America
19803	144	35	144	35	add afforestation,restoration and beccs	Noted. Section 7.6.6 has been removed.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
77041	144	35	144	35	Impacts of large-scale bioenergy other than BECCS is not covered. This is curious, as bioenergy is considered a key mitigation option.	Noted. Section 7.6.6 has been removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
20251	144	39	144	39	soil organic carbon (soc)	Noted. Section 7.6.6 has been removed.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
21589	144	46	144	46	The reference to manure management system is quite debatable in tropical area. Simple conservation practices, for example, make it possible to limit the losses of N. Manure management for greenhouse gas mitigation. Petersen S.O., Blanchard Mélanie, Chadwick D., Del Prado A., Edouard N., Mosquera J., Sommer S.G.. 2013. Animal (Cambridge), 7 (2), suppl. : 266-282. http://dx.doi.org/10.1017/S1751731113000736	Noted. Section 7.6.6 has been removed.	Government of France	Ministère de la Transition écologique et solidaire	France
81303	145	4	145	9	It might be useful to connect with chapter 17 and 4 here, and make a clearer bridge to the concept of 'just transitions'. It would also be worth noting that the issue of just transitions is notably underdeveloped in the literature in my view in the land sector, especially where large-scale land conversions are concerned that could be driven by dietary changes and resulting land-use changes. Including of course amenity values, which are often not very visible in such assessments but are a non-trivial barrier to significant policy interventions.	Noted. Section 7.6.6 has been removed.	Andy Reisinger	Ministry for the Environment	New Zealand
20253	145	5	145	5	afforestation,restoration,and BECCS	Noted. Section 7.6.6 has been removed.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
48037	145	7	145	7	Food price effects cannot be assumed from BECCS, even at large scale deployment, as this is very context dependent. Please see comments made on a number of points in Chapter 7, Cap 12 and Chapter 17.	Noted. Section 7.6.6 has been removed.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50957	145	7	145	7	Food price effects cannot be assumed from BECCS, even at large scale deployment, as this is very context dependent. Please see comments made on a number of points in Chapter 7, Cap 12 and Chapter 17.	Noted. Section 7.6.6 has been removed.	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
8825	146	1	148	1	Text and symbols in this table not currently legible - possible to break this into smaller sections? (as in a longer table but with half the number of cols?).	Noted. Section 7.6.6 has been removed.	Eamon Haughey	Galway-Mayo Institute of Technology	Ireland
29643	146	1	148	1	Please consider to split the table into the overarching catergories (e.g. one page for 1. Geophysical, one for 2. Environmental-ecological ect.) to make the tables more readable. In all pages, please include headlines.	Noted. Section 7.6.6 has been removed.	Government of Norway	Norwegian Environment Agency	Norway
30323	146	1	146	2	Table 7.10. Please consider if this table title can be shortened.	Noted. Section 7.6.6 has been removed.	Government of Norway	Norwegian Environment Agency	Norway
47627	146	1	146	1	Table 7.10: In the case of mixed evidence, it will be more relevant if the level of agrement and the level of confidence are differentiated for positive and negative of rating feasibility.	Noted. Section 7.6.6 has been removed.	Andriamihaja RANAIVOSON	Directorate General of Meteorology	Madagascar
54353	146	1			The first two options are missing confidence and level of agreement.	Noted. Section 7.6.6 has been removed.	Sabine Fuss	MCC Berlin	Germany
56163	146	1	148	19	Though this table approach is used in other chapters and explained in Chapter 6, there needs to be some minimal level of explanation/information provided here (presumably in each chapter) to explain what the different colors and +/- nomenclature means. Include the metrics being used so that the material is standalone.	Noted. Section 7.6.6 has been removed.	Government of United States of America	U.S. Department of State	United States of America
56165	146	1	148	19	Clarity on the role and treatment of biomass and BECCS is needed. In Table 7.10, the captions and preceding text say that only biomass energy from bymaterials flow/side streams (meaning residues and wastes, presumably) and BECCS are included, but the table does not make clear where the estimates of reductions come from (IAMs, sectoral, or both). If both, then per the chapter’s discussion, biomass from more than just residues may have been included in the reductions estimates (at least from the sectoral models). Unless these critical ambiguities are fixed, the results and key messages -- especially as seen in Table 7.10 -- are quite jumbled and less-than-insightful for readers/policymakers.	Noted. Section 7.6.6 has been removed.	Government of United States of America	U.S. Department of State	United States of America
63743	146	1	148	1	Impossible to read, characters are too small	Noted. Section 7.6.6 has been removed.	Government of Canada	Environment and Climate Change Canada	Canada
72691	146	1	148	44	figure 7.10 is overwhelming, difficult to read, not explained, redundant, and not very informative. The format is impossible to follow as the text is too small and the column headers cannot be seen except for the first couple of row. The table needs to be reformatted so that it easier to read. I suggest splitting it into several tables, either by practice or by numbered category. The units vary across practices making it difficult to compare them. There needs to be a legend of some sort. What do the numbers mean for level of agreement and confidence? What is rating feaasibiliy? Is it feasibility of implementation or of meeting the listed carbon goals? What do +, +-, NE, an 0 mean? The context column is mostly repeated text. This text can be put into one column that highlights the pros and cons across all categories and explains the feasibility rating. Overall I did not find this table helpful because I couldn't tell what what being described.	Noted. Section 7.6.6 has been removed.	Alan Di Vittorio	Lawrence Berkeley National Laboratory	United States of America
3931	146		148		Table 7.10 should be revised and better elaborated. It would be a good tool to summarize what has been said to this point, but (1) needs edition (capitalising, too many etc.); (2) mitigation options are not all at the same level to be able to fill in the same factors in the same way. For instance, "Enhance carbon in agricultural systems" can be done in by far more numerous ways than the management of forests, and cannot be qualified in single cells as there was only one option. E.g. are we dealing with canopy, soil management? In which time span? The GSP is finishing a manual of soil organic carbon containing about 75 practices in AFOLU and more than 80 case studies. On the other side, while there is only one mitigation option related to agriculture, there are 3 mitigation options related to forests (Restore Forests; Protect forests from change; Sustainable manage Forests), which can even overlap. In case it cannot be improved, I would rather not include this table, because it is oversimplified and can be misleading.	Noted. Section 7.6.6 has been removed.	Rosa M Poch	ITPS and UdL	Spain
11269	146				For Restore forest and other ecosystems, why for physical geophysical ressources and for land use the text is excatly the same?	Noted. Section 7.6.6 has been removed.	Bertrand Guenet	CNRS	France
48751	146				Idem Previous observation. Table 7.10 Water quality and quantity might vary very substantially if the plantations are of exotic or native species. In temperate regions of south américa, native forests are the land cover that provides more water per unit of surface, whereas fast growing trees plantations of eucaliptus (very frequents) provides the less. See related refereces in the upper cell.	Noted. Section 7.6.6 has been removed.	Alfredo Erlwein	Soil Science Institute, Universidad Austral de Chile	Chile
11865	147	1	147	45	Table 7.10. The effect of dietary shift vary tremendously across the planet. Semba, R.D., de Pee, S., Kim, B. et al. Adoption of the ‘planetary health diet’ has different impacts on countries’ greenhouse gas emissions. Nat Food 1, 481–484 (2020) show that emissions will increase in countries with a total of 2 billion people with the adoption of the diet proposed by Willet et al (2019).	Noted. Section 7.6.6 has been removed.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
20255	147	17	147	17	exactly	Noted. Section 7.6.6 has been removed.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
86289	147		147		Table 7.10: Line 'Enhance carbon in agricultural systems'; 5th column. The words 'tillage' and 'no-tillage' must be deleted. Where it reads "tillage, no-tillage, mulching, biodiversity conservation" it should be read as "zero-tillage, mulching, biodiversity conservation".	Noted. Section 7.6.6 has been removed.	Pedro Luiz Oliveira Almeida Machado	Embrapa - Brazilian Agricultural Research Corporation	Brazil

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
48039	148	0	148	0	The negative rating assigned to BECCS under “Effects on health and well-being” is completely inappropriate, lacks any evidence, and should be changed to a positive sign (+) under current evidence. The text of the corresponding cell in the table, in face of an admitted lack of evidence, reproduces language from the “Public Acceptance” column. Actually, significant literature is available indicating that bioenergy, especially in the form of liquid biofuels in low, middle or high level blends with fossil fuels, offer human health benefits by lowering very fine particulate pollutants from ICEs and helping to achieve cleaner air in cities. Biofuels, increasing octanes in gasoline, for instance, can also replace cancer-inducing gasoline additives such as MTBE. Along with a change from the negative sign to positive, the text in the corresponding table cell should be changed to “No evidence of negative health and well-being effects from bioenergy use as compared to equivalent fossil fuel use. Evidence indicates either neutral or positive effects on human health from introducing biofuels in blends”. References can be found below: M. de F. Andrade et al., “Air quality in the megacity of São Paulo: Evolution over the last 30 years and future perspectives,” Atmos. Environ., vol. 159, no. March, pp. 66–82, 2017, doi: 10.1016/j.atmosenv.2017.03.051. Renewable Fuels Association, “Environment. Ethanol, the Low Carbon Solution,” 2020. https://ethanolrfa.org/environment/. J. Yang et al., “Emissions from a flex fuel GDI vehicle operating on ethanol fuels show marked contrasts in chemical, physical and toxicological characteristics as a function of ethanol content,” Sci. Total Environ., vol. 683, pp. 749–761, 2019, doi: 10.1016/j.scitotenv.2019.05.279. E. M. P. A. Vormittag, C. G. Rodrigues, P. A. de André, and P. H. N. Saldiva, “Assessment and valuation of public health impacts from gradual biodiesel implementation in the transport energy matrix in Brazil,” Aerosol Air Qual. Res., vol. 18, no. 9, pp. 2375–2382, 2018, doi: 10.4209/aaqr.2017.11.0449. S. Mueller and O. H. Sciences, “Health Impact of Blending Ethanol into Gasoline in 5 Global Cities,” pp. 1–2, 2019. S. Mueller, “Avoided Mortalities from the substitution of ethanol for aromatics in gasoline with a focus on secondary particulate formation”. 2019. Energy Resources Center. S. Mueller, “Cancer Reductions from the use of high-octane ethanol-blended gasoline with a focus on toxic air compounds”. 2019. Energy Resources Center. X. Liang et al., “Air quality and health impacts from using ethanol blended gasoline fuels in China,” Atmos. Environ., vol. 228, no. March, 2020, doi: 10.1016/j.atmosenv.2020.117396. D. Jin, K. Choi, C. L. Myung, Y. Lim, J. Lee, and S. Park, “The impact of various ethanol-gasoline blends on particulates and unregulated gaseous emissions characteristics from a spark ignition direct injection (SIDI) passenger vehicle,” Fuel, vol. 209, no. January, pp. 702–712, 2017, doi: 10.1016/j.fuel.2017.08.063. K. Von Stackelberg, J. Buonocore, P. V. Bhave, and J. A. Schwartz, “Public health impacts of secondary particulate formation from aromatic hydrocarbons in gasoline,” Environ. Heal. A Glob. Access Sci. Source, vol. 12, no. 1, 2013, doi: 10.1186/1476-069X-12-19. M. Muñoz et al., “Bioethanol Blending Reduces Nanoparticle, PAH, and Alkyl- and Nitro-PAH Emissions and the Genotoxic Potential of Exhaust from a Gasoline Direct Injection Flex-Fuel Vehicle,” Environ. Sci. Technol., vol. 50, no. 21, pp. 11853–11861, 2016, doi: 10.1021/acs.est.6b02606. J. E. Tibaquirá, J. I. Huertas, S. Ospina, L. F. Quirama, and J. E. Niño, “The Effect of Using Ethanol-Gasoline Blends on the Mechanical, Energy and Environmental Performance of In-Use Vehicles,” Energies, vol. 11, no. 1, pp. 1–17, 2018, doi: 10.3390/en11010221. M. T. Pacheco, M. M. M. Parmigiani, M. de Fatima Andrade, L. Morawska, and P. Kumar, “A review of emissions and concentrations of particulate matter in the three major metropolitan	accept. Section 7.6.6 has been removed.	Marcelo moreira	UNICAMP - Agroicone	Brazil
50959	148	0	148	0	The negative rating assigned to BECCS under “Effects on health and well-being” is completely inappropriate, lacks any evidence, and should be changed to a positive sign (+) under current evidence. The text of the corresponding cell in the table, in face of an admitted lack of evidence, reproduces language from the “Public Acceptance” column. Actually, significant literature is available indicating that bioenergy, especially in the form of liquid biofuels in low, middle or high level blends with fossil fuels, offer human health benefits by lowering very fine particulate pollutants from ICEs and helping to achieve cleaner air in cities. Biofuels, increasing octanes in gasoline, for instance, can also replace cancer-inducing gasoline additives such as MTBE. Along with a change from the negative sign to positive, the text in the corresponding table cell should be changed to “No evidence of negative health and well-being effects from bioenergy use as compared to equivalent fossil fuel use. Evidence indicates either neutral or positive effects on human health from introducing biofuels in blends”. References can be found below: M. de F. Andrade et al., “Air quality in the megacity of São Paulo: Evolution over the last 30 years and future perspectives,” Atmos. Environ., vol. 159, no. March, pp. 66–82, 2017, doi: 10.1016/j.atmosenv.2017.03.051. Renewable Fuels Association, “Environment. Ethanol, the Low Carbon Solution,” 2020. https://ethanolrfa.org/environment/. J. Yang et al., “Emissions from a flex fuel GDI vehicle operating on ethanol fuels show marked contrasts in chemical, physical and toxicological characteristics as a function of ethanol content,” Sci. Total Environ., vol. 683, pp. 749–761, 2019, doi: 10.1016/j.scitotenv.2019.05.279. E. M. P. A. Vormittag, C. G. Rodrigues, P. A. de André, and P. H. N. Saldiva, “Assessment and valuation of public health impacts from gradual biodiesel implementation in the transport energy matrix in Brazil,” Aerosol Air Qual. Res., vol. 18, no. 9, pp. 2375–2382, 2018, doi: 10.4209/aaqr.2017.11.0449. S. Mueller and O. H. Sciences, “Health Impact of Blending Ethanol into Gasoline in 5 Global Cities,” pp. 1–2, 2019. S. Mueller, “Avoided Mortalities from the substitution of ethanol for aromatics in gasoline with a focus on secondary particulate formation”. 2019. Energy Resources Center. S. Mueller, “Cancer Reductions from the use of high-octane ethanol-blended gasoline with a focus on toxic air compounds”. 2019. Energy Resources Center. X. Liang et al., “Air quality and health impacts from using ethanol blended gasoline fuels in China,” Atmos. Environ., vol. 228, no. March, 2020, doi: 10.1016/j.atmosenv.2020.117396. D. Jin, K. Choi, C. L. Myung, Y. Lim, J. Lee, and S. Park, “The impact of various ethanol-gasoline blends on particulates and unregulated gaseous emissions characteristics from a spark ignition direct injection (SIDI) passenger vehicle,” Fuel, vol. 209, no. January, pp. 702–712, 2017, doi: 10.1016/j.fuel.2017.08.063. K. Von Stackelberg, J. Buonocore, P. V. Bhave, and J. A. Schwartz, “Public health impacts of secondary particulate formation from aromatic hydrocarbons in gasoline,” Environ. Heal. A Glob. Access Sci. Source, vol. 12, no. 1, 2013, doi: 10.1186/1476-069X-12-19. M. Muñoz et al., “Bioethanol Blending Reduces Nanoparticle, PAH, and Alkyl- and Nitro-PAH Emissions and the Genotoxic Potential of Exhaust from a Gasoline Direct Injection Flex-Fuel Vehicle,” Environ. Sci. Technol., vol. 50, no. 21, pp. 11853–11861, 2016, doi: 10.1021/acs.est.6b02606. J. E. Tibaquirá, J. I. Huertas, S. Ospina, L. F. Quirama, and J. E. Niño, “The Effect of Using Ethanol-Gasoline Blends on the Mechanical, Energy and Environmental Performance of In-Use Vehicles,” Energies, vol. 11, no. 1, pp. 1–17, 2018, doi: 10.3390/en11010221. M. T. Pacheco, M. M. M. Parmigiani, M. de Fatima Andrade, L. Morawska, and P. Kumar, “A review of emissions and concentrations of particulate matter in the three major metropolitan	Noted. Section 7.6.6 has been removed.	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
6091	149	1	159	19	one more knowledge gap: many grey literature that contribute significant results on mitigation are not included in AR, due to a lack of systematic documentation and management. “one way” scientific literature might not be sufficient to quantify mitigation as-whole	Noted. However, grey literature is included where relevant, although emphasis is on peer-reviewed literature for obvious reasons.	Liwah Wong	EIT Climate KIC, EIT RawMaterials	Germany
8145	149	1	150	19	Please add the missing knowledge about substitution to this list, as this can have severe implications on how biomass can be used for mitigation purposes - or not.	Noted. The authors thank the reviewer for their suggestion. Regrettably, the strict word count prevents the inclusion of additional material / topics.	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
11857	149	1	150	20	Other barriers could be "low farmers income" to mentioned under social-economical questions.	Noted. It is felt that farming income is covered under socio-economic factors and therefore is not explicitly mentioned	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
61357	149	1	150	20	Much is made throughout the report on the carbon loss to deforestation and land transformation. However, very limited data is given on the carbon loss from land degradation (i.e. a change n state that is not a total land transformation). This occurs in forest land (thining of trees) and non-forest land (e.g. over grazing). It is hard to detect and map from satellite imagery, and may be accompanied by both above ground and soil carbon loss. understanding this key carbon flux is critical	Accepted. Explicit reference is now made to land degradation.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
74893	149	1	150	20	Please consider including as a priority for research the issue of farmer behavoiral change when it comes to mitigation practices in agriculture in Africa and synergies and trade-offs on food and nutrition security.	Noted. The authors thank the reviewer(s) for their suggestion. Following consideration, it was hoped that the terms 'cultural' and 'socio-cultural', as added to the paragraph on understanding mitigation potential, might sufficiently cover farmer behavioural change.	Government of Kenya	Kenya Meteorological Service	Kenya
77043	149	1	150	19	Knowledge gaps should include questions on CCS, bioenergy and biofuels.	Noted. Regrettably, the strict word count limits prevent the inclusion of additional material / topics.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
77703	149	2	150	44	Knowledge gaps on the implications of ongoing biodiversity loss for ecosystem decline and tipping points and risk of premature release of GHG to the atmosphere; and essential and high priority actions to improve the integrity and stability of ecosystems to achieve long term carbon storage is urgently required. An IPCC Special Report (or joint IPBES/IPCC Report) on the Nexus between biodiversity and climate is urgently required to increase understanding of the spiral relationship between the two crises. Both crises amplify each other and we are on a downwards spiral that must be arrested and reversed. How does biodiversity loss and ecosystem decline affect the likelihood of ecosystem tipping points given already locked in climate change? What are the priority actions needed to halt and reverse this spiral? Can we still spiral up improving the outlook for biodiversity and carbon sequestration and storage through integrated action?	Accepted. The need for research into the impacts of mass biodiversity loss on mitigation options is now mentioned.	Virginia Young	Australian Rainforest Conservation Society	Australia
61355	149	5	149	10	One of the key unknowns is the dynamics of the SOC stocks relating to land degradation and restoration. These may well exceed the above ground carbon stocks, so gaining a better understanding of their dynamics is critically important.	Noted. Reference is now made to land degradation and restoration efforts in the third paragraph.	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa
74687	149	6	149	6	Most of the developing countries are using the Tier 1 methodologies for the estimation of Greenhouse Gases which are not truly representative of their emissions. For more robust analysis and precise estimation countries needs to be trained and facilitated in the development of tier 2 and tier 3 emission coefficients for the development of accurate GHG inventories.	Noted. With consideration it was felt that the reviewers' point is sufficiently covered in the first point concerning the refinement of accounting methodology, however, reference to enhancing knowledge exchange is now made.	Muhammad Arif Goheer	GCISC	Pakistan

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
77045	149	6	149	6	Insert "and" to read "inventory and accounting"	Noted. The word 'and' has been added, while inventory has been made plural.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
11271	149	11		14	I would add also the effect of land management in general on biophysic variables like sensible heat flux, evapotranpsiration, albedo, etc. that can totally counteract the C fertilization effects on climate	Noted and thank you for the suggestion. With consideration, it was decided not to include reference to biophysical aspects in this particular paragraph. It is intended to specifically refer to differences in methodology behind measuring land CO2 flux. Biophysical aspects are briefly mentioned elsewhere.	Bertrand Guenet	CNRS	France
56167	149	12	149	14	Should this be difference between bookkeeping models (as stated, so between models of that type) or between bookkeeping models and other modeling types, like economic models?	Noted. The sentence has been adjusted.	Government of United States of America	U.S. Department of State	United States of America
11859	149	20	149	27	The need for more knowledge on the mitigation potential of sustainable intensification is lifted. This is strongly supported.	Noted. It is not sure what is meant by 'lifted' (our apologies) but is hoped that the reviewer approves of slight adjustments to the mentioned paragraph.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
73901	149	23			The source of 'Godfray et al. 2014' cannot be found in the References.	Noted, thank you. This reference has been removed.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
73903	149	23			The source of 'Olsson et al. 2019' cannot be found in the References.	Noted. Reference to Olsson *et al.* has been removed.	Raehyun KIM	National Institute of Forest Science	Republic of Korea
63745	149	30	150	7	Country level analysis is important for providing a strategic perspective. However, mitigation decision-making is often at the regional or local level, so there is also a signficant need for regional/local analysis (as part of country-level analysis or separately) that can inform "on-the-ground" action. This point could be made.	Noted. Within IPCC terminology, 'regional' refers to groups of countries (e.g. Southern Asia). It is assumed that the reviewer refers to within-county regions. The term 'localised' has been included where deemed appropriate. In certain instances, it was felt that resolution beyond country-level, may not be feasible.	Government of Canada	Environment and Climate Change Canada	Canada
71909	149	36	149	42	Improvement is needed to better represent governance and other development constraints in economic potentials and MACCs	Accepted. However, it is felt that this point is covered in a subsequent paragraph that discusses need to consider socio-economic, cultural and institutional barriers when estimating mitigation potential.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
46035	149	41	149	42	Please reformulate knowledge gaps in a less policy-prescriptive way or delete. Comment: Whereas the first part of this bullet point is clearly stating requirements and scope for future research this last sentence merely claims deficits in an overly broad way without providing evidence or ideas for research. Please see also our comment on "research gaps" on the Entire Report.	Noted. The sentence has been modified.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
31409	149	44	150	2	Besides social, poltiical and environmental considerations in estimating potentials, also suggest to include 'cultural or socio-cultural' considerations as a mitigation measure may not be implemented and scaled up due to cultural related issues.	Noted. Considering the strict word limit, the word 'social' has been changed to 'socio-cultural'.	tamara van 't Wout	Food and Agriculture Organization of the United Nations (FAO)	Qatar
9547	149				7.7. Knowledge gaps: I would include that there is a gap on how sustainable digitalisation could build resilient futures and how digitalisation could support the CC mitigation and control of practices	Noted. The authors thank the reviewer for their suggestion. Regrettably, the strict word count restricts the inclusion of additional paragraphs / topics. With consideration, it was decided to keep discussion on the topics already included.	Blanca Casares Guillén	EfecTo TP	Spain
63747	150	3	150	3	Could also include here - identifying synergies/co-benefits between mitigation and adaptation actions too besides those with biodiversity and other ecosystem services	Accepted. Reference is now made to adaption capacity.	Government of Canada	Environment and Climate Change Canada	Canada
31411	150	7	150	10	This is quite a general statement and could include the importance of conducting cost-benefit analyses, which also help to determine impacts on these factors, such as studies undertaken by e.g. FAO. 2018. Cost-benefit analysis for climate change adaptation policies and investments in the agricultural sectors and FAO. 2019. Disaster risk reduction at farm level: Multiple benefits, no regrets. Results from cost-benefit analyses conducted in a multi-country study, 2016-2018.	Noted. knowledge gaps has been changed a lot	tamara van 't Wout	Food and Agriculture Organization of the United Nations (FAO)	Qatar
20401	150	15	150	17	Offsets are not the only policy option to enhance carbon stockss in agricultural soils and forests. Carbon tax/subsidy schemes are also possible, and have been long explored for example in the economic literature. This should be also mentioned here.	accept , we have a sectin on carbon pricing now 7.5.4.	Tommi Ekholm	Finnish Meteorological Institute	Finland
46037	150	15	150	19	Please reformulate knowledge gaps in a less policy-prescriptive way or delete. Comment: Whereas first sentence merely states a point of view as how to approach a long-disputed way of financing REDD+ the second sentence demands the “construction of constructs” which, however, seem to exist already. Also, the last sentence doesn't describe a gap in knowledge either. It is a political statement without evidence provided or respective references given. Please see also our comment on "research gaps" on the Entire Report.	Accepted. The section has been carefully checked and revised regarding avoidance of policy prescriptive language. The paragraph identified has also be adjusted.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
54355	150	15	150	19	In order for these policies to work, questions around MRV and accounting systems first have to be addressed.	Accepted. Reference is now made to MRV and appropriate accounting systems.	Sabine Fuss	MCC Berlin	Germany
4461	150	20	150	20	Add line on Regulation and Governance	Noted. The authors thank the reviewer for their suggestion. Regrettably, the strict word limit prevents the inclusion of additional points. However, reference is now made to need for policy research regarding Sustainable intensification and facilitating carbon offsets.	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
11861	150	20	150	20	The effect of biochar application on yield increase variates depending on soil type and region from high increases on tropical soils, but no effect in temperate climate regions (Jeffery et al., 2017). There are also indication that biochar can reduce yields by adsorption of nutrients, the same mechanism that, correctly, can adsorb organic pollutants, heavy metals and ions in soil of which the biochar can’t tell the good ones from the bad Laxmar (2017). References: Laxmar E., 2017. The effect of biochar addition and fertilization on yield levels in two field experiments. Master thesis Report 2017:03, Department of soil and environment, SLU. Jeffery, S., Abalos, D., Prodana, M., Bastos, A.C., van Groenigen, J.W., Bruce, A., Hungate, B.A., Verheijen, F., 2017. Biochar boosts tropical but not temperate crop yields. Environ. Res. Lett. 12: 053001.	Noted. Regrettably, a strict word limit prevents the inclusion of additional points, while it was felt that specific discussion on biochar may not be appropriate, considering the summarising and more general nature of the Knowledge Gaps subsection.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
9323	151	8	151	27	Readers with little background information might find it difficult to differentiate between the different perspectives on the AFOLU sector reflected in this FAQ. Is it possible to point out more clearly which of the different pathways (I would prefer "ways" here) look at AFOLU as an greenhouse gas inventory sector in the United Nations Convention on Climate Change (UNFCCC) and when you focus more on the actual elements of this sector - agriculture, forestry and other types of land use (which could be specified)?	Noted - mostly rejected. It is felt that discussion is sufficiently 'high level' and appropriate for those not familiar with the topic. However, wording has been slightly changed. Pathways or "ways" are outlined in accordance to discussion presented in the Ex. Sum. and introduction. UNFCCC accounting is avoided as the authors wish to keep discussion high level and general.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
9325	151	17	151	19	In howfar is this relevant to answer your question about the uniqueness of the AFOLU sector?	Accepted. This sentence has been removed.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
9327	151	25	151	27	I would suggest to move this last sentence to the begining of point 3 to highlight the uniqueness again.	Accepted. The sentence has been moved.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
31413	151	25	151	27	This sentence could be elaborated a bit added at the end along the lines of 'contributing to reduce vulnerability, enhance adaptive capacity and strengthen resilience to climate change and extreme weather events'. The latter is important as risk reduction and adaptation related measures often go hand in hand in the AFOLU sector due to the various co-benefits for both mitigation and adaptation (including risk reduction).	Noted. Unfortunately the sentence has been moved in response to another comments. The suggested new material may overcomplicate the message/paragraph. No changes have been made.	tamara van 't Wout	Food and Agriculture Organization of the United Nations (FAO)	Qatar
9329	151	30	151	43	Readers with little background knowledge might appreciate an explanation of "economic mitigation potential". They might also wonder if any conclusions can be drawn regarding mitigation options, efficiency, feasibility etc. However, as most of the FAQ focuses on reduction potentials (GtCO2eq yr instead of the USD100/tCO2 yr-1 introduced initally), the economic potential highlighted in the question might not become fully clear. How can readers put a price tag on the reduction potentials? Are you able to add such information?	Accepted. Explanation of economic potential is provided. The paragraph has been adjusted to make it clear that potentials outlined are economic potential, while reference to economic constraints being only one element of of feasibility is included.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
14779	151	35	151	35	Given that this is an FAQ, intended for general audiences, it would help to be clear about whether this mitigation potential of 6.1GtCO2eq per year will result in reduced emissions of this amount, or CO2 removal from the atmosphere of this amount (or a transition from one to the other over time?).	Noted. Following consideration, it was decided that breakdown of the 'type' or 'source' of mitigation was not necessary, as it might overcomplicate the desired key messages.	Elizabeth Bush	Environment and Climate Change Canada	Canada
51771	151	36	151	41	When calculating mitigation potential for supply-side and demand-side measures, is double-counting avoided? If so, can the related methodology be explained?	Noted. Reference is now made to the supply and demand side mitigation potentials not being additive.	Florin Vladu	UNFCCC Secretariat	Germany
20257	151	42	151	42	reduce deforestaion and increased reforestation and forest restoration	Noted. Thank you - but this sentence was removed in response to another comment.	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
17791	151	46	152	9	(FAQ 7.3) sets it out clearly but this is a big departure from AR5 WGIII and SR1S (figure SPM.3b and section SPM C.3) which (I think) were much less wary of BECCS. So need to be able to explain why we are now more reserved, and what new science there is that leads to that.	noted, our text in FAQ is reflected same manner also in main text	Jonathan Lynn	IPCC	Switzerland
20259	151	49	151	54	The European Commission in its report on biofuels (SEC (2006) 1721) stated that: “It is possible to further enhance the benefits of biofuel policy in terms of reducing greenhouse gas emissions and minimizing environmental risks through application of a simple incentive or aid mechanism that, for example, discourages the transformation of land with a high value in terms of biodiversity for the cultivation of raw materials for the manufacture of biofuels or the use of harmful methods of production of biofuels, and promote the application of second-generation production systems. "	noted, our text in FAQ is reflected same manner also in main text	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
56169	151	49	152	9	One aspect of BECCS in the modeling that leads to generation of such high adoption estimates in IAMs is the default treatment of CO2 emissions from biomass for energy as carbon neutral. It would be useful to include this element as it is part of the 'controversy'.	noted, our text in FAQ is reflected same manner also in main text	Government of United States of America	U.S. Department of State	United States of America
56171	151	49	152	9	The answer here, in particular the last several sentences, warrants revision. Though such IAM exercises may be more 'realistic' then previous iterations, they are still very highly stylized and at aggregated levels especially in terms of representation of the land use component and bioenergy supply chains. The text seems to dismiss concerns about potential food production and security, which still remain an important and realistic concern in terms of the potential of coming to fruition under large-scale bioenergy crop deployment. Recommend striking or fixing this text so it does not gloss over this concern.	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	Government of United States of America	U.S. Department of State	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
80679	151	49	152	9	BECCS even from managed forests does not deliver positive GHG balances due to the carbon deficit that results for many years, generally several decades to a century. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	Durwood Zaelke	Institute for Governance & Sustainable Development	United States of America
80823	151	49	152	9	BECCS even from managed forests does not deliver positive GHG balances due to the carbon deficit that results for many years, generally several decades to a century. Danielle Venton, Core Concept: Can bioenergy with carbon capture and storage make an impact?, PNAS (2016); Leturcq, P. (2020) GHG Displacement Factors of Harvested Wood Products: the Myth of Substitution, Nature Scientific Reports 10:1–9; Mary S. Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, Environ. Res. Lett. 13 (21 February 2018); Sterman J. D., et al. (2018) Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Envtl. Research Letters 13(015007):1–10, 1 ("We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clear-cut, depending on forest type—assuming the land remains forest. Surprisingly, replanting hardwood forests with fast-growing pine plantations raises the CO2 impact of wood because the equilibrium carbon density of plantations is lower than natural forests. Further, projected growth in wood harvest for bioenergy would increase atmospheric CO2 for at least a century because new carbon debt continuously exceeds NPP. Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue. Instead, explicit dynamic models should be used to assess the climate impacts of biofuels."). Furthermore, even if BECCS were net zero or negative in the relevant next couple of decades, which it is not, large-scale biodiversity development requires vast land-use changes, which may have significant implications for food security and biodiversity. National Academies of Sciences, Engineering, and Medicine, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda,10 (2019) ("Because food demand is expected to double by mid-century, repurposing a significant amount of current agricultural land to produce feedstocks for BECCS or for afforestation/reforestation might have a significant effect on food availability and food prices, with far-reaching effects on national security and biodiversity."). The IPCC Special Report on Climate Change and Land warns that high implementation of BECCS (11.3 GtCO2 yr-1 in 2050) could increase the population at risk of hunger by up to 150 million people and could have significant impacts on desertification and land degradation. IPCC, Summary for Policymakers, In: Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 27 (2019) ("Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 GtCO2 yr-1 in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several GtCO2 yr-1 when it is a low carbon energy source {2.6.1; 6.3.1}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.3.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.3.3; 6.3.4}."). Using BECCS to draw down between 2 and 10 Gt CO2 annually would require the dedication of land equivalent to the size of India, and possibly even double this amount, to support biomass production, introducing daunting logistical issues. Anderson K. & Peters G., The Trouble with Negative Emissions, Science 354:182–183 (2016) ("Moreover, the scale of biomass assumed in IAMs—typically, one to two times the area of India—raises profound questions about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy from the transport, heating, and industrial sectors. The logistics of collating and transporting vast quantities of bioenergy—equivalent to up to half of the total global primary energy consumption—is seldom addressed. Some studies suggest that BECCS pathways are feasible, at least locally, but globally there are substantial limitations. BECCS thus remains a highly speculative technology."). BECCS also faces infrastructure-based limits from the lack	Noted. This comment has been repeated elsewhere (Comment ID: 80679).	Gabrielle Dreyfus	Institute for Governance & Sustainable Development	United States of America
14781	151	50	151	52	Recommend that these lines describing BECCS explicitly mention the need for carbon storage following capture. This is a critical part of the 'system' to achieve net negative emissions. Permanent or at least long-term storage of the carbon. For BECCS, presumably this requires linking bioenergy systems to systems for transporting the captured carbon to suitable storage sites. This is another important consideration for BECCS implementation. Also, the phrase 'a carbon negative outcome' may not be readily understood by FAQ readers. Suggest writing this out in plainer language to explain how BECCS can achieve net negative carbon emissions (i.e. net removal/uptake of CO2 from the atmosphere and permanent storage).	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	Elizabeth Bush	Environment and Climate Change Canada	Canada
83257	151	51	151	51	For BECCS, better say that biomass is 'processed' (think of biofuels, but also other applications that would work with BECCS, like pulp & paper or even hydrogen)	Accepted. The word processed has been used.	Geden Oliver	German Institute for International and Security Affairs	Germany
14783	152	1	152	1	Suggest adding 'from the atmosphere' after 'removing carbon' given that this is an FAQ for general audiences. Good to be clear about what is meant, here.	Accepted. The sentence has been modified.	Elizabeth Bush	Environment and Climate Change Canada	Canada
20261	152	1	152	9	Lastly, bioenergy production also greatly affects environmental policy, due to the reduction of greenhouse gas emissions and its influence on the way and intensity of the main land uses in Europe (agriculture and forestry). Any change in land use has a great impact on water and soil resources, as well as on biodiversity and landscapes.	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
20263	152	1	152	9	The fact that bioenergy production influences three different policies makes it necessary to analyze possible conflicts and synergies between different policy objectives that are affected by large-scale bioenergy agriculture. Some of the different policy goals can be reconciled, while others require compromises and priorities. The shape and scale of the bioenergy sector will be factors of crucial influence for the integration potential of three policies agriculture-energy and environment. On the other hand, when formulating these policies in their respective fields, the need to find synergies between different policies of the EU, thus guiding the development of bioenergy production towards an environmental perspective.	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile
20265	152	1	152	9	Many regulatory instruments require cooperation between policy makers, consumers and producers to be effective. In the context of bioenergy, there is also a need for cooperation between three policy areas: energy, agriculture and the environment. From an environmental perspective, this is probably the most important aspect for the development of community energy production from agricultural biomass. It is essential to "promote environmental sustainability and fight climate change" for the production of biofuels, as specified in the Presidency Conclusions of the Council of the European Union of 8 and 9 March 2007 (41).	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	samuel francke-campaña	Ministry of agriculture chilean forestry service	Chile

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
51329	152	1	201	29	Reference - Agus, C., Karyanto, O., Kita, S., Haibara, K., Toda, H., Hardiwinoto, S., Supriyo, H., Na'iem, M., Wardana, W., Sipayung, M., Khomsatun and Wijoyo, S. 2004. Sustainable site productivity and nutrient management in a short rotation Gmelina arborea plantation in East Kalimantan, Indonesia. New Forest J. 28: 277-285 (http://www.kluweronline/issn/0169-4286). - Agus, C. 2018. Development of Blue Revolution through Integrated Bio-cycles System on Tropical Natural Resources Management. In: Leal Filho W., Pociovălișteanu D., Borges de Brito P., Borges de Lima I. (eds). World Sustainability Series: Towards a Sustainable Bioeconomy: Principles, Challenges and Perspectives. Springer, Cham. pp 155-172. https://link.springer.com/chapter/10.1007/978-3-319-73028-8_9 - Agus, C. E. Primananda, E. Faridah, D. Wulandari, T Lestari. 2019. Role of Arbuscular Mycorrhizal Fungi and Pongamia Pinnata for Revegetation of Tropical Open-Pit Coal Mining Soils. International Journal of Environmental Science and Technology (IJEST) 16(7):3365-3374. DOI: 10.1007/s13762-018-1983-5 - Agus C, MGCA Kusuma, E Faridah, A Dina, D Wulandari, Idi Bantara, BP Hutahaean and T Lestari. 2020. Paramagnetic Humus and Callophyllum inophyllum for Rehabilitation of Tropical Anthropogenic Deserted Tin-mined Soil. International Journal of Advanced Science and Technology (IJAST). Vol. 29, No. 7, (2020), pp. 2931-2941 - Freezailah, B.C.Y. 1998. General lecture by executive director of International Tropical Timber Organization (ITTO) at the University of Gadjah Mada, Yogyakarta on 10 August 1998. 10 pp Reference - Agus, C., Karyanto, O., Kita, S., Haibara, K., Toda, H., Hardiwinoto, S., Supriyo, H., Na'iem, M., Wardana, W., Sipayung, M., Khomsatun and Wijoyo, S. 2004. Sustainable site productivity and nutrient management in a short rotation Gmelina arborea plantation in East Kalimantan, Indonesia. New Forest J. 28: 277-285 (http://www.kluweronline/issn/0169-4286). - Agus, C. 2018. Development of Blue Revolution through Integrated Bio-cycles System on Tropical Natural Resources Management. In: Leal Filho W., Pociovălișteanu D., Borges de Brito P., Borges de Lima I. (eds). World Sustainability Series: Towards a Sustainable Bioeconomy: Principles, Challenges and Perspectives. Springer, Cham. pp 155-172. https://link.springer.com/chapter/10.1007/978-3-319-73028-8_9 - Agus, C. E. Primananda, E. Faridah, D. Wulandari, T Lestari. 2019. Role of Arbuscular Mycorrhizal Fungi and Pongamia Pinnata for Revegetation of Tropical Open-Pit Coal Mining Soils. International Journal of Environmental Science and Technology (IJEST) 16(7):3365-3374. DOI: 10.1007/s13762-018-1983-5 - Agus C, MGCA Kusuma, E Faridah, A Dina, D Wulandari, Idi Bantara, BP Hutahaean and T Lestari. 2020. Paramagnetic Humus and Callophyllum inophyllum for Rehabilitation of Tropical Anthropogenic Deserted Tin-mined Soil. International Journal of Advanced Science and Technology (IJAST). Vol. 29, No. 7, (2020), pp. 2931-2941 - Freezailah, B.C.Y. 1998. General lecture by executive director of International Tropical Timber Organization (ITTO) at the University of Gadjah Mada, Yogyakarta on 10 August 1998. 10 pp	Noted. The authors thank the reviewer for the suggested reference. It not quite clear what edits are recommended from the page and line numbers indicated. Accordingly, no changes have been made.	Cahyono Agus	Universitas Gadjah Mada Yogyakarta Indonesia	Indonesia
14785	152	2	152	2	How does this potential of BECCS of (up to) 11GtCO2eq/year related to the mtigation potential described in FAQ7.1? This estimate is outside the ranges provided there. Was BECCS not included in the mitigation potentials listed in FAQ7.1?	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts. clearly the 11 GT was an old number which was there to reflect old studies	Elizabeth Bush	Environment and Climate Change Canada	Canada
14787	152	5	152	7	This text is unclear in 2 respects: 1. What is meant by "where bioenergy is part of the full agriculture or wood chain"? Is this meant to differentiate dedicated bioenergy plantations from the use of agriculture or forest waste products as biomass supply for bioenergy? 2. Unclear what is meant by delivering positive GHG balances. This could be interpreted to mean positive GHG emissions - a bad thing. Is that what is intended?	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	Elizabeth Bush	Environment and Climate Change Canada	Canada
56173	152	5	152	7	This statement is overly definitive and should be removed: "However, where bioenergy is part of the full agriculture or wood chain, from sustainably managed forest or specialised plantations, it will deliver positive GHG balances." There is no universal truth of biomass like this, as biomass for energy outcomes depend largely on circumstances and feedstocks and many other factors. IPCC should not make such strong and overly simplistic statements, especially concerning this controversial subject.	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	Government of United States of America	U.S. Department of State	United States of America
14789	152	7	152	9	Recommend adding to this conclusion the potential contribution of additional approaches to achieving negative C emissions. As I understand it from the SOD, current IAMs primarily only incorporate BECCS and afforestation. Reducing the need for large scale BECCS implementation could be achieved either by more ambitious emission reductions across all sectors and/or by development and deployment of additional approaches to CDR.	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	Elizabeth Bush	Environment and Climate Change Canada	Canada
46525	152	7	152	9	FAQ 7.3: please consider a more neutral and balanced ending to this FAQ, since the current phrasing implies a goal of as much BECCS as possible and deeper transformation as undesirable.	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany
56175	152	7	152	9	This sentence should be removed: "Progress is important because if BECCS is not a feasible option at a large scale then deeper transformation will be required in other areas, or ambitious climate targets will have to be given up altogether." If not removed, then revise to make it less subjective and more constructive. Consider rewriting as: "Improvements to IAMs and other tools to better capture relevant environmental and social elements, including benefits and tradeoffs in efforts to simulate potential bioenergy and BECCS pathways, would significantly improve representation of the sector and its potential in future NDC and other climate-related goals."	noted, our text in FAQ is reflected same manner also in main text , with all pros and cons of bioenergy, and critical reflection on modelling attempts	Government of United States of America	U.S. Department of State	United States of America
4463	152	10	152	10	Add FAQ 7.4 _ Compounding effect of Urbanisation of land, Land for Infrastructure and other purpose	Noted. The authors thank the reviewer for the suggested addition. Unfortunately space restrictions do not allow an additional FAQ.	Alka Bharat	Maulana Azad National Institute of Technology (An Institute of National importance), Bhopal	India
8513	153	8		8	Refences always start from A to Z. Remove the abbreviations along with brackets from the first three refences, and start from A, B and so on.	noted, all refs are updated and completed	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10269	153	8	153	8	Refences always start from A to Z. Remove the abbreviations along with brackets from the first three refences, and start from A, B and so on.	noted, all refs are updated and completed	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
8515	153	13			never use et al in this section e.g. Abraha, M. et al. 2019 and others	noted, all refs are updated and completed	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
10271	153	13	153	13	never use et al in this section e.g. Abraha, M. et al. 2019 and others	noted, all refs are updated and completed	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
8573	153	36	153	36	Never use coauthros in this section too. Eg. Aggarwal, P. K., and Coauthors, 2018	noted, all refs are updated and completed	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
12487	153	38	153	39	African Progress Panel (2015). Power, People, Planet. Seizing Africa's Energy and Climate Opportunities.Africa Progress Report 2015. Geneva.	noted, all refs are updated and completed	Nelly Bore	University of Nairobi	Kenya
9489	153				According to n° 2 add : Hénault C., Bourennane, H., Ayzac, A., Ratié,C., Saby, N., Cohan, J.P., Eglin, T., Le Gall, C., 2019. Management of soil pH promotes nitrous oxide reduction and thus mitigates soil emissions of this greenhouse gas. Scientific Reports. 9:20182. doi.org/10.1038/s41598-019-56694-3	noted, all refs are updated and completed	Catherine Henault	INRAE - AGROECOLOGIE	France
9491	153				According to n° 2, add :Shabaan M.,Peng, Q., Hu, R., Wu, Y., Lin, S., Zhao, J. 2015. Dolomite application to acidic soils: a promising option for mitigating N2O emissions. Environmental Science and Pollution Research 22 (24), 19961-19970	noted, all refs are updated and completed	Catherine Henault	INRAE - AGROECOLOGIE	France
9493	153				According to n° 2 add : Bakken LR, Frostegard A, 2020. Emerging options for mitigating N2O emissions from food production by manipulating the soil microbiota. Current opinion in Environmental sustainability. 47:89-94 https://doi.org/10.1016/j.cosust.2020.08.010	noted, all refs are updated and completed	Catherine Henault	INRAE - AGROECOLOGIE	France
9495	153				1. Holland, J.E., Bennett, A.E., Newton, A.C., White, P.J., McKenzie, B.M., George, T.S., Pakeman, R.J., Bailey, J.S., Fornara, D.A., Hayes, R.C. Liming impacts on soils, crops and biodiversity in the UK : A review. Sci. Total Environ. 610-611, 316-332, (2018)	noted, all refs are updated and completed	Catherine Henault	INRAE - AGROECOLOGIE	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
86295	153		153		Suggested references: Assad, E.D., L.C. Costa, S. Martins, M. Calmon, R. Feltran-Barbieri, M. Campanilli, C. A. Nobre, 2019: Papel do Plano ABC e do Planaveg na adaptação da agricultura e da pecuária às mudanças climáticas. Working Paper. WRI Brasil. https://wribrasil.org.br/pt/publicacoes. Gallo, P., E. Albrecht, 2019: Brazil and the Paris Agreement: REDD+ as an instrument of Brazil's Nationally Determined Contribution compliance. Int Environ Agreements, https://doi.org/10.1007/s10784-018-9426-9 Godar J., T. A. Gardner, E. J. Tizado, P. Pacheco, 2014: Actor-specific contributions to the deforestation slowdown in the Brazilian Amazon. Proc Natl Acad Sci USA 111:15591–15596. https://doi.org/10.1073/pnas.1322825111 Piao, R.S., V. L. Silva, I. N. del Aguila, J. B. Jiménez, 2021: Green Growth and Agriculture in Brazil. Sustainability, https://doi.org/10.3390/su13031162 Sá, J.C.M.S., R. Lal, C.C. Cerri, K. Lorenz, M. Hungria, P.C.F. Carvalho, 2017: Low-carbon agriculture in South America to mitigate global climate change and advance food security. Environm. Int., http://dx.doi.org/10.1016/j.envint.2016.10.020 Soares-Filho, B., R. Rajão, M. Macedo, A. Carneiro, W. Costa, M. Coe, H. Rodrigues, A. Alencar, 2014: Cracking Brazil's Forest Code. Science, https://doi.org/10.1126/science.1246663 Soterroni, A.C., A. Mosnier, A.X.Y. Carvalho, G. Câmara, M. Obersteiner, P.R. Andrade, R.C. Souza, R. Brock, J. Pirker, F. Kraxner, P. Havlik, V. Kapos, E.K.H.J. zu Ermgassen, H. Valin, F.M. Ramos, 2018: Future environmental and agricultural impacts of Brazil's Forest Code. Environ. Res. Lett. 13, https://doi.org/10.1088/1748-9326/aaccbb van der Hoff, R., R. Rajão, P. Leroy, 2018. Clashing interpretations of REDD+ "results" in the Amazon Fund. Climatic Change, https://doi-org.ez103	noted, all refs are updated and completed	Pedro Luiz Oliveira Almeida Machado	Embrapa - Brazilian Agricultural Research Corporation	Brazil
12481	160	7	160	8	Byamugisha, F. (2013). Securing Africa's Land for Shared Prosperity: A Program to Scale Up Reforms and Investments. Washington, DC: World Bank.	noted, all refs are updated and completed	Nelly Bore	University of Nairobi	Kenya
70015	162	24	162	24	Add: Córdova, R., Hogarth, N., Kanninen, M. 2018. Sustainability of Smallholder Livelihoods in the Ecuadorian Highlands: A Comparison of Agroforestry and Conventional Agriculture Systems in the Indigenous Territory of Kayambi People. Land 7(2):45. https://doi.org/10.3390/land7020045	noted, all refs are updated and completed	Markku Kanninen	University of Helsinki	Finland
70017	162	24	162	24	Add: Córdova, R., Hogarth, N., Kanninen, M. 2019. Mountain farming systems' exposure and sensitivity to climate change and variability: Agroforestry and conventional agriculture systems compared in Ecuador's indigenous territory of Kayambi people. Sustainability 11(9) 2623. https://doi.org/10.3390/su11092623.	noted, all refs are updated and completed	Markku Kanninen	University of Helsinki	Finland
73905	162	37			It is likely to put '.' between 'Crippa, M' and ',(the following comma).	noted, all refs are updated and completed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
47873	163	27	163	27	incorrect citaion- IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages. https://doi.org/10.5281/zenodo.3553579	noted, all refs are updated and completed	Aidan Farrell	The University of the West Indies	Trinidad and Tobago
1193	166	31	166	32	Favero reference is incomplete	noted, all refs are updated and completed	Reid Miner	Private Consultant	United States of America
73907	169	20			Unlike the body of the report, there is only one work in the References conducted by 'Goldewijk et al. (2017)'.	noted, all refs are updated and completed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
12483	170	5	170	6	Guo L and R Gifford. 2002. Soil carbon stocks and land use change: a meta analysis. Global Change Biology 8: 345-360	noted, all refs are updated and completed	Nelly Bore	University of Nairobi	Kenya
84581	175	55	175	56	Please insert the following reference: "Karlsson, M., Alfredsson E. & Westling N. (2020) Climate policy co-benefits: a review, Climate Policy 20, 292-316. DOI: 10.1080/14693062.2020.1724070".	noted, all refs are updated and completed	Mikael Karlsson	KTH Royal Institute of Technology	Sweden
1195	182	48	182	48	Miner reference is incomplete. Citation is as follows Miner, R. (2010) FAO Forestry Paper 159, Food and Agriculture Organization of the United Nations, Rome, 2010.	noted, all refs are updated and completed	Reid Miner	Private Consultant	United States of America
73909	190	6			The reference of the work 'Romijn' is not clear.	noted, all refs are updated and completed	Raehyun KIM	National Institute of Forest Science	Republic of Korea
12485	197	34	197	35	UN-HABITAT (2008) Secure Land Rights for All. Nairobi: United Nations Human Settlements Programme (UN-HABITAT).	noted, all refs are updated and completed	Nelly Bore	University of Nairobi	Kenya
8575	201	25	201	25	faba bean (Vicia faba L.) all botanical crops namaes must be italic.	noted, all refs are updated and completed	Amanullah Amanullah	Department of Agronomy, The University of Agriculture Peshawar	Pakistan
43297	746		750		This table is now more broadly inclusive of technology and innovations that can help ag sector mitigate climate change impacts.	Thank you for your feedback	Jeffrey Seale	Bayer Crop Science	United States of America
43299	793	11	793	23	This section is much improved highlighting the complexities in changes to primarily organic systems and the potential for leakage by conversion of other ecosystems into production to count for the lower yield potential.	The authors are grateful for this positive feedback.	Jeffrey Seale	Bayer Crop Science	United States of America
11957	43647	28	43647	31	Traditional remote-sensing (satellite) measures of vegetation growth and decay e.g. optical band vegetation indices etc. are often less reliable due to the effect of cloud contamination, which are still relevant after implementing multiple different quality control and post-processing measures on different satellite data products, and more so over the tropical regions e.g. India during monsoon. Hence, validating such studies with ground-based estimates such as inventory reports by the government agencies are very important for proper estimation of forest growth/decay. It may be a good idea to mention explicitly if the estimates used here (and at other sections of this document) take care of these.	accept, whole section as been improved	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11959	43647	33	43647	34	I am not sure if this is the place to point this out and also if this is relevant considering the spatial extent of the study, but I would like to point out a study quantifying the soil-CO2 emission from a tropical mangrove forest in India using in situ measurements. If pertinent, this may be considered, https://link.springer.com/article/10.1007/s10661-019-7407-2	noted, thank you	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11949	44476	2	44476	2	This figure is not very clear and a bit confusing (to me). The schematic shows the link between Ch-7 and Ch-8 with city cooling in parentheses, while the caption says it is not considered.	unclear which, but all figs have been improved	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11951	44537	16	44537	16	This is already told in the table caption, so, I guess it can be removed from here.	unclear which, but all figs have been improved	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11953	44537	17	44537	21	Does this estimate also include the CO2 emission from soil due to the agricultural practices such as tilling etc?	unclear which, but all figs have been improved	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11955	44537	22	44537	22	The EDGAR database has been shown to overestimate the CH4 emission from India, by ~30% by Ganesan et al., 2017, Nature Communications (https://doi.org/10.1038/s41467-017-00994-7). Considering the importance to represent the CH4 emissions from India accurately in the assessment this point may be taken care of.	Noted. It seems the page number that the reviewer refers to is incorrect, but it is assumed that they refer to section 7.2.3. The authors thank the reviewer for pointing this out. Following consideration, it was decided not to included this point or reference as (1) error/uncertainty levels in the data are provided (30% for CH4) and (2) there is no specific discussion on India.	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11961	44743	22	45108	21	In the disaggregation solution provided in panel b of Fig. 7.7, the final term on right (the NGHGIs LULUCF box) should also include the [unmanaged land-Indirect human-induced effects Natural effects] to maintain conformity with the L.H.S. Isn't it?	reject. no, not correct	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11963	48030	1	48030	4	Can the picture quality, especially the embedded text be improved i.e. higher resolution?	unclear which, but all figs have been improved	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11965	48396	1	48396	2	Can this sentence be rephrased? At first glance, it seems to convey a contradictory statement.	unclear which, but all figs have been improved	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11967	48396	24	48396	26	These references seem to be missing from the text, Neogi 2020a and Neogi2020b.	thank you	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11969	48761	37	48761	37	Define this acronym IIRSA.	accept, removed	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11971	48761	38	48761	38	What is meant by illegal or unplanned road building?	accept, section improved	Pramit Kumar Deb Burman	Indian Institute of Tropical Meteorology Pune	India
11737	0				Many of the measures presented are focused on agriculture. Measures for agriculture needs to be regionalized. In highly productive agriculture, the potential for action is often largely exploited. Perhaps therefore it is best to present measures as part of a "Tool-Box". Measures that is not regionally limited is plant breeding, new technology, digitization and innovation in general. These measures are also strongly correlated with increased productivity and therefore needs to be raised significantly more.	Noted. To be considered	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer Name	Reviewer Affiliation	Reviewer Country
11739	0				Knowledge Gaps 1: Regional and national implementations; Europe already has a negative net CO2 –emission calculation on AFOLU. What will be the effects of implementing more measures or measures strongly put forwards by IPCC on a global scale, such as Agroforestry, use of biochar. There is urgent need for developing and implementing regionally adapted tool boxes.	Rejected. The authors are not sure to which specific point the reviewer refers. If they are suggesting additional paragraphs, regrettably the strict word limit prevents further inclusions. In addition and regarding the reviewer's point, all possible mitigation potential (and options) should be pursued, regardless of a region already being estimated as having net-negative CO2 emissions. The more mitigation the better! Additionally, the need for research at a country- or localised-level is strongly emphasized within several of the paragraphs.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
11741	0				Knowledge Gaps 2: What is the potential of successful use of modern plant breeding technologies on AFOLU emissions and sequestration?	The authors thank the reviewer for their suggestions. Unfortunately the strict word count limit prevents the addition of new topics / paragraphs.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
11743	0				Knowledge Gaps 3: More knowledge is needed on the mitigation effects of the components of new management systems such as conservation agriculture, regenerative agriculture and agroecology. Presently, a lot of non-substantiated claims are being used by both protagonists and antagonists of the mentioned systems.	Noted. Unfortunately, the strict word count limit prevents the inclusion of additional points. Additionally, it is felt the information box specifically exploring mitigation within such farming systems (currently Box 7.5) sufficiently identifies associated knowledge gaps.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
249					How to chieve the net zero emission for development pathways especailly developing countries	noted, but too general comment. this is dealt with in mnay chapters, also ch 3, ch 4, chapter on international cooperation, etc	edvin aldrian	BPPT Indonesia	Indonesia
251					Sciences Advance, vol 7 No 3, DOI: 10.1126/sciadv.aay1052	noted, thank you	edvin aldrian	BPPT Indonesia	Indonesia
253					How "Temperature dependence of the terrestrial carbon sink" would be in IPCC report. It will change the game, will it change traditional emision sink strategy from ocean and tropical forest.	noted, too general. this is mostly WGI	edvin aldrian	BPPT Indonesia	Indonesia
8125					Please include a statement about the limitations of IAMs and bookkeeping models to assess biomass production within agriculture, forestry, and combined systems (agro-forestry) as your colleagues did in Chapter 12 (page 69, lines 20 - 26). This would explain many difficulties to estimate land area requirements and explain why there still is limited insight in biomass-based CCU.	accept, we state that IAMs are not good in subtle changes in management in these systems	Joachim Rock	Thuenen-Institute of Forest Ecosystems	Germany
16427					The content about perennial crops needs to be checked in detail.	noted, all sections were imporved	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
17219					Soil is a finite resource. Healthy soil is full of life: there are more organisms in a tablespoon of uncontaminated soil than population on Earth. The soil is home to a quarter of the planet's biodiversity. Biodiversity or biodiversity is defined as "the variability of living organisms from any source, including terrestrial, aquatic or marine ecosystems".	noted, thank you	carlos ramirez	AFA-ANDALUCIA	Spain
17221					Soil is one of nature's most complex ecosystems and one of the most diverse habitats on earth: There is no place in nature with a higher concentration of species than soils; however, this biodiversity is hardly known as it is underground.	noted, thank you	carlos ramirez	AFA-ANDALUCIA	Spain
17223					More than 1,000 species of invertebrates can be found in a single m2 of forest land. A single gram of soil can harbor millions of living things and several thousand species of bacteria. A typical healthy soil can house several species of vertebrate animals, various species of earthworms, between 20 and 30 species of mites, about 50-100 species of insects, dozens of species of nematodes, hundreds of fungal species and perhaps thousands of species of bacteria and actinomycetes.	noted, thank you	carlos ramirez	AFA-ANDALUCIA	Spain
17225					So-called climate change is often thought to be something that happens only in the atmosphere. But atmospheric carbon also affects the soil, because carbon that is not used for the growth of surface plants is distributed through the roots and deposited in the soil. Healthy soil can therefore help mitigate climate change.	noted, we do have a whole box on various types of agricutlure (organic faring etc) and their pros and cons	carlos ramirez	AFA-ANDALUCIA	Spain
17227					As far as carbon deposit is concerned, not all soils are the same. The most carbon-rich soils are peatlands, which are mainly found in northern Europe. Grassland soil stores a lot of carbon per hectare, while soil in the hotlest and driest areas of southern Europe contains less carbon.	noted, too general. this is mostly WGI & II	carlos ramirez	AFA-ANDALUCIA	Spain
17229					In some parts of Europe, rising temperatures lead to increased vegetation growth and increased carbon storage in the soil. However, high temperatures could also increase the decomposition and mineralization of soil organic matter, reducing organic carbon content.	noted, too general. this is mostly WGI & II	carlos ramirez	AFA-ANDALUCIA	Spain
17231					There are already scientific evidence that soil moisture content is being affected by rising temperatures and changes in precipitation patterns. It is estimated that the release of greenhouse gases from the soil will be especially important in the far north of Europe and Russia, where the fusion of permafrost can release large amounts of methane, a much more potent greenhouse gas than carbon dioxide.	noted, too general. this is mostly WGI & II	carlos ramirez	AFA-ANDALUCIA	Spain
17233					With the rise in temperature, let's remember that 2015 and 2016 were the warmest in history, these soils that have remained hundreds or thousands of years in freezing, are beginning to thaw. This figure is a very abrupt change for something that should be in permanent freezing.	noted, too general. this is mostly WGI	carlos ramirez	AFA-ANDALUCIA	Spain
17235					After hundreds or thousands of years this soil begins to thaw and also lose its structure. But there is an obvious risk that warming in the atmosphere will cause the soil to release more greenhouse gases, causing a vicious cycle that accelerates climate change.	noted, too general. this is mostly WGI	carlos ramirez	AFA-ANDALUCIA	Spain
17237					Climate change is not the only factor that can cause soil to go from being a carbon sink to a source of emissions. How we use soil also influences how much carbon the soil can retain.	noted, too general. this is mostly WGI	carlos ramirez	AFA-ANDALUCIA	Spain
17239					Currently, the carbon reserve of European forests is on the rise, due to changes in forest management and changes in the environment. Half of that carbon is stored in forest soils. When forests degrade or cut down, the carbon they store is released and emitted into the atmosphere. In this case, forests can become net contributors to atmospheric carbon.	noted, too general. this is mostly WGI	carlos ramirez	AFA-ANDALUCIA	Spain
17241					Under the legislation adopted in May 2018, during the period 2021 to 2030 EU Member States must ensure that greenhouse gas emissions resulting from land use, land use change and forestry are offset, at a minimum, by equivalent CO2 absorptions from the atmosphere.	noted, thank you	carlos ramirez	AFA-ANDALUCIA	Spain
17243					On 14 May 2018 the Council adopted the Regulation on the inclusion of greenhouse gas emissions and absorptions resulting from land use, land use change and forestry (UTCUTS) in the framework of climate and energy action until 2030.	noted, thank you	carlos ramirez	AFA-ANDALUCIA	Spain
17245					https://www.eldiario.es/aragon/economia/quimicos-tierra-arboles-dispara-ingresos-agricultor_1_7259717.html	noted, thank you	carlos ramirez	AFA-ANDALUCIA	Spain
17247					https://www.contextoganadero.com/blog/biodiversidad-del-suelo-base-para-la-produccion-sostenible	noted, thank you	carlos ramirez	AFA-ANDALUCIA	Spain
17249					https://ecoremedi.es/biodiversidad-y-usos-del-suelo/	noted, thank you	carlos ramirez	AFA-ANDALUCIA	Spain
43293					There was no mention of the use of basalt rock dust to provide benefits both as a fertiliser (land round volcanoes is highly fertile) and as a means of carbon capture: see https://www.nature.com/articles/s41586-020-2448-9.epdf and https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.15089	noted, thank you	David Hendry	Nuffiled College, Oxford University	United Kingdom (of Great Britain and Northern Ireland)
55125					the notion of "nature-based solutions" lacks legitimacy because its definition was never debated and agreed within the framework of a universal or nearly universal intergovernmental institution. Instead, repeated attempts have been made to impose this expression by technocratic fiat without the appropriate discussion in truly representative fora. In view of the above, Brazil requests that all references to "nature-based solutions" be replaced by the expression "ecosystem-based approaches" (EBA).	Noted The benefits for farmers need more attention	Government of Brazil	Ministry of Foreign Affairs of Brazil	Brazil
56177					Although forestry efforts provide the greatest mitigation benefits, there seems to be a lack of balance in Chapter 7 towards the remainder, namely agriculture and other land uses. In particular, agriculture receives cursory treatment and has few references.	Noted but balance is the objective	Government of United States of America	U.S. Department of State	United States of America
56179					Chapter 7 would benefit from material and references from the Fourth National Climate Assessment (NCA4) and the Second State of the Carbon Cycle Report (SOCCR2). Also AgMIP and some of the multi-disciplinary modeling work performed by some of its authors like Cynthia Rosenzwieg. Charles Rice (KSU), Brian Murray (Duke), and Keith Paustian (CSU) have done much more than the one article mentioned, as has Amy Swan (CSU). All have done a great deal of work in the agriculture mitigation world.	Noted and the related references will be considered	Government of United States of America	U.S. Department of State	United States of America
56181					This chapter needs a grammatical and spelling scrub. It does not read as written in one voice. The early pages are too dense and have long, run-on sentences such that they must be reread several times to understand. The latter sections are generally much easier to understand.	noted	Government of United States of America	U.S. Department of State	United States of America
56183					Some figures and many tables (e.g., Table 7.10) are illegible and the accompanying text is therefore unable to be compared/contrasted.	noted and it will be improved	Government of United States of America	U.S. Department of State	United States of America
56185					Also see the USDA LTARs and USDA Climate Hubs The Long-Term Agroecosystem Research Network (usda.gov) and https://www.climatehubs.usda.gov/ for background on agriculture and carbon in the U.S.	Highly relevant website.	Government of United States of America	U.S. Department of State	United States of America
56187					A brief explanation or example of supply-side and demand-side mitigation measures at the beginning would really help.	Noted - Glossary	Government of United States of America	U.S. Department of State	United States of America
56189					Improved forest management has not been defined in the chapter. How does this concept differ from forest management? Inclusion in the definition box would help to clarify and some description in the section on IFM would be useful. There is no discussion on harvested wood products in solid waste disposal sites and the fate of this material as a potential pathway. This can be permanent in many cases but, given the global scale of this chapter, having a sense for how HWP in SWDS are captured and accounted for globally would be useful.	accept, we clarify in section now. (within page limits)	Government of United States of America	U.S. Department of State	United States of America
61423					General comment Nature based solutions should be extensively elaborated and promoted within forestry, agriculture and other relevant sectors. I found few places where NBS are mentioned, but that is not enough for this publication of global significance. I propose to develop subchapter for each sector that will rely on possible NBS that can be applies or that are already applied within different regions and effects have or will have.	Noted. Taken into account	Graham von Maltitz	UNIVERSITY OF STELLENBOSCH; UNCCD SCIENCE POLICY INTERFACE	South Africa

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86077					There is no discussion of political constraints to carbon offsetting, including ethical and practical concerns (Carattini and Tavoni Economics Bulletin 2016) and resistance to international offsetting (e.g. Baranzini, Borzykowski, and Carattini Journal of Forest Economics 2018; Buntaine and Prather 2018; Diederich and Goeschl JEEM 2018).	reject, we have mnay parts on risks, constraints, and detailed feasibility per section and measure	Carattini Stefano	Georgia State University	United States of America
86291					Comment:	Unfortunatly no commentary was provided.	Pedro Luiz Oliveira Almeida Machado	Embrapa - Brazilian Agricultural Research Corporation	Brazil