4.SM Strengthening and Implementing the Global Response
Supplementary Material

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4.SM.1 Benchmark Indicators for Sectoral Changes in Emissions as Presented in Table 4.1 (Section 4.2.1)

Integrated assessment models (IAMs) and other sector scenarios provide sectoral detail underpinning the declines in greenhouse gas (GHG) emissions by the middle of the century (Section 2.3 and Section 2.4). Table 4.SM.1 indicates the pace of the transitions that are deemed necessary in 2020, 2030 and 2050 at the sector level for 1.5°C-consistent pathways, and complements this with bottom-up studies from literature that give actionable policy targets (the lines in white). A summary of this table is presented in Section 4.2.1.

Table 4.SM.1: Benchmark indicators indicating the sectoral changes in emissions, fuels and technologies that would need to take place in 1.5°C-consistent pathways, based on selected IAM 1.5°C pathways assessed in Chapter 2 (with no, low and high overshoot) (dark grey rows), four archetype scenarios (light grey rows) and bottom-up studies including IEA (white rows). The numbers in square brackets in some columns indicate the scenario count for the specific indicator.

				Share of Renewables		Share of Fossil Fuels	Change in Energy Demand in Buildings	Direct Emissions Reductions from Buildings	Share of Low-Carbon Fuels	Share of Electricity	Share of Biofuels	Industrial Emissions Reductions
		Median (interquartile range)	Scenario count	in primary energy (%)	in electricity generation (%)	in electricity generation (%)	relative to 2010 (%)	relative to 2010 (%)	in transport (%)	in transport (%)	in transport (%)	relative to 2010 (%)
2020	IAM pathways	No or low overshoot 1.5	50	14.90 (16.25, 14.24)	26.32 (29.04, 24.13)	61.32 (63.15, 58.64)	-10.84 (-7.49, -11.96) [42]	-1.47 (6.62, -7.98) [42]	4.42 (4.51, 3.66) [29]	1.24 (1.75, 1.10) [49]	3.03 (3.23, 1.69) [37]	-12.68 (-0.50, -15.79) [42]
		Low overshoot 1.5	43	15.31 (16.23, 14.03)	26.26 (28.83, 23.58)	61.08 (63.17, 58.74)	-10.86 (-7.53, -14.83) [35]	-0.83 (6.62, -9.69) [35]	4.39 (4.51, 3.59) [23]	1.24 (1.79, 1.09) [42]	1.97 (3.17, 1.55) [31]	-11.81 (-1.66, -17.80) [35]
		High overshoot 1.5	35	15.08 (15.84, 14.44)	28.37 (29.24, 24.33)	61.58 (63.83, 59.70)	-12.49 (-10.75, -19.44) [29]	-3.52 (6.62, -15.22) [29]	3.59 (4.45, 3.27) [23]	1.40 (1.53, 1.10)	2.18 (2.98, 1.72) [24]	-15.50 (-12.70, -23.70) [29]
		S1		12.46	23.24	63.72	-9.20	-0.83		0.95	1.69	4.46
		S2		16.61	27.00	60.11	-16.20	-0.25	2.18	0.97	1.22	-20.61
		S5		13.46	17.38	71.03			3.16	0.95	2.20	
		LED		15.63	24.61	54.11	-8.78	15.11		2.51		-32.87
	Sectoral studies	Löffler et al. (2017)		13.47	31.41	57.60						
		IEA (2017a) (ETP)		19.02	29.91	58.63	-1.52	10.25	5.74	1.70	4.03	-9.37
		IEA (2017b) (WEM)		16.67	29.32	58.75	-7.44	5.78	4.94	1.21	3.73	-6.51
2030	IAM pathways	No or low overshoot 1.5	50	29.08 (37.06, 25.73)	53.68 (64.80, 46.74)	30.04 (37.60, 20.25)	0.30 (7.31, -6.73) [42]	33.53 (51.77, 21.47) [42]	12.07 (17.83, 8.55) [29]	5.20 (7.13, 3.27) [49]	6.54 (10.05, 2.51) [37]	42.29 (54.71, 34.25) [42]
		Low overshoot 1.5	43	28.75 (35.31, 25.45)	52.63 (58.90, 44.48)	31.54 (38.14, 23.14)	-2.61 (5.41, -7.73) [35]	30.11 (43.16, 20.58) [35]	9.71 (15.24, 8.44) [23]	4.99 (6.84, 3.18) [42]	5.06 (9.60, 2.12) [31]	39.81 (49.58, 30.13) [35]
		High overshoot 1.5	35	23.65 (27.45, 20.03)	42.73 (53.78, 36.91)	42.02 (47.27, 32.61)	-16.64 (-12.07, -20.01) [29]	8.15 (23.54, -0.61) [29]	6.65 (8.32, 5.55) [23]	3.46 (4.68, 2.54)	3.54 (3.85, 1.38) [24]	17.67 (27.65, -12.81) [29]

		S1		28.79	57.89	27.84	-7.68	35.32		3.92	5.06	49.09
		S2		28.72	47.89	35.37	-14.12	47.92	5.17	4.46	0.71	19.11
		S5		13.78	25.11	57.38			3.43	1.32	1.93	
		LED		37.42	59.64	17.14	30.42	59.81		20.93		42.10
	Sectoral studies	**Löffler et al. (2017)**		45.59	79.25	13.73						
		IEA (2017a) (ETP)		31.09	46.73	37.92	1.98	46.91	13.80	5.47	8.18	22.39
		IEA (2017b) (WEM)		27.24	49.58	34.74	-6.37	32.03	17.12	5.76	11.20	15.28
2050	**IAM pathways**	**No or low overshoot 1.5**	50	60.24 (67.09, 51.77)	77.12 (86.43, 69.23)	8.61 (13.42, 3.88)	-17.19 (3.31, -36.20) [42]	70.26 (89.56, 54.48) [42]	55.00 (65.66, 34.67) [29]	22.67 (28.73, 17.30) [49]	15.24 (22.95, 10.95) [37]	78.75 (90.79, 67.33) [42]
		Low overshoot 1.5	43	58.37 (66.65, 49.97)	75.98 (85.32, 68.54)	8.69 (13.59, 4.80)	-19.43 (2.17, -37.44) [35]	68.30 (89.48, 54.32) [35]	52.95 (65.14, 34.10) [23]	22.63 (30.20, 16.74) [42]	14.71 (21.73, 10.11) [31]	78.69 (89.17, 70.60) [35]
		High overshoot 1.5	35	62.16 (67.51, 47.48)	82.39 (88.34, 63.65)	6.33 (16.06, 2.26)	-37.41 (-13.37, -51.04) [29]	48.64 (59.49, 40.82) [29]	38.38 (43.62, 27.01) [23]	18.49 (22.88, 13.67)	14.96 (17.78, 5.10) [24]	68.12 (80.61, 53.62) [29]
		S1		58.37	81.26	10.15	-20.54	79.74		33.68	12.95	73.70
		S2		52.90	63.08	11.42	-24.59	89.65	25.65	22.67	2.98	72.81
		S5		67.04	70.27	6.69			53.36	9.54	35.46	
		LED		72.51	77.40	0.19	44.67	95.00		59.21		91.38
	Sectoral studies	**Löffler et al. (2017)**		100.00	99.76	0.00						
		IEA (2017a) (ETP)		57.77	74.33	9.72	5.10	82.71	54.83	29.65	24.43	57.26
		IEA (2017b) (WEM)		47.02	68.72	13.71	-5.38	73.14	58.18	32.07	25.19	54.61

Notes: Values for no or low, low and high overshoot 1.5 indicate the median and the interquartile ranges for indicators for 1.5°C-consistent pathways distinguishing the level of overshoot, collected in the scenario database established for the assessment of this Special Report (see Section 2.1 and Annex 2.3). Four illustrative pathway archetypes were selected for comparison: S1 (AIM 2.0, SSP1–19), S2 (MESSAGE-GLOBIOM 1.0, SSP2–19), S5 (REMIND-MAgPIE 1.5, SSP5–19) and low energy demand (MESSAGEix-GLOBIOM 1.0, LED) (see Section 2.1). The selected studies indicate mitigation transitions in key sectors consistent with limiting warming to 1.5°C (IEA, 2017a, 2017c; Löffler et al., 2017), grounded in published scenarios combined with expert judgement.

4.SM.2 Enabling Conditions and Constraints of Overarching Adaptation Options as Discussed in Section 4.3.5

Table 4.SM.2: Overarching adaptation options: Enabling conditions and constraints. This table underpins Section 4.3.5.

Adaptation Option	Feasibility	Enabling Conditions	Constraints	Examples
Disaster risk management	*Medium evidence (high agreement)*	Pools resources and expertise for risk reduction (Howes et al., 2015; Kelman et al., 2015; Wallace, 2017). Integrates adaptation into existing management (Howes et al., 2015). Supports post-disaster recovery and reconstruction (Kelman et al., 2015; Kull et al., 2016). Engages local and indigenous knowledge to improve preparedness and response (McNamara and Prasad, 2014; Mawere and Mubaya, 2015; Kaya and Koitsiwe, 2016; Chambers et al., 2017; Granderson, 2017).	Uncertainty over projected climate impacts and absence of downscaled climate projections (van der Keur et al., 2016; de Leon and Pittock, 2017; Wallace, 2017). Limited institutional, technical and financial capacity in frontline agencies (de Leon and Pittock, 2017; Kita, 2017; Wallace, 2017). Adaptation and disaster risk management communities operate separately (Kelman et al., 2015; Serrao-Neumann et al., 2015; de Leon and Pittock, 2017).	*Glacial lake outburst floods (GLOFs)* 1.5°C will increase risk of GLOFs (Cogley, 2017; Kraaijenbrink et al., 2017). Infrastructural measures technically and economically unfeasible in many regions (Muñoz et al., 2016; Schwanghart et al., 2016; Watanabe et al., 2016; Haeberli et al., 2017). Early warning systems (Anacona et al., 2015) and monitoring of dangerous lakes and surrounding slopes (including using remote sensing) offer disaster risk management opportunities (Emmer et al., 2016; Milner et al., 2017). Institutional leadership and community engagement essential for effectiveness (Anacona et al., 2015; Watanabe et al., 2016).
Risk sharing and spreading: insurance	*Medium evidence (medium agreement)*	Buffers climate risk (Wolfrom and Yokoi-Arai, 2015; O'Hare et al., 2016; Glaas et al., 2017; Jenkins et al., 2017; Patel et al., 2017). Shifts the mobilization of financial resources towards strategic approaches (Surminski et al., 2016). Incentivizes investments and behaviour that reduce exposure (Linnerooth-Bayer and Hochrainer-Stigler, 2015; Shapiro, 2016; Jenkins et al., 2017).	Can provide disincentives for reducing risk and can distort incentives for adaptation strategies (Annan and Schlenker, 2015; de Nicola, 2015). Underwrites a return to the 'status quo' rather than enabling adaptive behaviour (O'Hare et al., 2016). Financial, social and institutional barriers to implementation and uptake, especially in low-income nations (García Romero and Molina, 2015; Joyette et al., 2015;	*Crop insurance* In Kenya during the 2011 drought, index-based insurance payouts for livestock reduced distress sales by 64% among better-off pastoralist households and reduced the likelihood of rationing food intake by 43% among poorer households (Hansen et al., 2017). In USA Annan and Schlenker (2015) found insured crops were significantly more sensitive to extreme heat because insured farmers were disincentivized from investing in costly adaptation strategies since their insurance compensated for potential losses

			Lashley and Warner, 2015; Jin et al., 2016).	In Bangladesh low institutional trust and financial literacy mean that fewer women enrol in weather-based crop insurance (Akter et al., 2016). *World Bank 'cat bond' issuance in Caribbean* In 2007 the Caribbean Catastrophe Risk Insurance Facility (CCRIF) was formed to pool risk from tropical cyclones, earthquakes and excess rainfalls (Murphy et al., 2012; CCRIF, 2017). 36 payouts have been made to 13 governments, totalling 130.5 million USD and partially funded by CCRIF, within 14 days of the event (CCRIF, 2017). Speed of payment allows countries to finance immediate needs (Murphy et al., 2012). Though widely perceived to be successful, evidence of success remains limited (Teh, 2015).
Risk sharing and spreading: social protection programmes	*Medium evidence (medium agreement)*	Builds generic adaptive capacity and reduces social vulnerability (Weldegebriel and Prowse, 2013; Eakin et al., 2014; Lemos et al., 2016; Schwan and Yu, 2017). Must be complemented with a comprehensive climate risk management approach (Schwan and Yu, 2017) that also takes into account disaster risk management, adaptation and vulnerability reduction goals (Davies et al., 2013).	Inadequate targeting, leakages and lack of institutional architecture, especially in Least Developed Countries (Ravi and Engler, 2015; Schwan and Yu, 2017). Uncertainties about effectiveness of processes of delivering social protection (e.g., cash or 'in kind'). Necessary but insufficient to decrease households' vulnerability if stand-alone (Lemos et al., 2016). When delivered without emphasis on vulnerability reduction, investments may be maladaptive in long run (Nelson et al., 2016).	*Cash transfer programmes* In sub-Saharan Africa cash transfer programmes targeting poor communities have proven successful in smoothing household welfare and food security during droughts, strengthening community ties and reducing debt levels (del Ninno et al., 2016; Asfaw et al., 2017; Asfaw and Davis, 2018). In Brazil higher levels of income due to cash transfer programmes have been linked to food security, as households are able to invest in irrigation, but there have been limited long-term investments in reducing vulnerability among the poorest households (Lemos et al., 2016; Mesquita and Bursztyn, 2016; Nelson et al., 2016).
Education and learning	*Medium evidence (high agreement)*	Co-production of solutions strengthens adaptation implementation (Butler et al., 2016a; Thi Hong Phuong et al., 2017; Ford et al., 2018).	Not appropriate in all circumstances (e.g., highly marginalized locations) (Ford et al., 2016, 2018).	*Participatory scenario planning (PSP)* PSP is a process by which multiple stakeholders work together to envision future scenarios under a range of climatic conditions (Flynn et al., 2018).

		Social learning strengthens adaptation and affects longer-term change (Clemens et al., 2015; Ensor and Harvey, 2015; Henly-Shepard et al., 2015). International learning and cooperation mechanisms, supranational organizations (Vinke-de Kruijf and Pahl-Wostl, 2016) and international, collaborative projects (Cochrane et al., 2017; Harvey et al., 2017) can build adaptive capacity.	Education and learning on their own may not provide 'enough adaptive capacity to respond to climate change' (Thi Hong Phuong et al., 2017). Participation in and of itself does not necessarily build capacity (Ford et al., 2016).	PSP has been observed to facilitate the interaction of multiple knowledge systems, resulting in learning and the co-production of knowledge on adaptation (Tschakert et al., 2014; Oteros-Rozas et al., 2015; Star et al., 2016; Flynn et al., 2018).
Population health and health systems	*Medium evidence (high agreement)*	1.5°C will primarily exacerbate existing health challenges (K.R. Smith et al., 2014), which can be targeted by enhancing health services. Age, pre-existing medical conditions and social deprivation are found to be the key (but not the only) factors that make people vulnerable and lead to more adverse health outcomes related to climate change impacts. Interventions to reduce climate change-driven health impacts can be mainstreamed through existing health programming and service delivery (WHO, 2015; Paavola, 2017). Needs to be combined with iterative management involving regular monitoring of effectiveness in the light of climate impacts (Hess and Ebi, 2016; Ebi and Otmani del Barrio, 2017). Collaboration with local stakeholders, public education campaigns and the tailoring of communication to local needs are essential (Berry and Richardson, 2016; van Loenhout et al., 2016).	Governance challenges: for example, absence of coordination across scales, lack of mandate for action on adaptation (Austin et al., 2016; Ebi and Otmani del Barrio, 2017; Shimamoto and McCormick, 2017). Absence of information and understanding on climate impacts (Nigatu et al., 2014; Xiao et al., 2016; Sheehan et al., 2017). Many health services currently do not consider climate change (Hess and Ebi, 2016). Adaptation strategies based on individual preparedness, action and behaviour change may aggravate health and social inequalities due to their selective uptake, unless they are coupled with broad public information campaigns and financial support for undertaking adaptive measures (Paavola, 2017).	*Heat wave early warning and response systems* Heat wave early warning and response systems coordinate the implementation of multiple measures in response to predicted extreme temperatures (e.g., public announcements, opening public cooling shelters, distributing information on heat stress symptoms) and have been shown to be effective in a wide variety of contexts (Knowlton et al., 2014; Takahashi et al., 2015; Nitschke et al., 2016, 2017).

Indigenous knowledge	*Medium evidence (high agreement)*	Indigenous knowledge underpins the adaptive capacity of indigenous communities through the diversity and flexibility of indigenous agro-ecological systems, collective social memory, repository of accumulated experience and from social networks that are essential for disaster response and recovery (Hiwasaki et al., 2015; Pearce et al., 2015; Mapfumo et al., 2016; Sherman et al., 2016; Ingty, 2017; Ruiz-Mallén et al., 2017). Knowledge of environmental conditions helps communities detect and monitor change (Johnson et al., 2015; Mistry and Berardi, 2016; Williams et al., 2017).	Acculturation, dispossession of land rights and land grabbing, colonization and social change are challenging indigenous knowledge systems (Ford, 2012; Nakashima et al., 2012; McNamara and Prasad, 2014; Pearce et al., 2015). Broader structural challenges, systemic inequality and dominant governance systems prevent indigenous epistemologies and worldviews from meaningfully being integrated into adaptation (Thornton and Manasfi, 2010; Mistry et al., 2016; Russell-Smith et al., 2017). Can promote conservative attitudes, limit uptake of new information and practices and may not be sustainable in all circumstances given socio-cultural changes experienced (Granderson, 2017; Kihila, 2017; Mccubbin et al., 2017).	*Cultural programming* Options such as integration of indigenous knowledge into resource management systems and school curricula, digital storytelling and filmmaking, cultural events, web-based knowledge banks, radio dramas and documentation of knowledge are identified as potential adaptations (Cunsolo Willox et al., 2013; McNamara and Prasad, 2014; MacDonald et al., 2015b; Pearce et al., 2015; Chambers et al., 2017; Inamara and Thomas, 2017), but need to be carefully analysed for their potential to reduce vulnerability, including potential trade-offs (Granderson, 2017).
Human migration	*Low evidence* (but rapidly growing, *low agreement)*	Revising and adopting migration issues in national disaster risk reduction policies, national action plans, and intended nationally determined contributions (INDCs)/NDCs (Kuruppu and Willie, 2015; Yamamoto et al., 2017). Utilizing existing social protection programmes to manage climate-induced migration (Schwan and Yu, 2017). Moving away from ad hoc approaches to migration and displacement (Thomas and Benjamin, 2018).	Research conducted on a 'case by case' approach fails to provide the effective scaling of policy to national or international levels (Gemenne and Blocher, 2017; Grecequet et al., 2017). Few policies on migration exist at the national or sub-national scales (Yamamoto et al., 2017). Financial, social and ecological costs (Grecequet et al., 2017). Stress on urban system resources and services (Bhagat, 2017).	*Autonomous and planned relocation in small island developing states and semi-arid regions* Migration is improving access to financial and social capital and reducing risk exposure in some locations (e.g., in the Solomon Islands; Birk and Rasmussen, 2014). The ad hoc nature of migration and displacement can be overcome by integrating disaster risk reduction and climate change adaptation into national sustainable development plans (Thomas and Benjamin, 2018). In semi-arid India, populations in rural regions already experiencing 1.5°C warming are migrating to cities (Gajjar et al., 2018) but are inadequately covered by existing policies (Bhagat, 2017).

		Migration can serve as an important risk management strategy, leading to increased incomes (Cattaneo and Peri, 2016). Migration might become the only feasible adaptation option in highly vulnerable areas (Betzold, 2015; Wilkinson et al., 2016).	Migrants at risk of insecure tenure, unsafe living conditions and exclusion in their destinations (Gioli et al., 2016; Bettini et al., 2017; Bhagat, 2017; Schwan and Yu, 2017).	
Climate services	*Medium evidence (high agreement)*	Rapid technical development, due to increased financial inputs and growing demand, is enabling improved quality of climate information (Rogers and Tsirkunov, 2010; Clements et al., 2013; Perrels et al., 2013; Gasc et al., 2014; WMO, 2015; Roudier et al., 2016). Multiple stakeholder engagement and participatory processes to interpret climate information are effective to improve uptake and use (Mantilla et al., 2014; Sivakumar et al., 2014; Coulibaly et al., 2015; Gebru et al., 2015; Brasseur and Gallardo, 2016; Lourenço et al., 2016; Singh et al., 2016; Vaughan et al., 2016; Kihila, 2017; Lobo et al., 2017). Scaling climate services may occur through: leveraging capacities of project champions, knowledge brokers, and intermediaries (Mantilla et al., 2014; Coulibaly et al., 2015); co-production of knowledge (Kirchhoff et al., 2013) that enables users to actively participate in adaptation decisions (Vaughan and Dessai, 2014); developing clear financial models to ensure sustainability (Webber and Donner, 2017), which includes multi-stakeholder engagement through iterative participatory processes (Girvetz et al., 2014; Dorward et al., 2015); and leveraging appropriate	Issues of timing of information provision and scale of information remain barriers (Dinku et al., 2014; Jancloes et al., 2014; Gebru et al., 2015; Weisse et al., 2015; Brasseur and Gallardo, 2016; Cortekar et al., 2016; Singh et al., 2016; Snow et al., 2016; Vaughan et al., 2016; Kihila, 2017). Lower uptake by women, remote communities and those without technical support (Singh et al., 2017; Carr and Onzere, 2018). Issues of trust and usability of information provided (L. Jones et al., 2016; Singh et al., 2017; C.J. White et al., 2017). Continued focus on supply-driven provision of climate information rather than specific needs of end users (Lourenço et al., 2016).	Semi-arid regions in India and sub-Saharan Africa facing 1.5°C warming are seeing benefits of climate services in agriculture planning, drought management and flood warning (Vincent et al., 2015; Lobo et al., 2017; Singh et al., 2017; C. Vaughan et al., 2018). Climate services are being widely applied in sectors such as agriculture, health, disaster management and insurance (Lourenço et al., 2016; C. Vaughan et al., 2018), with implications for adaptation decision-making. Several programmes aimed at using climate services for better decision-making are showing signs of success: from various actors, at various scales, using different forms of information delivery and uptake. These involve: participatory analysis of seasonal forecasts in East Africa (Dorward et al., 2015); non-governmental organization-driven weather advisories in India (Lobo et al., 2017); innovations in government agriculture extension services in various countries across sub-Saharan Africa and South Asia (Singh et al., 2016); and broadening the scope of climate services to directly inform spatial planning and adaptation interventions in the Netherlands (Goosen et al., 2013).

		communication channels such as mobile technology (Hampson et al., 2014; Gebru et al., 2015).		

4.SM.3 Carbon Dioxide Removal Costs, Deployment and Side Effects: Literature Basis for Figure 4.2 (Section 4.3.7)

Table 4.SM.3: References supporting Figure 4.2 in Section 4.3.7. Evidence on Carbon Dioxide Removal (CDR) abatement costs, 2050 deployment potentials and side effects. Based on systematic review (Fuss et al., 2018).

Technology	Costs	Potentials
Afforestation and reforestation (AR)	Myers and Goreau, 1991; van Kooten et al., 1992, 1999; Winjum et al., 1992, 1993; Dixon et al., 1993; Swisher, 1994; Brown et al., 1995; Chang, 1999; Plantinga et al., 1999; Sohngen and Alig, 2000; van Kooten, 2000; Plantinga and Mauldin, 2001; Ravindranath et al., 2001; Sohngen and Mendelsohn, 2003; van Vliet et al., 2003; Baral and Guha, 2004; Richards and Stokes, 2004; Koning et al., 2005; Lakyda et al., 2005; Lee et al., 2005; Olschewski and Benítez, 2005; Richards and Stavins, 2005; Yemshanov et al., 2005; Benítez and Obersteiner, 2006; Han et al., 2007; Ahn, 2008; Hedenus and Azar, 2009; Dominy et al., 2010; Rootzén et al., 2010; Ryan et al., 2010; Torres et al., 2010; Winsten et al., 2011; Paterson and Bryan, 2012; Townsend et al., 2012; Nijnik et al., 2013; Paul et al., 2013; Polglase et al., 2013; Carwardine et al., 2015; Evans et al., 2015; Maraseni and Cockfield, 2015; Haim et al., 2016	Dixon et al., 1994; Nilsson and Schopfhauser, 1995; Cannell, 2003; Richards and Stokes, 2004; Houghton et al., 2015; Houghton and Nassikas, 2018
Bioenergy with carbon dioxide capture and storage (BECCS)	Möllersten et al., 2003, 2004, 2006; Keith et al., 2006; Azar et al., 2006; Luckow et al., 2010; Abanades et al., 2011; Gough and Upham, 2011; Laude and Ricci, 2011; Laude et al., 2011; Ranjan and Herzog, 2011; Carbo et al., 2011; De Visser et al., 2011; Fabbri et al., 2011; Koornneef et al., 2012b; Kärki et al., 2013; Fornell et al., 2013; Akgul et al., 2014; N. Johnson et al., 2014; Arasto et al., 2014; Al-Qayim et al., 2015; Onarheim et al., 2015; Creutzig et al., 2015; Moreira et al., 2016; Rochedo et al., 2016; Sanchez and Callaway, 2016	Fischer and Schrattenholzer, 2001; Yamamoto et al., 2001; Hoogwijk et al., 2005, 2009; Moreira, 2006; Obersteiner et al., 2006; Smeets et al., 2007; Smeets and Faaij, 2007; Hakala et al., 2008; van Vuuren et al., 2009; Dornburg et al., 2010; Gregg and Smith, 2010; Thrän et al., 2010; Beringer et al., 2011; Haberl et al., 2011; Cornelissen et al., 2012; Erb et al., 2012; Rogner et al., 2012; W.K. Smith et al., 2012; Lauri et al., 2014; Kraxner and Nordström, 2015; Searle and Malins, 2015; Buchholz et al., 2016; Calvin et al., 2016; Tokimatsu et al., 2017
Biochar	McCarl et al., 2009; Smith, 2016	Lehmann et al., 2006; Laird et al., 2009; Lee et al., 2010; Moore et al., 2010; Pratt and Moran, 2010; Woolf et al., 2010; Powell and Lenton, 2012; Hamilton et al., 2015; Lomax et al., 2015; Smith, 2016
Soil carbon sequestration	Smith et al., 2008; Smith, 2016	Batjes, 1998; Metting et al., 2001; Lal, 2003a, b, 2004a, c, 2010, 2011, 2013; Lal et al., 2007; Smith et al., 2008; Salati et al., 2010; Conant, 2011; Smith, 2012, 2016; Benbi, 2013; Lorenz and Lal, 2014; Powlson et al., 2014; Sommer and Bossio, 2014; Henderson et al., 2015; Lassaletta and Aguilera, 2015; Smith, 2016; Minasny et al., 2017; Zomer et al., 2017

Direct air carbon dioxide capture and storage (DACCS)	Zeman, 2003, 2014; Keith et al., 2006; Nikulshina et al., 2006; Stolaroff et al., 2008; Lackner, 2009; House et al., 2011; Simon et al., 2011; Socolow et al., 2011; Holmes and Keith, 2012; Kulkarni and Sholl, 2012; Mazzotti et al., 2013; W. Zhang et al., 2014; Geng et al., 2016; Sakwa-Novak et al., 2016; SEAB, 2016; Sinha et al., 2017; van der Giesen et al., 2017	
Enhanced weathering (EW)	Schuiling and Krijgsman, 2006; Hartmann and Kempe, 2008; Köhler et al., 2010; Renforth, 2012; Taylor et al., 2016; Strefler et al., 2018a	Hartmann and Kempe, 2008; Köhler et al., 2010, 2013; Renforth et al., 2011; Hauck et al., 2016; Taylor et al., 2016; Strefler et al., 2018a
Ocean alkalinization (OA)	Rau and Caldeira, 1999; Rau et al., 2007; Harvey, 2008; Rau, 2008; Paquay and Zeebe, 2013; Renforth et al., 2013; Renforth and Kruger, 2013; Renforth and Henderson, 2017	Harvey, 2008; Paquay and Zeebe, 2013; González and Ilyina, 2016
Reviews	Lenton, 2010, 2014; McGlashan et al., 2012; McLaren, 2012; Caldecott et al., 2015; NRC, 2015; UNEP, 2017b	

4.SM.4 Guidance and Assessment for Feasibility Assessment

4.SM.4.1 Guidance for Feasibility Assessment in Section 4.5.1

Table 4.SM.4: Guidance for conducting the feasibility assessment of mitigation and adaptation options. See 4.SM.4.2 for the assessment and literature basis of the assessment of mitigation options and 4.SM.4.3 for the assessment and literature basis of adaptation options.

<table>
<tr><th>Entry for Indicator-Option Combination</th><th colspan="2">Guidance for Conducting the Feasibility Assessment of Mitigation and Adaptation Options</th></tr>
<tr><td>NA (not applicable)</td><td colspan="2">The indicator is not relevant to the option</td></tr>
<tr><td>NE (no evidence)</td><td colspan="2">• No peer-reviewed literature could be located supporting an assessment of whether this indicator would limit the option’s feasibility
• The peer-reviewed literature that mentions the issue is not robust enough</td></tr>
<tr><td>LE (limited evidence)</td><td colspan="2">• One or two papers make statements/present research that could be a basis for the assessment, but this evidence is considered too limited
• Two or more papers provide a basis for the assessment as a side issue in the paper, not as a core issue</td></tr>
<tr><td>A</td><td rowspan="3">A feasibility assessment can be made:

• If there are one or two robust papers (or more) that contain references which also support the assessment
• If literature is plentiful
• If one or a number of meta-studies and reviews provide extensive treatment of the indicator-option combination</td><td>A = The indicator could block the feasibility of this option</td></tr>
<tr><td>B</td><td>B = The indicator does not have a positive nor a negative effect on the feasibility of the option</td></tr>
<tr><td>C</td><td>C = The indicator does not pose any barrier to the feasibility of this option</td></tr>
</table>

Table 4.SM.5: Parameters used for the calculation of the overall feasibility of the dimension-option combinations.

$\#indicators$	Number of indicators used to assess the overall feasibility of a dimension, typically two to five
$\#NA$	Number of indicators that are not applicable (NA) to the option
$\#NE\&LE$	Total number of indicators for which there is no evidence (NE) or limited evidence (LE)
$\#A$	Number of indicators assessed as A
$\#B$	Number of indicators assessed as B
$\#C$	Number of indicators assessed as C

$\#effective\ indicators$	$\#effective\ indicators = \#indicators - \#NA$
AVG	*(1*#A +2*#B+3*#C)/(#effective indicators - #NE&LE)*

Table 4.SM.6: Legend criteria for the overall feasibility of the dimension-option combinations as shown in Table 4.11 for mitigation options and Table 4.12 for adaptation options.

Legend of Table 4.11 and Table 4.12	**Legend Criteria for the Overall Feasibility of each of the Dimension-Option Combinations**
NA	$\#indicators = \#NA$
	$\#NE\&LE > 0.5 * \#effective\ indicators$
	$AVG \leq 1.5$ $\#NE\&LE \leq 0.5 * \#effective\ indicators$
	$1.5 < AVG \leq 2.5$ $\#NE\&LE \leq 0.5 * \#effective\ indicators$
	$AVG > 2.5$ $\#NE\&LE \leq 0.5 * \#effective\ indicators$

4.SM.4.2 Feasibility Assessment of Mitigation Options as Presented in Section 4.5.2

4.SM.4.2.1 Feasibility Assessment of Mitigation Options in Energy System Transitions

Table 4.SM.7: Feasibility assessment of energy system transition mitigation options: wind (on-shore and off-shore), solar photovoltaic (PV), and bioenergy. For methodology, see 4.SM.4.1.

		Wind (On-shore and Off-shore)		**Solar PV**		**Bioenergy**	
	Evidence	Robust		Robust		Robust	
	Agreement	Medium		High		Medium	
Economic	Cost-effectiveness		IRENA, 2015, 2016; Shafiee et al., 2016; Silva Herran et al., 2016; Voormolen et al., 2016; WEC, 2016		Cengiz and Mamiş, 2015; IRENA, 2015, 2016; Climate Council, 2017a		Brown, 2015; Creutzig et al., 2015; Patel et al., 2016
	Absence of distributional effects		Corfee-Morlot et al., 2012; Greene and Geisken, 2013		Corfee-Morlot et al., 2012; Toovey and Malin, 2016		Agoramoorthy et al., 2009; Ewing and Msangi, 2009; Arndt et al., 2011a; Schoneveld et al., 2011; German and Schoneveld, 2012; Creutzig et al., 2013; Hunsberger et al., 2014; Popp et al., 2014; Persson, 2015; Buck, 2016; Kline et al., 2017; Robledo-Abad et al., 2017; Stevanović et al., 2017
	Employment and productivity enhancement potential		Clean Energy Council, 2012; Climate Council, 2016; IEA, 2017; IRENA, 2017		Climate Council, 2016, 2017b; IEA, 2017d; IRENA, 2017b		Parcell and Westhoff, 2006; Gohin, 2008; Wicke et al., 2009; Arndt et al., 2011a; Rathmann et al., 2012; Silalertruksa et al., 2012; Augusto Horta Nogueira and Silva Capaz, 2013; Ribeiro, 2013
Technological	Technical scalability		Al-Maghalseh and Maharmeh, 2016; Silva Herran et al., 2016; IRENA, 2017a, b		IRENA, 2017a		Soccol et al., 2009; Fiorese et al., 2014; Vimmerstedt et al., 2015; Humpenöder et al., 2017

	Maturity		IRENA, 2017a; UNEP, 2017a		Despotou, 2012		Soccol et al., 2009; Corsatea, 2014; Fiorese et al., 2014; Creutzig et al., 2015; Strzalka et al., 2017
	Simplicity		IRENA, 2016		IRENA, 2016		Demirbas and Demirbas, 2007; Surendra et al., 2014
	Absence of risk		UNEP, 2017a		Bahill and Chaves, 2013; UNEP 2017a		Carbon neutrality debate (Buchholz et al., 2016; Liu et al., 2018)
Institutional	Political acceptability		Borch et al., 2014; Baker, 2015; Furtado and Perrot, 2015; Kar and Sharma, 2015; WEC, 2016; Bistline, 2017; UNEP, 2017a		Baker, 2015; UNEP, 2017a; Shukla et al., 2018		Longstaff et al., 2015; Favretto et al., 2017; Goetz et al., 2017 (Timilsina et al., 2012; Broch et al., 2013; Montefrio and Sonnenfeld, 2013; Stattman et al., 2013; Aha and Ayitey, 2017)
	Legal and administrative acceptability		Kar and Sharma, 2015; Bistline, 2017; Comello et al., 2017; UNEP, 2017a		Shrimali and Rohra, 2012; Comello et al., 2017; UNEP, 2017a; Shukla et al., 2018		Gamborg et al., 2014; Amos, 2016; Naiki, 2016
	Institutional capacity		Corfee-Morlot et al., 2012; Kar and Sharma, 2015; Goodale and Milman, 2016; Bistline, 2017; Comello et al., 2017; UNEP, 2017a		Corfee-Morlot et al., 2012; Shrimali and Rohra, 2012; Comello et al., 2017; UNEP, 2017a; Shukla et al., 2018	LE	Gamborg et al., 2014; Favretto et al., 2017
	Transparency and accountability potential		Eberhard et al., 2014; Furtado and Perrot, 2015; Swilling et al., 2016; Bistline, 2017; UNEP, 2017a		Eberhard et al., 2014; Swilling et al., 2016; UNEP, 2017a		Plevin et al., 2010; Schulze et al., 2012; Zanchi et al., 2012; Pyörälä et al., 2014; Buchholz et al., 2014; Repo et al., 2015; Röder et al., 2015; Creutzig et al., 2015; Hammar et al., 2015; Harris et al., 2015; Qin et al., 2016; Röder and Thornley, 2016; Torssonen et al., 2016; DeCicco et al., 2016; Baul et al., 2017; Robledo-Abad et al., 2017; Daioglou et al., 2017; Kilpeläinen et al., 2017; Booth, 2018; Sterman et al., 2018

Socio-cultural	Social co-benefits (health, education)		Silva Herran et al., 2016; Geels et al., 2017; IEA, 2017d; UNEP, 2017a, b		Geels et al., 2017; IEA, 2017d; UNEP, 2017a, b		Kar et al., 2012; Anenberg et al., 2013; Knoblauch et al., 2014; Porter et al., 2015; Weldu et al., 2017
	Public acceptance		Kondili and Kaldellis, 2012; Borch et al., 2014; Heidenreich, 2015; Geraint and Gianluca, 2016; Brennan et al., 2017; Geels et al., 2017; IEA, 2017d; Sütterlin and Siegrist, 2017; UNEP, 2017a, b		Brennan et al., 2017; Geels et al., 2017; IEA, 2017d; Sütterlin and Siegrist, 2017; UNEP, 2017a, b		Khanal et al., 2010; Delshad and Raymond, 2013; Dragojlovic and Einsiedel, 2015; Fytili and Zabaniotou, 2017; Goetz et al., 2017; Moula et al., 2017
	Social and regional inclusiveness		Geels et al., 2017; IEA 2017d; UNEP,. 2017a, b		Geels et al., 2017; IEA 2017d; UNEP, 2017a, b		Creutzig et al., 2013, 2015; Favretto et al., 2017; Robledo-Abad et al., 2017
	Intergenerational equity		Geels et al., 2017; IEA, 2017d; UNEP, 2017a, b		Geels et al., 2017; IEA 2017d; UNEP, 2017a, b	NE	
	Human capabilities		Bistline, 2017; Geels et al., 2017; IEA, 2017d; UNEP, 2017a, b		Shrimali and Rohra, 2012; Geels et al., 2017; IEA, 2017d; UNEP, 2017a, b; Shukla et al., 2018	NE	
Environmental/ecological	Reduction of air pollution		Clean Energy Council, 2012; Kondili and Kaldellis, 2012; UNEP, 2017a, b		UNEP, 2017a, b	LE	Kar et al., 2012; Anenberg et al., 2013; Knoblauch et al., 2014; Porter et al., 2015; Weldu et al., 2017
	Reduction of toxic waste		UNEP, 2017a, b		UNEP, 2017a, b	NE	
	Reduction of water use		UNEP, 2017a, b; Kondili & Kaldellis 2012		UNEP, 2017a, b		Gerbens-Leenes et al., 2009; Gheewala et al., 2011; Smith and Torn, 2013; Bonsch et al., 2016; Lampert et al., 2016; Mouratiadou et al., 2016; Smith et al., 2016; Wei et al., 2016; Mathioudakis et al., 2017
	Improved biodiversity		UNEP, 2017a, b		UNEP, 2017a, b		Immerzeel et al., 2014; Dale et al., 2015; Holland et al., 2015; Kline et al., 2015; Santangeli et al., 2016; Tarr et al., 2017

Geophysical	Physical feasibility (physical potentials)		Al-Maghalseh & Maharmeh, 2016; UNEP, 2017a, b		UNEP, 2017a, b		Beringer et al., 2011; Klein et al., 2014; Slade et al., 2014; Creutzig et al., 2015; Kraxner and Nordström, 2015; Searle and Malins, 2015; Smith et al., 2016; Boysen et al., 2017b; Tokimatsu et al., 2017; Heck et al., 2018
	Limited use of land		Silva Herran et al., 2016; Mohan, 2017; UNEP, 2017a, b		Mohan, 2017; UNEP, 2017a, b		Popp et al., 2014; Creutzig et al., 2015; Bonsch et al., 2016; Hammond and Li, 2016; Williamson, 2016; Robledo-Abad et al., 2017
	Limited use of scarce (geo)physical resources		UNEP, 2017a, b		UNEP, 2017a, b	NA	
	Global spread		UNEP, 2017a, b		UNEP, 2017a, b		Deng et al., 2015; Daioglou et al., 2017; Robledo-Abad et al., 2017

Table 4.SM.8: Feasibility assessment of energy system transition mitigation options: electricity storage, power sector carbon capture and storage (CCS) and nuclear energy. For methodology, see 4.SM.4.1.

		Electricity Storage		**Power Sector CCS**		**Nuclear Energy**	
	Evidence	Robust		Robust		Robust	
	Agreement	Medium		High		High	
Economic	Cost-effectiveness		ACOLA, 2017; IRENA, 2015; Schmidt et al., 2017; Quann, 2017		Studies indicate that CCS in the power sector is somewhere in the middle range of mitigation options. It is a significant additional cost but the scale is usually large, so much carbon dioxide is reduced (Rubin et al., 2015; Global CCS Institute, 2017; IEA, 2017a; Castrejón et al., 2018)		Finon and Roques, 2013; Bruckner et al., 2014; Lovering et al., 2016; Koomey et al., 2017
	Absence of distributional effects		Corfee-Morlot et al., 2012; ACOLA, 2017	NE		NE	
	Employment and productivity enhancement potential		ACOLA, 2017; Climate Council, 2017a; IEA, 2017d; IRENA, 2017b		Higher than coal/gas without CCS, on par with wind, geothermal and nuclear (Wei et al., 2010; Koelbl et al., 2016; IEA, 2017a)		Kenley et al., 2009; Wei et al., 2010
Technological	Technical scalability		ACOLA, 2017; IRENA, 2017a		IPCC, 2005; de Coninck and Benson, 2014; Aminu et al., 2017		Bruckner et al., 2014; IAEA, 2018 (for current-generation plants)
	Maturity		ACOLA, 2017; IRENA, 2017a		Zheng and Xu, 2014; Abanades et al., 2015; Bui et al., 2018; Qiu and Yang, 2018		Bruckner et al., 2014
	Simplicity		IRENA, 2016; ACOLA, 2017	LE	Wei et al., 2010; IEA GHG, 2012		Esteban and Portugal-Pereira, 2014
	Absence of risk		ACOLA, 2017; UNEP, 2017a		IPCC, 2005; Boot-Handford et al., 2014; de Coninck and Benson, 2014; Aminu et al., 2017		Hirschberg et al., 2016; Rose and Sweeting, 2016; Wheatley et al., 2016

Institutional	Political acceptability		ACOLA, 2017; Nguyen et al., 2017; UNEP, 2017a		de Coninck and Benson, 2014; Boot-Handford et al., 2014; Aminu et al., 2017		Bruckner et al., 2014; IAEA, 2017
	Legal and administrative acceptability		ACOLA, 2017; Nguyen et al., 2017; UNEP, 2017a		Boot-Handford et al., 2014; de Coninck and Benson, 2014; Dixon et al., 2015	NE	
	Institutional capacity		Corfee-Morlot et al., 2012; ACOLA, 2017; IEA, 2017a; Nguyen et al., 2017; UNEP, 2017a	LE	Ashworth et al., 2015		Tosa, 2015; Vivoda and Graetz, 2015; Figueroa, 2016; Juraku, 2016; Taebi and Mayer, 2017;
	Transparency and accountability potential		ACOLA, 2017; Nguyen et al., 2017; UNEP, 2017a	NE			Figueroa, 2016
Socio-cultural	Social co-benefits (health, education)		ACOLA, 2017; Geels et al., 2017; IEA, 2017c; UNEP, 2017a, b	NE			WHO, 2011; Endo et al., 2012; Nagataki et al., 2013; Bruckner et al., 2014; Ishikawa, 2014; Nakayachi et al., 2015; Beresford et al., 2016; Fridman et al., 2016; Hirschberg et al., 2016; Oe et al., 2016; Suzuki et al., 2016; Kawaguchi and Yukutake, 2017
	Public acceptance		ACOLA, 2017; Climate Council, 2017a; Geels et al., 2017; IEA, 2017c; UNEP, 2017a, b		Seigo et al., 2014; Ashworth et al., 2015; Aminu et al., 2017		Bruckner et al., 2014; Kim et al., 2014; Diaz-Maurin and Kovacic, 2015; Murakami et al., 2015; Nishikawa et al., 2016; Tsujikawa et al., 2016; Huhtala and Remes, 2017; IAEA, 2017; Wu, 2017; Ho et al., 2018
	Social and regional inclusiveness		ACOLA, 2017; Geels et al., 2017; IEA, 2017d; UNEP, 2017a, b	NA		NE	
	Intergenerational equity		ACOLA, 2017; Geels et al., 2017; IEA, 2017c; UNEP, 2017a, b		Alcalde et al., 2018		Bruckner et al., 2014
	Human capabilities		ACOLA, 2017; Geels et al., 2017; IEA, 2017d; Newman et al., 2017; UNEP, 2017a, b		Shackley et al., 2009; IEA GHG, 2012	NE	
Environmental/ec	Reduction of air pollution		ACOLA, 2017; UNEP, 2017a, b		Koornneef et al., 2008; Odeh and Cockerill, 2008; Pehnt and Henkel,		Cheng and Hammond, 2017

					2009; Korre et al., 2010; Nie et al., 2011; Modahl et al., 2012; Corsten et al., 2013; Cuéllar-Franca and Azapagic, 2015; Gibon et al., 2017		
	Reduction of toxic waste		ACOLA, 2017; UNEP, 2017a, b		Koornneef et al., 2008; Odeh and Cockerill, 2008; Pehnt and Henkel, 2009; Korre et al., 2010; Nie et al., 2011; Modahl et al., 2012; Corsten et al., 2013; Cuéllar-Franca and Azapagic, 2015; Gibon et al., 2017		Bruckner et al., 2014
	Reduction of water use		ACOLA, 2017; UNEP, 2017a, b		Koornneef et al., 2008, 2012a; Odeh and Cockerill, 2008; Pehnt and Henkel, 2009; Korre et al., 2010; Nie et al., 2011; Modahl et al., 2012; Corsten et al., 2013; Cooney et al., 2015; Cuéllar-Franca and Azapagic, 2015; Gibon et al., 2017		Bailly du Bois et al., 2012; Kato et al., 2012; Sakaguchi et al., 2012; Tsumune et al., 2012; Ueda et al., 2013; Bruckner et al., 2014
	Improved biodiversity	NA			Koornneef et al., 2008, 2012a; Odeh and Cockerill, 2008; Pehnt and Henkel, 2009; Korre et al., 2010; Nie et al., 2011; Modahl et al., 2012; Corsten et al., 2013; Cuéllar-Franca and Azapagic, 2015; Gibon et al., 2017		Cheng and Hammond, 2017
Geophysical	Physical feasibility (physical potentials)		ACOLA, 2017; UNEP, 2017a, b		IPCC, 2005; de Coninck and Benson, 2014; Scott et al., 2015		Bruckner et al., 2014
	Limited use of land		ACOLA, 2017; UNEP, 2017a, b		Non-controversial so not investigated		Cheng and Hammond, 2017
	Limited use of scarce (geo)physical resources		ACOLA, 2017; Newman et al., 2017; UNEP, 2017a, b		IPCC, 2005; de Coninck and Benson, 2014; Scott et al., 2015 On storage capacity, otherwise no issues		Bruckner et al., 2014; NEA, 2016
	Global spread		ACOLA, 2017; UNEP, 2017a, b		IPCC, 2005; de Coninck and Benson, 2014		IAEA, 2017

4.SM.4.2.2 Feasibility Assessment of Mitigation Options in Land and Ecosystem Transitions

Table 4.SM.9: Feasibility assessment of the land and ecosystem transition mitigation options: reduced food wastage and efficient food production, dietary shifts, sustainable intensification of agriculture and ecosystems restoration. For methodology, see 4.SM.4.1.

		Reduced Food Wastage and Efficient Food Production		**Dietary Shifts**		**Sustainable Intensification of Agriculture**		**Ecosystems Restoration**	
	Evidence	Robust		Medium		Medium		Medium	
	Agreement	High		High		High		High	
Economic	Cost-effectiveness		FAO, 2013a; Thyberg and Tonjes, 2016; Hebrok and Boks, 2017	LE	FAO, 2013b	LE	Havlik et al., 2014		Kindermann et al., 2008; Dang Phan et al., 2014; Overmars et al., 2014; Griscom et al., 2017; Ickowitz et al., 2017; Phan et al., 2017; Rakatama et al., 2017
	Absence of distributional effects		Porpino et al., 2015; Thyberg and Tonjes, 2016; Alexander et al., 2017; Hebrok and Boks, 2017	LE	Żukiewicz-Sobczak et al., 2014	LE	A. Smith et al., 2017		Caplow et al., 2011; German and Schoneveld, 2012; Atela et al., 2014; Sunderlin et al., 2014; Howson and Kindon, 2015; Erb et al., 2016; Poudyal et al., 2016
	Employment and productivity enhancement potential		Shepon et al., 2016; Thyberg and Tonjes, 2016; Alexander et al., 2017; Popp et al., 2017		Haggblade et al., 2015; Tschirley et al., 2015; Berti and Mulligan, 2016; Blay-Palmer et al., 2016; Shepon et al., 2016; Alexander et al., 2017; Clark and Tilman, 2017		Foley et al., 2011; Harvey et al., 2014; Clark and Tilman, 2017; Griscom et al., 2017		Brander et al., 2013; Neimark et al., 2016; Fenger et al., 2017; Jena et al., 2017, but are not uncontested (Blackman and Rivera, 2011; Hidayat et al., 2015; Oya et al., 2017)
Technological	Technical scalability		Högy et al., 2009; DaMatta et al., 2010; Lin et al., 2013; Challinor et al., 2014; Papargyropoulou et al.,		Hallström et al., 2015; Alexander et al., 2017; Clark and Tilman, 2017		Harvey et al., 2014; Pretty and Bharucha, 2014; Petersen and Snapp, 2015; Clark and Tilman, 2017; Griscom		P. Smith et al., 2014, Table 11.22; Houghton et al., 2015; Griscom et al., 2017; Houghton and Nassikas, 2018

			2014; De Souza et al., 2015; Hebrok and Boks, 2017				et al., 2017; Waldron et al., 2017; P. Adhikari et al., 2018; Ramankutty et al., 2018		
	Maturity	NE		NE		LE	Pretty and Bharucha, 2014; Petersen and Snapp, 2015		McLaren, 2012; P. Smith et al., 2012; Goetz et al., 2015
	Simplicity	NE		NE		NE			(P. Smith et al., 2014; Erb et al., 2017; Griscom et al., 2017)
	Absence of risk		Lin et al., 2013; Papargyropoulou et al., 2014; Hebrok and Boks, 2017		Hallström et al., 2015; Alexander et al., 2017; Clark and Tilman, 2017; Röös et al., 2017		Harvey et al., 2014; Clark and Tilman, 2017; Griscom et al., 2017; Waldron et al., 2017; P. Adhikari et al., 2018; Ramankutty et al., 2018; Sparovek et al., 2018		P. Smith et al., 2014 Table 11.9 *No major breakthroughs since AR5
Institutional	Political acceptability		Refsgaard and Magnussen, 2009; Lin et al., 2013; Thornton and Herrero, 2014; L. Jones et al., 2016; Thyberg and Tonjes, 2016; Singh et al., 2017; C.J. White et al., 2017	NE			Smith and Gregory, 2013; Godfray and Garnett, 2014; Harvey et al., 2014; Sparovek et al., 2018		Cronin et al., 2016; Di Gregorio et al., 2017; Nantongo, 2017
	Legal and administrative acceptability	NE		NE			Smith and Gregory, 2013; Harvey et al., 2014		Sunderlin et al., 2014
	Institutional capacity		Refsgaard and Magnussen, 2009; Thornton and Herrero, 2014; Briley et al., 2015; L. Jones et al., 2016; Thyberg and Tonjes, 2016; Singh et al., 2017; C.J. White et al., 2017	NE			Smith and Gregory, 2013; Harvey et al., 2014; Lu et al., 2015; Petersen and Snapp, 2015; Mungai et al., 2016; P. Adhikari et al., 2018; Sparovek et al., 2018		Unruh, 2011; Marion Suiseeya and Caplow, 2013; Wylie et al., 2016

	Transparency and accountability potential		Briley et al., 2015; L. Jones et al., 2016; Thyberg and Tonjes, 2016; Singh et al., 2017; C.J. White et al., 2017	NE		NE			Strassburg et al., 2014; Neimark et al., 2016
Socio-cultural	Social co-benefits (health, education)		Lin et al., 2013; Tilman and Clark, 2014; Wellesley et al., 2015; Thyberg and Tonjes, 2016; Hebrok and Boks, 2017; Popp et al., 2017		Alexander et al., 2016, 2017; Stoll-Kleemann and Schmidt, 2017; Ritchie et al., 2018		Pretty et al., 2011; Jones et al., 2012; Smith and Gregory, 2013; Harvey et al., 2014; Falconnier et al., 2018; Ramankutty et al., 2018; Sparovek et al., 2018		Caplow et al., 2011; Spencer et al., 2017
	Public acceptance		Lin et al., 2013; Popp et al., 2017		Alexander et al., 2016, 2017; Stoll-Kleemann and Schmidt, 2017		Smith and Gregory, 2013; Godfray and Garnett, 2014; Harvey et al., 2014; P. Adhikari et al., 2018; Ramankutty et al., 2018; Sparovek et al., 2018		Lin et al., 2012; Kragt et al., 2016; Scholte et al., 2016; Thompson et al., 2016; Braun et al., 2017
	Social and regional inclusiveness		Lin et al., 2013; Tilman and Clark, 2014; Hebrok and Boks, 2017; Popp et al., 2017		Khoury et al., 2014; Tilman and Clark, 2014; Alexander et al., 2016, 2017; Stoll-Kleemann and Schmidt, 2017; Ritchie et al., 2018		Pretty et al., 2011; Smith and Gregory, 2013; Franke et al., 2014; Harvey et al., 2014; Pretty and Bharucha, 2014; Petersen and Snapp, 2015; Struik and Kuyper, 2017; Ramankutty et al., 2018; Sparovek et al., 2018		Ribot and Larson, 2012; Jagger et al., 2014; Lyons and Westoby, 2014; Brimont et al., 2015; Howson and Kindon, 2015
	Intergenerational equity	NE		LE	Bajželj et al., 2014	NE			Pascuala et al., 2010; Unruh, 2011 *No major breakthroughs since AR5
	Human capabilities		Tilman and Clark, 2014; Thyberg and Tonjes, 2016; Hebrok and Boks, 2017		Tilman and Clark, 2014; Ritchie et al., 2018	LE	Baltenweck et al., 2003; Pretty and Bharucha, 2014; Mungai et al., 2016	LE	P. Smith et al., 2014 Table 11.5 *No major breakthroughs since AR5

Environmental/ ecological	Reduction of air pollution	LE	Thyberg and Tonjes, 2016		Tilman and Clark, 2014; Hallström et al., 2015; Ritchie et al., 2018	NE		NE	
	Reduction of toxic waste	NE		NE			Stevens and Quinton, 2009; Tilman et al., 2011a; Pretty and Bharucha, 2014; Soussana and Lemaire, 2014; Lu et al., 2015; Ramankutty et al., 2018	NE	
	Reduction of water use		Bajželj et al., 2014; West et al., 2014; Westhoek et al., 2014; Thyberg and Tonjes, 2016		Bajželj et al., 2014; West et al., 2014; Westhoek et al., 2014	LE	Pretty and Bharucha, 2014		Brander et al., 2013; Devaraju et al., 2015; van Noordwijk et al., 2016; Ellison et al., 2017
	Improved biodiversity		J.A. Johnson et al., 2014; Ramankutty et al., 2018		Tilman and Clark, 2014; Hallström et al., 2015; Clark and Tilman, 2017; Ramankutty et al., 2018		Pretty and Bharucha, 2014; Waldron et al., 2017		Rey Benayas et al., 2009; Bullock et al., 2011; Jantz et al., 2014; Veldman et al., 2015; Jantke et al., 2016; Kaiser-Bunbury et al., 2017
Geophysical	Physical feasibility (physical potentials)		Cherubin et al., 2015; Ivy et al., 2017	NE		NE			Canadell and Schulze, 2014; Houghton et al., 2015; Erb et al., 2016, 2017; Griscom et al., 2017; Houghton and Nassikas, 2018 REDD+ (Canadell and Raupach, 2008; Strassburg et al., 2014)
	Limited use of land		Thyberg and Tonjes, 2016; Ramankutty et al., 2018; Sparovek et al., 2018	LE	Shepon et al., 2016; Benton et al., 2018; Ramankutty et al., 2018		Harvey et al., 2014; Clark and Tilman, 2017		Strassburg et al., 2014; Humpenöder et al., 2015; Erb et al., 2016; Kreidenweis et al., 2016
	Limited use of scarce (geo)physical resources	NE		NE			Foley et al., 2011	NE	
	Global spread	LE	Thyberg and Tonjes, 2016	NE		LE	Tilman et al., 2011b; Havlik et al., 2014;		(Strassburg et al., 2014; Erb et al., 2017)

							Petersen and Snapp, 2015; Mungai et al., 2016		

4.SM.4.2.3 Feasibility Assessment of Mitigation Options in Urban and Infrastructure System Transitions

Table 4.SM.10: Feasibility assessment of urban and infrastructure system transition mitigation options: land use and urban planning; electric cars and buses; and sharing schemes. For methodology, see 4.SM.4.1.

		Land Use and Urban Planning		**Electric Cars and Buses**		**Sharing Schemes**	
	Evidence	Robust		Medium		Limited	
	Agreement	Medium		High		Medium	
Economic	Cost-effectiveness		Trubka et al., 2010; Nahlika and Chester, 2014; Ahlfeldt and Pietrostefani, 2017; Lee and Erickson, 2017; Sharma, 2018		Peterson and Michalek, 2013; IEA, 2017b		Ambrosino et al., 2016; Cheyne and Imran, 2016; Kent and Dowling, 2016
	Absence of distributional effects		Colenbrander et al., 2015; Lwasa, 2017; Broekhoff et al., 2018; Teferi and Newman, 2018; Wiktorowicz et al., 2018		Glazebrook and Newman, 2018; Sivak and Schoettle, 2018		Gomez et al., 2015; Ambrosino et al., 2016; Kent and Dowling, 2016
	Employment and productivity enhancement potential		Ambrosino et al., 2016; Ahlfeldt and Pietrostefani, 2017; Broto, 2017; Gao and Newman, 2018; Han et al., 2018		Whitelegg, 2016; IEA, 2017b		Sweet, 2014; Cheyne and Imran, 2016
Technological	Technical scalability		Broekhoff et al., 2018; Sharma, 2018; R. Zhang et al., 2018		Brown et al., 2010; IEA, 2017b		Broch et al., 2013; Ambrosino et al., 2016; Kent and Dowling, 2016; Reis et al., 2016
	Maturity		Parnell, 2015; Newman et al., 2017		Whitelegg, 2016; IEA, 2017b		Le Vine et al., 2014; Kent and Dowling, 2016
	Simplicity		Lilford et al., 2017; Newman et al., 2017		IEA, 2017b; Glazebrook and Newman, 2018		Ambrosino et al., 2016; Giuliano and Hanson, 2017
	Absence of risk	LE	Newman et al., 2017		Whitelegg, 2016; IEA, 2017b		Ambrosino et al., 2016; Kent and Dowling, 2016
Institutional	Political acceptability		Broekhoff et al., 2018; Grandin et al., 2018		Bakker and Trip, 2013; IEA, 2017b		Le Vine et al., 2014; Ambrosino et al., 2016
	Legal and administrative acceptability		Broekhoff et al., 2018; Grandin et al., 2018		Wirasingha et al., 2008; IEA, 2017b		Cannon and Summers, 2014; Le Vine et al., 2014

	Institutional capacity		Geneletti et al., 2017; Chau et al., 2018		Wirasingha et al., 2008; IEA, 2017b		Kent and Dowling, 2016; Glazebrook and Newman, 2018
	Transparency and accountability potential		Moglia et al., 2018		Wirasingha et al., 2008; IEA, 2017b		Newman et al., 2017; Glazebrook and Newman, 2018
Socio-cultural	Social co-benefits (health, education)		Nahlika and Chester, 2014; Jillella et al., 2015; Chava and Newman, 2016; Su et al., 2016; Chava et al., 2018a, b		IEA, 2017b; Newman et al., 2017		de Groot and Steg, 2007; Rojas-Rueda et al., 2012; Cheyne and Imran, 2016; Kent and Dowling, 2016
	Public acceptance		Jillella et al., 2015; Chava and Newman, 2016; Chava et al., 2018a, b; Moglia et al., 2018		Zhang et al., 2011; Bockarjova and Steg, 2014; Liao et al., 2017		de Groot and Steg, 2007; Le Vine et al., 2014; Ambrosino et al., 2016; Kent and Dowling, 2016; Reis et al., 2016
	Social and regional inclusiveness		Jillella et al., 2015; Chava and Newman, 2016; Colenbrander et al., 2017; Endo et al., 2017; Lwasa, 2017; Broekhoff et al., 2018; Chava et al., 2018a, b; Teferi and Newman, 2018	LE	Newman et al., 2017		Cheyne and Imran, 2016; Kent and Dowling, 2016
	Intergenerational equity	LE	Newman et al., 2017		Newman et al., 2017; Kenworthy and Schiller, 2018		Le Vine et al., 2014; Cheyne and Imran, 2016; Glazebrook and Newman, 2018
	Human capabilities		Moglia et al., 2018		Wirasingha et al., 2008; Newman et al., 2017		Reis et al., 2016; Newman et al., 2017
Environmental/ecological	Reduction of air pollution		Zubelzu et al., 2015; Glazebrook and Newman, 2018; Sharma, 2018; Thomson and Newman, 2018; R. Zang et al., 2018		Sioshansi and Denholm, 2009; Kenworthy and Schiller, 2018		Le Vine et al., 2014; Newman and Kenworthy, 2015; Nijland and van Meerkerk, 2017; Glazebrook and Newman, 2018
	Reduction of toxic waste	LE	Thomson and Newman, 2018	LE	Hawkins et al., 2013		Newman and Kenworthy, 2015; Newman et al., 2017; Glazebrook and Newman, 2018
	Reduction of water use		Serrao-Neumann et al., 2017	LE	Glazebrook and Newman, 2018		Stephan and Crawford, 2016; Newman et al., 2017
	Improved biodiversity		Huang et al., 2018	LE	Glazebrook and Newman, 2018		Newman and Kenworthy, 2015; Newman et al., 2017; Glazebrook and Newman, 2018

Geophysical	Physical feasibility (physical potentials)		Hsieh et al., 2017; Wiktorowicz et al., 2018		Glazebrook and Newman, 2018; Kenworthy and Schiller, 2018		Kent and Dowling, 2016; Newman et al., 2017
	Limited use of land		Hsieh et al., 2017		Glazebrook and Newman, 2018; Kenworthy and Schiller, 2018		Kent and Dowling, 2016; Newman et al., 2017; Hamilton and Wichman, 2018
	Limited use of scarce (geo)physical resources	LE	Thomson and Newman, 2018		Newman et al., 2017; Kenworthy and Schiller, 2018		Newman and Kenworthy, 2015; Newman et al., 2017; Glazebrook and Newman, 2018
	Global spread		Pacheco-Torres et al., 2017; Glazebrook and Newman, 2018		Dhar et al., 2017, 2018; Newman et al., 2017		Le Vine et al., 2014; Kent and Dowling, 2016

Table 4.SM.11: Feasibility assessment of urban and infrastructure system transition mitigation options: public transport, non-motorised transport, and aviation and shipping. For methodology, see 4.SM.4.1.

		Public Transport		**Non-motorised Transport**		**Aviation and Shipping**	
	Evidence	Robust		Robust		Medium	
	Agreement	Medium		High		Medium	
Economic	Cost-effectiveness		Nahlika and Chester, 2014; Bouf and Faivre D'arcier, 2015; Lee and Erickson, 2017; Lin and Du, 2017; Glazebrook and Newman, 2018; Kenworthy and Schiller, 2018		Deenihan and Caulfield, 2014; Gössling and Choi, 2015; MacDonald Gibson et al., 2015; V. Brown et al., 2016; Matan and Newman, 2016; Rajé and Saffrey, 2016; Litman, 2017, 2018		Corbett et al., 2009; Dessens et al., 2014; Cames et al., 2015a, b
	Absence of distributional effects		Kenworthy and Schiller, 2018; Linovski et al., 2018; Yangka and Newman, 2018		Newman and Kenworthy, 2015; Matan and Newman, 2016; Jensen et al., 2017; Lohmann and Gasparini, 2017; Litman, 2018	LE	Cames et al., 2015a
	Employment and productivity enhancement potential		Hazledine et al., 2017; Gao and Newman, 2018; Kenworthy and Schiller, 2018		Matan and Newman, 2016; Litman, 2017, 2018; Rohani and Lawrence, 2017		Cames et al., 2015a; Gencsü and Hino, 2015
Technological	Technical scalability		Kenworthy and Schiller, 2018; Yangka and Newman, 2018; R. Zhang et al., 2018		Newman and Kenworthy, 2015; Matan and Newman, 2016; Reis et al., 2016; Stevenson et al., 2016		Dessens et al., 2014; Gencsü and Hino, 2015
	Maturity		Newman et al., 2017; Kenworthy and Schiller, 2018		Newman et al., 2015, 2017; Matan and Newman, 2016; Stevenson et al., 2016; Jensen et al., 2017		Corbett et al., 2009; Cames et al., 2015b
	Simplicity		Newman et al., 2017; Kenworthy and Schiller, 2018		Matan and Newman, 2016; Rajé and Saffrey, 2016; Stevenson et al., 2016; Litman, 2017, 2018	LE	Dessens et al., 2014
	Absence of risk		Mohamed et al., 2017; Kenworthy and Schiller, 2018		Matan and Newman, 2016; Stevenson et al., 2016; Lohmann and Gasparini, 2017	LE	Dessens et al., 2014

Institutional	Political acceptability		Mohamed et al., 2017; Wijaya et al., 2017; Gao and Newman, 2018; Glazebrook and Newman, 2018; Kenworthy and Schiller, 2018; Sharma, 2018; Yangka and Newman, 2018		Newman and Kenworthy, 2015; Giles-Corti et al., 2016; Matan and Newman, 2016; Jensen et al., 2017; Litman, 2017, 2018; McCosker et al., 2018		Smale et al., 2012; Bows-Larkin, 2015; Sikorska, 2015; Shi, 2016; Zhang, 2016
	Legal and administrative acceptability		Kenworthy and Schiller, 2018; Yangka and Newman, 2018		Lohmann and Gasparini, 2017; Litman, 2018		Smale et al., 2012; Bows-Larkin, 2015; Sikorska, 2015; Shi, 2016; Zhang, 2016
	Institutional capacity		Newman et al., 2017; Kenworthy and Schiller, 2018; Sharma, 2018		Reis et al., 2016; Litman, 2018		Smale et al., 2012; Bows-Larkin, 2015; Sikorska, 2015; Shi, 2016; Zhang, 2016
	Transparency and accountability potential	LE	Bouf and Faivre D'arcier, 2015; Kenworthy and Schiller, 2018		Newman and Kenworthy, 2015; Matan and Newman, 2016; Lah, 2017		Smale et al., 2012; Bows-Larkin, 2015; Sikorska, 2015; Shi, 2016; Zhang, 2016
Socio-cultural	Social co-benefits (health, education)		Steg, 2003; Gatersleben and Uzzell, 2007; Nahlika and Chester, 2014; Lin and Du, 2017; Yangka and Newman, 2018		Woodcock et al., 2009; Maibach et al., 2009; Deenihan and Caulfield, 2014; Mansfield and Gibson, 2015; Matan et al., 2015; Gilderbloom et al., 2015; MacDonald Gibson et al., 2015; V. Brown et al., 2016; Matan and Newman, 2016; Rajé and Saffrey, 2016; Stevenson et al., 2016; Giles-Corti et al., 2016; Maizlish et al., 2017; Jensen et al., 2017; Lah, 2017; Lohmann and Gasparini, 2017; Litman, 2018	LE	EEA, 2017
	Public acceptance		Steg, 2003; Wijaya et al., 2017		Gatersleben and Uzzell, 2007; Matan and Newman, 2016; Jensen et al., 2017; Lohmann and Gasparini, 2017; Newman et al., 2017		Bows-Larkin, 2015; Sikorska, 2015; EEA, 2017

	Social and regional inclusiveness		Nahlika and Chester, 2014; Yangka and Newman, 2018		Gilderbloom et al., 2015; Stevenson et al., 2016; Jensen et al., 2017	LE	EEA, 2017
	Intergenerational equity		Newman et al., 2017; Kenworthy and Schiller, 2018; Yangka and Newman, 2018		Rajé and Saffrey, 2016; Litman, 2018	LE	Gencsü and Hino, 2015
	Human capabilities		Newman et al., 2017; Kenworthy and Schiller, 2018		Reis et al., 2016; Newman et al., 2017		Bows-Larkin, 2015; Sikorska, 2015; EEA, 2017b
Environmental/ecological	Reduction of air pollution		Glazebrook and Newman, 2018; Kenworthy and Schiller, 2018; Yangka and Newman, 2018; R. Zhang et al., 2018		Woodcock et al., 2009; Stevenson et al., 2016; Maizlish et al., 2017		Dessens et al., 2014; Cames et al., 2015a; Bouman et al., 2017; EEA, 2017
	Reduction of toxic waste	LE	Newman et al., 2017	LE	Newman et al., 2017		Maragkogianni et al., 2016; EEA, 2017
	Reduction of water use	LE	Newman et al., 2017	LE	Newman et al., 2017		Maragkogianni et al., 2016; EEA, 2017
	Improved biodiversity		Newman et al., 2017; Kenworthy and Schiller, 2018	LE	Newman et al., 2017		Maragkogianni et al., 2016; EEA, 2017
Geophysical	Physical feasibility (physical potentials)		Kenworthy and Schiller, 2018; Yangka and Newman, 2018		Panter et al., 2016; Lah, 2017		Bows-Larkin, 2015; Sikorska, 2015; EEA, 2017
	Limited use of land		Ahmad et al., 2016; Kenworthy and Schiller, 2018		McCormack and Shiell, 2011; Stevenson et al., 2016; Litman, 2017; Newman et al., 2017; Ye et al., 2018	LE	EEA, 2017
	Limited use of scarce (geo)physical resources		Lin and Du, 2017; Kenworthy and Schiller, 2018		Newman et al., 2017; Ye et al., 2018		de Jong et al., 2017; EEA, 2017
	Global spread		Bouf and Faivre D’arcier, 2015; Glazebrook and Newman, 2018; Kenworthy and Schiller, 2018		Stevenson et al., 2016; Litman, 2017; Lohmann and Gasparini, 2017		Maragkogianni et al., 2016; EEA, 2017

Table 4.SM.12: Feasibility assessment of urban and infrastructure system transition mitigation options: smart grids, efficient appliances and low/zero-energy buildings. For methodology, see 4.SM.4.1.

		Smart Grids		**Efficient Appliances**		**Low/Zero-energy Buildings**	
	Evidence	Medium		Medium		Medium	
	Agreement	Medium		High		High	
Economic	Cost-effectiveness		Crispim et al., 2014; Hall and Foxon, 2014; Marques et al., 2014; Muench et al., 2014; Foxon et al., 2015; Bigerna et al., 2016; Ramos et al., 2016; Schachter and Mancarella, 2016		McNeil and Bojda, 2012; Garg et al., 2017; Gerke et al., 2017		Neroutsou and Croxford, 2016; Balaban and Puppim de Oliveira, 2017; Ballarini et al., 2017; Stocker and Koch, 2017; Carlson and Pressnail, 2018
	Absence of distributional effects		Green and Newman, 2017; Neureiter, 2017; Wiktorowicz et al., 2018		Rao, 2013; Rao et al., 2016; McInnes, 2017; Rao and Ummel, 2017		Figus et al., 2017; McInnes, 2017
	Employment and productivity enhancement potential		Naus et al., 2014; Foxon et al., 2015; Shomali and Pinkse, 2016		Ryan and Campbell, 2012; Cambridge Econometrics, 2015; Garrett-Peltier, 2017; Hartwig et al., 2017		Scott et al., 2008; Ryan and Campbell, 2012; Urge-Vorsatz et al., 2012; Mirasgedis et al., 2014; Cambridge Econometrics, 2015; Hartwig et al., 2017; Krarti and Dubey, 2018
Technological	Technical scalability		Connor et al., 2014; Crispim et al., 2014; Zheng et al., 2014; Derakhshan et al., 2016; Ramos et al., 2016		Roland and Wood, 2009; Parikh and Parikh, 2016; Rao et al., 2016; Rao and Ummel, 2017; Salleh et al., 2018		Hartwig et al., 2017; Krarti et al., 2017
	Maturity		Abi Ghanem and Mander, 2014; Crispim et al., 2014; Zheng et al., 2014; Clerici et al., 2015; Derakhshan et al., 2016; Ramos et al., 2016; Otuoze et al., 2018		Zogg et al., 2009; Diczfalusy and Taylor, 2011; Rao et al., 2016; Rao and Ummel, 2017		Diczfalusy and Taylor, 2011; González et al., 2017; Jain et al., 2017b
	Simplicity		Abi Ghanem and Mander, 2014; Crispim et al., 2014; Giannantoni, 2014; Zheng et al., 2014; Clerici et al., 2015; Derakhshan et al., 2016;		Reyna and Chester, 2017	LE	Salvalai et al., 2017

			Ramos et al., 2016; Otuoze et al., 2018				
	Absence of risk		Crispim et al., 2014; Naus et al., 2014; Clerici et al., 2015; Bigerna et al., 2016; Ramos et al., 2016; Otuoze et al., 2018	NE		NE	
Institutional	Political acceptability		Crispim et al., 2014; Hall and Foxon, 2014; Marques et al., 2014; Naus et al., 2014; Bulkeley et al., 2016; Shomali and Pinkse, 2016; Vesnic-Alujevic et al., 2016; Meadowcroft et al., 2018		Pereira and da Silva, 2017; Ringel, 2017		Pereira and da Silva, 2017; Ringel, 2017
	Legal and administrative acceptability		Crispim et al., 2014; Marques et al., 2014; Foxon et al., 2015; Bigerna et al., 2016		Pereira and da Silva, 2017		Chandel et al., 2016; Jain et al., 2017a; Pereira and da Silva, 2017
	Institutional capacity		Crispim et al., 2014; Marques et al., 2014; Muench et al., 2014; Clerici et al., 2015; Foxon et al., 2015; Ramos et al., 2016; Meadowcroft et al., 2018; Otuoze et al., 2018		Shah et al., 2015; Pereira and da Silva, 2017		Pereira and da Silva, 2017; Yu et al., 2017
	Transparency and accountability potential		Hall and Foxon, 2014; Naus et al., 2014; Bigerna et al., 2016; Hansen and Hauge, 2017; Otuoze et al., 2018	LE	Gentile et al., 2015	LE	Meyers and Kromer, 2008
Socio-cultural	Social co-benefits (health, education)		Naus et al., 2014; Foxon et al., 2015; Shomali and Pinkse, 2016; Hansen and Hauge, 2017; Meadowcroft et al., 2018; Otuoze et al., 2018		Ryan and Campbell, 2012; Payne et al., 2015		Ryan and Campbell, 2012; Payne et al., 2015; Xiong et al., 2015; Balaban and Puppim de Oliveira, 2017
	Public acceptance		Hall and Foxon, 2014; Naus et al., 2014; Bigerna et al., 2016; Green and Newman, 2017; Hansen and Hauge, 2017		Winward et al., 1998; Boardman, 2004; Swim et al., 2014; Reyna and Chester, 2017; Jain et al., 2018	NE	
	Social and regional inclusiveness		Green and Newman, 2017; Neureiter, 2017; Wiktorowicz et al., 2018		Rao et al., 2016; Rao and Pachauri, 2017; Rao and Ummel, 2017	NE	
	Intergenerational equity		Schlör et al., 2015; Green and Newman, 2017	NA	Energy efficiency saves natural resources and therefore it is fair for future generations	NA	Energy efficiency saves natural resources and therefore it is fair for future generations

	Human capabilities		Naus et al., 2014; Hansen and Hauge, 2017	NA		NE	
Environmental/ecological	Reduction of air pollution		Clerici et al., 2015; Newman et al., 2017		Ryan and Campbell, 2012; Zhou et al., 2018		Ryan and Campbell, 2012; Xiong et al., 2015; Balaban and Puppim de Oliveira, 2017; Zhou et al., 2018
	Reduction of toxic waste		Foxon et al., 2015; Newman et al., 2017		Ryan and Campbell, 2012		Ryan and Campbell, 2012
	Reduction of water use		Newman et al., 2017; Wiktorowicz et al., 2018		Zhou et al., 2018		Loiola et al., 2018
	Improved biodiversity		Newman et al., 2017; Wiktorowicz et al., 2018	NA		NA	
Geophysical	Physical feasibility physical potentials)		Foxon et al., 2015; Green and Newman, 2017; Wiktorowicz et al., 2018		Laitner, 2013; Heidari et al., 2018		Laitner, 2013
	Limited use of land	NA		NA	Energy efficient appliances do not take up more land than inefficient appliances	NA	Existing buildings refurbishment do not use additional land New buildings use more land if not rebuilt over demolished buildings
	Limited use of scarce (geo)physical resources		Newman et al., 2017; Wiktorowicz et al., 2018	LE	Needhidasan et al., 2014 Possible that upgrades lead to landfill contamination	NA	Limited impact and limited use of scarce resources
	Global spread		Crispim et al., 2014; Foxon et al., 2015; Ramos et al., 2016	NA	Efficient appliances available everywhere where access to electricity or energy is available	NA	

4.SM.4.2.4 Feasibility Assessment of Mitigation Options in Industrial System Transitions

Table 4.SM.13: Feasibility assessment of industrial system transition mitigation options: energy efficiency; bio-based and circularity; electrification and hydrogen; and industrial carbon capture, utilization and storage (CCUS). For methodology, see 4.SM.4.1.

		Energy Efficiency		**Bio-based and Circularity**		**Electrification and Hydrogen**		**Industrial CCUS**	
	Evidence	Robust		Medium		Medium		Robust	
	Agreement	High		Medium		High		High	
Economic	Cost-effectiveness		Hasanbeigi et al., 2014; Napp et al., 2014; Forman et al., 2016; Wesseling et al., 2017		Taibi et al., 2012; Ali et al., 2017; Wesseling et al., 2017		Åhman et al., 2016; Philibert, 2017; Wesseling et al., 2017; Bataille et al., 2018		Mikunda et al., 2014; Rubin et al., 2015; Irlam, 2017
	Absence of distributional effects	LE	Zha and Ding, 2015	NE		LE	Nabernegg et al., 2017	NE	
	Employment and productivity enhancement potential		He et al., 2013; Zhang et al., 2015; Henriques and Catarino, 2016; Färe et al., 2018		Fuentes-Saguar et al., 2017; Nabernegg et al., 2017	LE	Nabernegg et al., 2017		Koelbl et al., 2016
Technological	Technical scalability		Fischedick et al., 2014; Bataille et al., 2018		de Besi and McCormick, 2015; Wesseling et al., 2017		Fischedick et al., 2014; J. Wang et al., 2017; Bataille et al., 2018		Boot-Handford et al., 2014; Global CCS Institute, 2017; Bui et al., 2018
	Maturity		Hasanbeigi et al., 2014; Napp et al., 2014; Forman et al., 2016; Wesseling et al., 2017		Quader et al., 2016; Wesseling et al., 2017		Quader et al., 2016; Philibert, 2017		Boot-Handford et al., 2014; Mikunda et al., 2014; Abanades et al., 2015; Global CCS Institute, 2017; Bui et al., 2018
	Simplicity		Fernández-Viñé et al., 2010; Wakabayashi, 2013		Henry et al., 2006; Wesseling et al., 2017	NE			IEA GHG, 2012
	Absence of risk	NA		LE	Ali et al., 2017	NE			IPCC, 2005; Boot-Handford et al., 2014; de Coninck and Benson, 2014; Aminu et al., 2017

Institutional	Political acceptability		Zhang et al., 2015; Åhman et al., 2016; Henriques and Catarino, 2016	LE	Longstaff et al., 2015; Sleenhoff and Osseweijer, 2016; Goetz et al., 2017		Åhman et al., 2016; Philibert, 2017; Wesseling et al., 2017; Bataille et al., 2018		Mikunda et al., 2014; Aminu et al., 2017
	Legal and administrative acceptability		Zhang et al., 2015; Åhman et al., 2016; Henriques and Catarino, 2016		Wesseling et al., 2017	NE			de Coninck and Benson, 2014; Dixon et al., 2015; Bui et al., 2018
	Institutional capacity		Fernández-Viñé et al., 2010; Wakabayashi, 2013; Henriques and Catarino, 2016		Henry et al., 2006; Lewandowski, 2016	NE			Boot-Handford et al., 2014; de Coninck and Benson, 2014; Dixon et al., 2015; Bui et al., 2018
	Transparency and accountability potential	NA		LE	Schulze et al., 2012; Harris et al., 2015; Lewandowski, 2015; Repo et al., 2015; DeCicco et al., 2016; Qin et al., 2016	NA		NE	
Socio-cultural	Social co-benefits (health, education)	NA		NE		NA		NA	
	Public acceptance		Fischedick et al., 2014		Khanal et al., 2010; Delshad and Raymond, 2013; Pfau et al., 2014; Dragojlovic and Einsiedel, 2015; Lewandowski, 2015; Sleenhoff and Osseweijer, 2016; Moula et al., 2017	LE	Åhman et al., 2016; Wesseling et al., 2017		Wallquist et al., 2012; Seigo et al., 2014; Ashworth et al., 2015; Aminu et al., 2017
	Social and regional inclusiveness	NA			Creutzig et al., 2013, 2015; Knoblauch et al., 2014; Porter et al., 2015; Robledo-Abad et al., 2017	NA		NE	
	Intergenerational equity	NA		NE		NA		NE	
	Human capabilities		Cagno et al., 2013; Brunke et al., 2014; Wesseling et al., 2017	LE	Henry et al., 2006	NE		LE	IEA GHG, 2012

Environmental/ecological	Reduction of air pollution		Brunke et al., 2014; Rasmussen, 2017; S. Zhang et al., 2018	NE		NE			IPCC, 2005; Koornneef et al., 2012a
	Reduction of toxic waste	NE		NE		NE		NE	
	Reduction of water use		Walker et al., 2013; Gu et al., 2014; Kubule et al., 2016	NE		NE			Koornneef et al., 2012a; Hylkema and Rand, 2014
	Improved biodiversity	NE		NE		NE		LE	Koornneef et al., 2012a
Geophysical	Physical feasibility (physical potentials)		Napp et al., 2014; Åhman et al., 2016; Wesseling et al., 2017		Beringer et al., 2011; Klein et al., 2014; Slade et al., 2014; Creutzig et al., 2015; Kraxner and Nordström, 2015; Searle and Malins, 2015; Smith et al., 2016; Boysen et al., 2017b; Tokimatsu et al., 2017; Heck et al., 2018		Philibert, 2017		IPCC, 2005; de Coninck and Benson, 2014; Scott et al., 2015
	Limited use of land	NA			Popp et al., 2014; Creutzig et al., 2015; Bonsch et al., 2016; Hammond and Li, 2016; Williamson, 2016; Robledo-Abad et al., 2017; Henry et al., 2018	NE		NE	
	Limited use of scarce (geo)physical resources		S. Zhang et al., 2014; Rasmussen, 2017	NE		NE		NE	
	Global spread		Worrell et al., 2008; Fischedick et al., 2014; Åhman et al., 2016; Bataille et al., 2018		Taibi et al., 2012; Fischedick et al., 2014; Wesseling et al., 2017		Taibi et al., 2012; Fischedick et al., 2014; Wesseling et al., 2017		Kuramochi et al., 2012; Mikunda et al., 2014; Bui et al., 2018

4.SM.4.2.5 Feasibility Assessment of Carbon Dioxide Removal Mitigation Options

Table 4.SM.14: Feasibility assessment of carbon dioxide removal mitigation options: bioenergy with carbon dioxide capture and storage (BECCS), and direct air carbon dioxide capture and storage (DACCS). For methodology, see 4.SM.4.1.

		BECCS		**DACCS**	
	Evidence	Robust		Medium	
	Agreement	Medium		Medium	
Economic	Cost-effectiveness		Luckow et al., 2010; De Visser et al., 2011; Fabbri et al., 2011; Koornneef et al., 2012; McLaren, 2012; Kärki et al., 2013; Fornell et al., 2013; Akgul et al., 2014; Johnson et al., 2014; Arasto et al., 2014; Al-Qayim et al., 2015; NRC, 2015; Onarheim et al., 2015; Caldecott et al., 2015; Rochedo et al., 2016; Sanchez and Callaway, 2016; Bhave et al., 2017; Fuss et al., 2018; Honegger and Reiner, 2018		Keith et al., 2006; Pielke, 2009; House et al., 2011; Ranjan and Herzog, 2011; Simon et al., 2011; Holmes and Keith, 2012; Zeman, 2014; Sanz-Pérez et al., 2016; Sinha et al., 2017
	Absence of distributional effects		Arndt et al., 2011; German and Schoneveld, 2012; Creutzig et al., 2013, 2015; Hunsberger et al., 2014; Popp et al., 2014; Persson, 2015; Buck, 2016; Searchinger et al., 2017; Stevanović et al., 2017; Kline et al., 2017; Robledo-Abad et al., 2017	NA	
	Employment and productivity enhancement potential	NE		NA	
Technological	Technical scalability		Azar et al., 2010, 2013; Gough and Upham, 2011; Nemet et al., 2018		Lackner, 2009; Pielke, 2009; Lackner et al., 2012; Nemet and Brandt, 2012; Pritchard et al., 2015; Nemet et al., 2018
	Maturity		McGlashan et al., 2012; McLaren, 2012; Boucher et al., 2014; Fuss et al., 2014; Kemper, 2015; Anderson and		McLaren, 2012; Holmes et al., 2013; Rau et al., 2013; Boot-Handford et al., 2014; NRC, 2015; Agee et al., 2016;

			Peters, 2016; Vaughan and Gough, 2016; Minx et al., 2017; Pang et al., 2017; N.E. Vaughan et al., 2018; Nemet et al., 2018; Strefler et al., 2018c		Nemet et al., 2018
	Simplicity		Möllersten et al., 2003;		Niche markets: Lackner et al., 2012; Hou et al., 2017; Ishimoto et al., 2017
	Absence of risk		IPCC, 2005; Boot-Handford et al., 2014; de Coninck and Benson, 2014; Anderson and Peters, 2016; Vaughan and Gough, 2016; Aminu et al., 2017; Boysen et al., 2017b		IPCC, 2005; Boot-Handford et al., 2014; de Coninck and Benson, 2014; Aminu et al., 2017
Institutional	Political acceptability		BECCS features rarely in policy debates (Boysen et al., 2017a; Fridahl, 2017)	NE	
	Legal and administrative acceptability	LE	Kemper, 2015; Honegger and Reiner, 2018		Boot-Handford et al., 2014; de Coninck and Benson, 2014; Dixon et al., 2015
	Institutional capacity		McLaren, 2012; Frank et al., 2013; Kemper, 2015; Burns and Nicholson, 2017	NE	McLaren, 2012
	Transparency and accountability potential	LE	McLaren, 2012; NRC, 2015; Nemet et al., 2018	LE	McGlashan et al., 2012; McLaren, 2012; Nemet et al., 2018
Socio-cultural	Social co-benefits (health, education)		Knoblauch et al., 2014; Porter et al., 2015; Weldu et al., 2017	NA	
	Public acceptance		Thornley et al., 2009; Gough and Upham, 2011; Wallquist et al., 2012; Mabon et al., 2013; Boot-Handford et al., 2014; Gough et al., 2014; Dowd et al., 2015; Lomax et al., 2015; Boysen et al., 2017b; Fridahl, 2017; Robledo-Abad et al., 2017		Lackner and Brennan, 2009; Mabon et al., 2013; Boot-Handford et al., 2014; Gough et al., 2014; Lomax et al., 2015
	Social and regional inclusiveness	LE	Creutzig et al., 2013, 2015; Robledo-Abad et al., 2017	NE	
	Intergenerational equity	NE		NE	

	Human capabilities	LE	IEA GHG, 2012	LE	IEA GHG, 2012
	Impact on landscapes	NE		NE	
Environmental/ecological	Reduction of air pollution		Knoblauch et al., 2014; Porter et al., 2015; Weldu et al., 2017	NA	
	Reduction of toxic waste	NA		NA	
	Reduction of water use		Gerbens-Leenes et al., 2009; Gheewala et al., 2011; Koornneef et al., 2012a; Smith and Torn, 2013; Hylkema and Rand, 2014; Bonsch et al., 2016; Smith et al., 2016; Wei et al., 2016; Lampert et al., 2016; Mouratiadou et al., 2016; Fajardy and Mac Dowell, 2017; Mathioudakis et al., 2017	NE	
	Improved biodiversity		Lindenmayer and Hobbs, 2004; Barlow et al., 2007; Immerzeel et al., 2014; Creutzig et al., 2015; Dale et al., 2015; Holland et al., 2015; Kline et al., 2015; Santangeli et al., 2016; Tarr et al., 2017	NA	
Geophysical	Physical feasibility (physical potentials)		Bioenergy: Beringer et al., 2011; Klein et al., 2014; Creutzig et al., 2015; Kraxner and Nordström, 2015; Searle and Malins, 2015; Smith et al., 2016; Boysen et al., 2017b; Tokimatsu et al., 2017; Heck et al., 2018) CCS: Dooley, 2013; Selosse and Ricci, 2017		McLaren, 2012; Dooley, 2013; NRC, 2015; Smith et al., 2016; Selosse and Ricci, 2017; Fuss et al., 2018
	Limited use of land		Beringer et al., 2011; Creutzig et al., 2015; NRC, 2015; Smith et al., 2016; Heck et al., 2018		Keith, 2009; Holmes and Keith, 2012; Lackner et al., 2012; NRC, 2015

	Limited use of scarce (geo)physical resources	NE		NE	
	Global spread		Bright et al., 2015; Robledo-Abad et al., 2017		Clarke et al., 2014

Table 4.SM.15: Feasibility assessment of carbon dioxide removal mitigation options: afforestation and reforestation, soil carbon sequestration and biochar, and enhanced weathering. For methodology, see 4.SM.4.1.

		Afforestation and Reforestation		**Soil Carbon Sequestration and Biochar**		**Enhanced Weathering**	
	Evidence	Robust		Robust		Medium	
	Agreement	High		High		Low	
Economic	Cost-effectiveness		Sohngen and Mendelsohn, 2003; Richards and Stokes, 2004; Richards and Stavins, 2005; Nijnik and Halder, 2013; Humpenöder et al., 2014 McLaren, 2012; Caldecott et al., 2015; NRC, 2015		McGlashan et al., 2012; McLaren, 2012; Caldecott et al., 2015; Smith et al., 2016; Fuss et al., 2018 Biochar: Roberts et al., 2010; Shackley et al., 2011; Smith, 2016 Soil carbon sequestration: Smith, 2016		Schuiling and Krijgsman, 2006; Hartmann and Kempe, 2008; Köhler et al., 2010; McLaren, 2012; Renforth, 2012; Hartmann et al., 2013; NRC, 2015; Taylor et al., 2016; Strefler et al., 2018a Ocean alkalinisation: Renforth and Henderson, 2017
	Absence of distributional effects		Lyons and Westoby, 2014; Locatelli et al., 2015		Stringer et al., 2012	NE	
	Employment and productivity enhancement potential		P. Smith et al., 2014		Lal, 2004c; Van Straaten, 2006; Pan et al., 2009; Jeffery et al., 2011	NE	
Technological	Technical scalability		Shvidenko et al., 1997; Polglase et al., 2013; Cunningham et al., 2015; Zhang and Yan, 2015; Nemet et al., 2018		Jiang et al., 2014; Novak et al., 2016; Kammann et al., 2017; Nemet et al., 2018 Biochar: Roberts et al., 2010; Shackley et al., 2011		Hangx and Spiers, 2009; Taylor et al., 2016; Nemet et al., 2018
	Maturity		McLaren, 2012; Gong et al., 2013; NRC, 2015; Zinda et al., 2017; Nemet et al., 2018		McLaren, 2012; Olson, 2013; Olson et al., 2014; Piccoli et al., 2016; Triberti et al., 2016; Vochozka et al., 2016; Nemet et al., 2018		McLaren, 2012; Hartmann et al., 2013; NRC, 2015; Nemet et al., 2018

	Simplicity	NE		NE		NE	
	Absence of risk	NE		NE		NE	
Institutional	Political acceptability	NE		NE		NE	
	Legal and administrative acceptability	NE		NE		NA	
	Institutional capacity		McLaren, 2012; Wang et al., 2016; Wehkamp et al., 2018b Meta analysis until February 2016 (Wehkamp et al., 2018a)	LE	Whitman and Lehmann, 2009; Dilling and Failey, 2013; Stavi and Lal, 2013	LE	McLaren, 2012; Moosdorf et al., 2014; Buck, 2016
	Transparency and accountability potential	LE	McLaren, 2012		Sanderman and Baldock, 2010; McLaren, 2012; Smith et al., 2012; Downie et al., 2014; Jandl et al., 2014; Nemet et al., 2018	NE	McLaren, 2012
Socio-cultural	Social co-benefits (health, education)		Genesio et al., 2016; Ravi et al., 2016	NE		NE	Schuiling and Krijgsman, 2006; Taylor et al., 2016
	Public acceptance		Private landholders: Nijnik and Halder, 2013; Schirmer and Bull, 2014; Trevisan et al., 2016		Glenk and Colombo, 2011; Lomax et al., 2015; Jørgensen and Termansen, 2016	LE	M..J. Wright et al., 2014
	Social and regional inclusiveness		Atela et al., 2014; Sunderlin et al., 2014; Brugnach et al., 2017; Ngendakumana et al., 2017; Turnhout et al., 2017	NE		NE	
	Intergenerational equity	LE	P. Smith et al., 2014	NE		NE	
	Human capabilities	NE		NE		NE	
Environmental/ecological	Reduction of air pollution	NA		NA			Schuiling and Krijgsman, 2006; Taylor et al., 2016
	Reduction of toxic waste	NA		NE		LE	Schuiling and Krijgsman, 2006; Hartmann et al., 2013

	Reduction of water use		Jackson et al., 2005; Smith and Torn, 2013; Deng et al., 2017		Lal, 2004b; Bamminger et al., 2016; Smith, 2016	LE	Kheshgi, 1995; Rau and Caldeira, 1999; Harvey, 2008; Köhler et al., 2013; NRC, 2015
	Improved biodiversity		Díaz et al., 2009; McKinley et al., 2011; Hall et al., 2012; Venter et al., 2012; Greve et al., 2013; Cunningham et al., 2015; Locatelli et al., 2015b; Paul et al., 2016	NE		NA	
Geophysical	Physical feasibility (physical potentials)		Sohngen and Mendelsohn, 2003; Canadell and Raupach, 2008; Strengers et al., 2008; Thomson et al., 2008; van Minnen et al., 2008; Houghton et al., 2015; Sonntag et al., 2016; Griscom et al., 2017		Biochar: Lehmann et al., 2006; Laird et al., 2009; Lee et al., 2010; Woolf et al., 2010; Lenton, 2010; Moore et al., 2010; Pratt and Moran, 2010; McLaren, 2012; Powell and Lenton, 2012; Lomax et al., 2015; Smith, 2016; Paustian et al., 2016 Soil carbon sequestration: Batjes, 1998; Metting et al., 2001; Lal, 2003a, b, 2004a, c, 2010, 2011, 2013; Lal et al., 2007; Smith et al., 2008; Salati et al., 2010; Conant, 2011; Smith, 2012, 2016; Benbi, 2013; Lorenz and Lal, 2014; Powlson et al., 2014; Sommer and Bossio, 2014; Henderson et al., 2015; Lassaletta and Aguilera, 2015; Minasny et al., 2017; Zomer et al., 2017		House et al., 2007; Hartmann and Kempe, 2008; Hangx and Spiers, 2009; Wilson et al., 2009; Köhler et al., 2010, 2013; Morales-Florez et al., 2011; Renforth et al., 2011; Manning and Renforth, 2013; Taylor et al., 2016; Hauck et al., 2016; Strefler et al., 2018a
	Limited use of land		Smith and Torn, 2013; Houghton et al., 2015		Smith, 2016; Fuss et al., 2018		Hartmann et al., 2013; Strefler et al., 2018b Could enhance yields reducing land competition pressure (Edwards et al., 2017; Kantola et al., 2017)

	Limited use of scarce (geo)physical resources	LE	Smith and Torn, 2013	NA		LE	NRC, 2015
	Global spread		Anderson et al., 2011; Arora and Montenegro, 2011; Wang et al., 2014		Biochar: Zimmermann et al., 2012; Sheng et al., 2016		Garcia et al., 2018; Strefler et al., 2018a

4.SM.4.3 Feasibility Assessment of Adaptation Options as Presented in Section 4.5.3

4.SM.4.3.1 Feasibility Assessment of Adaptation Options in Energy System Transitions

Table 4.SM.16: Feasibility assessment of energy system transition adaptation option: power infrastructure, including water. For methodology, see 4.SM.4.1.

		Power Infrastructure, Including Water	
	Evidence	Medium	
	Agreement	High	
Economic	Microeconomic viability		Kopytko and Perkins, 2011; Inderberg and Løchen, 2012; Brouwer et al., 2015
	Macroeconomic viability		Koch and Vögele, 2009; Kopytko and Perkins, 2011; Soito and Freitas, 2011; Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Brouwer et al., 2015; Cortekar and Groth, 2015; Panteli and Mancarella, 2015; van Vliet et al., 2016
	Socio-economic vulnerability reduction potential		Koch and Vögele, 2009; Soito and Freitas, 2011; Cortekar and Groth, 2015; van Vliet et al., 2016
	Employment and productivity enhancement potential		Inderberg and Løchen, 2012; Cortekar and Groth, 2015; Panteli and Mancarella, 2015; van Vliet et al., 2016
Technological	Technical resource availability		Koch and Vögele, 2009; Soito and Freitas, 2011; Inderberg and Løchen, 2012; Jahandideh-Tehrani et al., 2014; Cortekar and Groth, 2015; Murrant et al., 2015; Panteli and Mancarella, 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016
	Risks mitigation potential (stranded assets, unforeseen impacts)		Koch and Vögele, 2009; Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Cortekar and Groth, 2015; Murrant et al., 2015; Panteli and Mancarella, 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016
Institutional	Political acceptability		Soito and Freitas, 2011; Inderberg and Løchen, 2012; Cortekar and Groth, 2015; Murrant et al., 2015
	Legal and regulatory acceptability		Soito and Freitas, 2011; Inderberg and Løchen, 2012; Cortekar and Groth, 2015; Benson, 2018
	Institutional capacity and administrative feasibility		Eisenack and Stecker, 2012; Inderberg and Løchen, 2012; Cortekar and Groth, 2015; Murrant et al., 2015
	Transparency and accountability potential	LE	Inderberg and Løchen, 2012; Cortekar and Groth, 2015

Socio-cultural	Social co-benefits health, education)	NA	Soito and Freitas, 2011
	Socio-cultural acceptability	NE	Soito and Freitas, 2011; Inderberg and Løchen, 2012
	Social and regional inclusiveness	LE	Soito and Freitas, 2011
	Intergenerational equity	LE	Soito and Freitas, 2011
Environm ental/ecolo	Ecological capacity		Koch and Vögele, 2009; Soito and Freitas, 2011; Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015
	Adaptive capacity/resilience		Koch and Vögele, 2009; Soito and Freitas, 2011; Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Cortekar and Groth, 2015; Murrant et al., 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016
Geophysical	Physical feasibility		Koch and Vögele, 2009; Eisenack and Stecker, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Brouwer et al., 2015; Cortekar and Groth, 2015; Murrant et al., 2015; Panteli and Mancarella, 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016
	Land use change enhancement potential		Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Parkinson and Djilali, 2015
	Hazard risk reduction potential		Inderberg and Løchen, 2012; Schaeffer et al., 2012; Jahandideh-Tehrani et al., 2014; Brouwer et al., 2015; Cortekar and Groth, 2015; Murrant et al., 2015; Panteli and Mancarella, 2015; Parkinson and Djilali, 2015; van Vliet et al., 2016

4.SM.4.3.2 Feasibility Assessment of Adaptation Options in Land and Ecosystem Transitions

Table 4.SM.17: Feasibility assessment of land and ecosystem transition adaptation options: conservation agriculture, efficient irrigation, efficient livestock systems, agroforestry and community-based adaptation. For methodology, see 4.SM.4.1.

		Conservation Agriculture		**Efficient Irrigation**		**Efficient Livestock Systems**		**Agroforestry**		**Community-based Adaptation**	
	Evidence	Medium		Medium		Limited		Medium		Medium	
	Agreement	Medium		Medium		High		High		High	
Economic	Microeconomic viability		Grabowski and Kerr, 2014; Jat et al., 2014; Pittelkow et al., 2014; Thierfelder et al., 2015, 2017; H. Smith et al., 2017		Olmstead, 2014; Roco et al., 2014; Venot et al., 2014; Varela-Ortega et al., 2016; Bjornlund et al., 2017; Herwehe and Scott, 2017; Mdemu et al., 2017		Thornton and Herrero, 2014; Herrero et al., 2015; Weindl et al., 2015; Ghahramani and Bowran, 2018		Valdivia et al., 2012; K Murthy, 2013; Lasco et al., 2014; Mbow et al., 2014a, b; Brockington et al., 2016; Iiyama et al., 2017; Jacobi et al., 2017; Hernández-Morcillo et al., 2018		Mannke, 2011; Archer et al., 2014; H. Wright et al., 2014; Fernández-Giménez et al., 2015; Dodman et al., 2017a
	Macroeconomic viability		Ndah et al., 2015; Thierfelder et al., 2015; H. Smith et al., 2017		Elliott et al., 2014; Kirby et al., 2014; Olmstead, 2014; Girard et al., 2015; Kahil et al., 2015; Varela-Ortega et al., 2016; Bjornlund et al., 2017; Herwehe and Scott, 2017		Herrero et al., 2015; Weindl et al., 2015; García de Jalón et al., 2017		Valdivia et al., 2012; Lasco et al., 2014; Jacobi et al., 2017; Hernández-Morcillo et al., 2018	NE	
	Socio-economic vulnerability reduction potential		Bhan and Behera, 2014; Pittelkow et al., 2014; Stevenson et al., 2014; Prosdocimi et al., 2016; H. Smith et al., 2017		Burney and Naylor, 2012; Levidow et al., 2014; Roco et al., 2014; Venot et al., 2014; Ashofteh et al., 2017; Bjornlund et al., 2017		Herrero et al., 2015; García de Jalón et al., 2017; Thornton et al., 2018		Valdivia et al., 2012; Brockington et al., 2016; Coq-Huelva et al., 2017; Coulibaly et al., 2017; Iiyama et al., 2017; Jacobi et al., 2017; Quandt et al., 2017		Mannke, 2011; Archer et al., 2014; Reid and Huq, 2014; H. Wright et al., 2014; Fernández-Giménez et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018
	Employment and productivity		Bhan and Behera, 2014; Grabowski and Kerr, 2014; Kirkegaard et al.,		Burney and Naylor, 2012; Burney et al., 2014; Kirby et al., 2014; Levidow et al., 2014		Briske et al., 2015; García de Jalón et al., 2017	LE	Verchot et al., 2007; Buckeridge et al., 2012		Mannke, 2011; Reid and Huq, 2014; Fernández-Giménez et al., 2015

	enhancement potential		2014; Pittelkow et al., 2014; Stevenson et al., 2014								
Technological	Technical resource availability		Palm et al., 2014; Stevenson et al., 2014; Adenle et al., 2015; H. Smith et al., 2017		Venot et al., 2014; Esteve et al., 2015; Fishman et al., 2015; Azhoni et al., 2017; Mdemu et al., 2017		Descheemaeker et al., 2016; Thornton et al., 2018		Verchot et al., 2007; Valdivia et al., 2012; Mbow et al., 2014a; Iiyama et al., 2017; Jacobi et al., 2017; Hernández-Morcillo et al., 2018	LE	H. Wright et al., 2014; Fernández-Giménez et al., 2015
	Risks mitigation potential		Bhan and Behera, 2014; Palm et al., 2014; Pittelkow et al., 2014		Burney et al., 2014; Fishman et al., 2015; Jägermeyr et al., 2015; Blanc et al., 2017		Briske et al., 2015; Thornton and Herrero, 2015; Thornton et al., 2018		Verchot et al., 2007; Jacobi et al., 2017; Abdulai et al., 2018; Hernández-Morcillo et al., 2018; Sida et al., 2018	NA	
Institutional	Political acceptability		Adenle et al., 2015; Dougill et al., 2017; Westengen et al., 2018		Burney and Naylor, 2012; Esteve et al., 2015	NE			Buckeridge et al., 2012; Mbow et al., 2014b; Jacobi et al., 2017	NA	
	Legal and regulatory acceptability	NE		NA		NE			Place et al., 2012; Mbow et al., 2014a, b; Jacobi et al., 2017; Hernández-Morcillo et al., 2018	NA	
	Institutional capacity and administrative feasibility		Bhan and Behera, 2014; Harvey et al., 2014; Kassam et al., 2014; Adenle et al., 2015; Baudron et al., 2015; Ndah et al., 2015; Li et al., 2016; Dougill et al., 2017; H. Smith et al., 2017		Burney and Naylor, 2012; Burney et al., 2014; Levidow et al., 2014; Venot et al., 2014; Kahil et al., 2015; Azhoni et al., 2017; Mdemu et al., 2017		Herrero et al., 2015; Descheemaeker et al., 2016		Buckeridge et al., 2012; Place et al., 2012; Jacobi et al., 2017; Hernández-Morcillo et al., 2018		Mannke, 2011; Archer et al., 2014; Ayers et al., 2014; H. Wright et al., 2014; Reid and Huq, 2014; Sovacool et al., 2015; Fernández-Giménez et al., 2015; Scolobig et al., 2015; Ensor et al., 2016, 2018; Reid, 2016; Ford et al., 2018
	Transparency and	LE	Brouder and Gomez-Macpherson, 2014;		Levidow et al., 2014; Azhoni et al., 2017	NA		NE			Archer et al., 2014; Reid and Huq, 2014; Fernández-Giménez et

	accountability potential		Palm et al., 2014; Challinor et al., 2018								al., 2015; Sovacool et al., 2015
Socio-cultural	Social co-benefits (health, education)		Pittelkow et al., 2014; H. Smith et al., 2017; Pradhan et al., 2018	LE	Venot et al., 2014; Mdemu et al., 2017		Herrero et al., 2015; Thornton and Herrero, 2015; Thornton et al., 2018		Brockington et al., 2016; Varela-Ortega et al., 2016; Clark and Tilman, 2017; Coq-Huelva et al., 2017; Coulibaly et al., 2017; Jacobi et al., 2017; Quandt et al., 2017; Thierfelder et al., 2017; Hernández-Morcillo et al., 2018		Mannke, 2011; Archer et al., 2014; Ayers et al., 2014; Wise et al., 2014; H. Wright et al., 2014; Fernández-Giménez et al., 2015; Sovacool et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018
	Socio-cultural acceptability		Giller et al., 2015; Ndah et al., 2015; Thierfelder et al., 2015		Roco et al., 2014; Venot et al., 2014; Girard et al., 2015; Mdemu et al., 2017		Herrero et al., 2015; Ghahramani and Bowran, 2018; Thornton et al., 2018		Jarvis et al., 2008; Valdivia et al., 2012; Coq-Huelva et al., 2017; Iiyama et al., 2017; Jacobi et al., 2017; Hernández-Morcillo et al., 2018		Mannke, 2011; Green et al., 2014; Reid and Huq, 2014; Wise et al., 2014; H. Wright et al., 2014; Fernández-Giménez et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018
	Social and regional inclusiveness		Brouder and Gomez-Macpherson, 2014; Pittelkow et al., 2014; Ndah et al., 2015; H. Smith et al., 2017		Burney and Naylor, 2012; Jägermeyr et al., 2015		Briske et al., 2015; García de Jalón et al., 2017; Thornton et al., 2018		Valdivia et al., 2012; Iiyama et al., 2017; Jacobi et al., 2017		Archer et al., 2014; H. Wright et al., 2014; Fernández-Giménez et al., 2015; Sovacool et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018
	Intergenerational equity	NA		NA		NA		NE			H. Wright et al., 2014; Fernández-Giménez et al., 2015
Environmental/	Ecological capacity		Bhan and Behera, 2014; Palm et al., 2014; Thierfelder et al., 2015; Prosdocimi et al., 2016		Kirby et al., 2014; Pfeiffer and Lin, 2014; Fishman et al., 2015; Jägermeyr et al., 2015		Lemaire et al., 2014; Herrero et al., 2015; Thornton et al., 2018		Lusiana et al., 2012; K Murthy, 2013; Lasco et al., 2014; Barral et al., 2015; Coq-Huelva et al., 2017; Quandt et al., 2017; Hernández-Morcillo et al., 2018; Sida et al., 2018	LE	H. Wright et al., 2014; Fernández-Giménez et al., 2015

	Adaptive capacity/resilience		Aleksandrova et al., 2014; Grabowski and Kerr, 2014; Kirkegaard et al., 2014; Pittelkow et al., 2014; Stevenson et al., 2014; Thierfelder et al., 2015; Li et al., 2016; H. Smith et al., 2017; Pradhan et al., 2018		Burney and Naylor, 2012; Burney et al., 2014; Levidow et al., 2014; Jägermeyr et al., 2015; Fader et al., 2016; Varela-Ortega et al., 2016; Ashofteh et al., 2017; Hong and Yabe, 2017		Bell et al., 2014; Havet et al., 2014; Lemaire et al., 2014; Thornton and Herrero, 2014; Briske et al., 2015; Herrero et al., 2015; Weindl et al., 2015; Ghahramani and Bowran, 2018		Sendzimir et al., 2011; Lusiana et al., 2012; K Murthy, 2013; Lasco et al., 2014; Mbow et al., 2014a; Varela-Ortega et al., 2016; Clark and Tilman, 2017; Coq-Huelva et al., 2017; Thierfelder et al., 2017; Coulibaly et al., 2017; Quandt et al., 2017; Hernández-Morcillo et al., 2018		Mannke, 2011; Archer et al., 2014; Ayers et al., 2014; H. Wright et al., 2014; Reid and Huq, 2014; Wise et al., 2014; Fernández-Giménez et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018; Singh, 2018
Geophysical	Physical feasibility		Stevenson et al., 2014; Giller et al., 2015; Thierfelder et al., 2017		Levidow et al., 2014; Fishman et al., 2015; Jägermeyr et al., 2015		Weindl et al., 2015; Thornton et al., 2018		Coulibaly et al., 2017; Hernández-Morcillo et al., 2018	NA	
	Land use change enhancement potential		Grabowski and Kerr, 2014; Stevenson et al., 2014; Giller et al., 2015; Prosdocimi et al., 2016; Cui et al., 2018; Pradhan et al., 2018		Fader et al., 2016		Briske et al., 2015; Weindl et al., 2015		Lasco et al., 2014; Mbow et al., 2014a; Coulibaly et al., 2017; Hernández-Morcillo et al., 2018	LE	H. Wright et al., 2014
	Hazard risk reduction potential	NE		NA		NA			Lasco et al., 2014; Mbow et al., 2014a; Coulibaly et al., 2017; Abdulai et al., 2018; Hernández-Morcillo et al., 2018		Mannke, 2011; Archer et al., 2014; H. Wright et al., 2014; Fernández-Giménez et al., 2015; Ensor et al., 2016, 2018; Ford et al., 2018

Table 4.SM.18: Feasibility assessment of land and ecosystem transition adaptation options: ecosystem restoration and avoided deforestation, biodiversity management, coastal defence and hardening, and sustainable aquaculture. For methodology, see 4.SM.4.1.

		Ecosystem Restoration and Avoided Deforestation		**Biodiversity Management**		**Coastal Defence and Hardening**		**Sustainable Aquaculture**	
	Evidence	Robust		Medium		Robust		Limited	
	Agreement	Medium		Medium		Medium		Medium	
Economic	Microeconomic viability		Dang Phan et al., 2014; Ingalls and Dwyer, 2016; Rakatama et al., 2017; Spencer et al., 2017		Rodrigues et al., 2009; Alagador et al., 2014; Mantyka-Pringle et al., 2016; Gómez-Aíza et al., 2017; Reside et al., 2017b; Monahan and Theobald, 2018		Firth et al., 2014; Barbier, 2015a; Elliott and Wolanski, 2015; Diaz, 2016; Betzold and Mohamed, 2017		Boonstra and Hanh, 2015; Joffre et al., 2015; FAO, 2016; FAO et al., 2017; Pérez-Escamilla, 2017
	Macroeconomic viability		Dang Phan et al., 2014; Rakatama et al., 2017; Spencer et al., 2017; Turnhout et al., 2017; Well and Carrapatoso, 2017	NE		LE	Hinkel et al., 2014; Estrada et al., 2017	LE	UNEP, 2013; Edwards, 2015; Moffat, 2017
	Socio-economic vulnerability reduction potential		Atela et al., 2015; Elmqvist et al., 2015; Camps-Calvet et al., 2016; Ingalls and Dwyer, 2016; McPhearson et al., 2016; Collas et al., 2017; Ngendakumana et al., 2017; Spencer et al., 2017		Rodrigues et al., 2009; Berrang-Ford et al., 2012; Pullin et al., 2013; Brockington and Wilkie, 2015; Newbold et al., 2015; Oldekop et al., 2016; Griscom et al., 2017; Milman and Jagannathan, 2017; Terraube et al., 2017; Essl and Mauerhofer, 2018		Rabbani et al., 2010a, b; Gutiérrez et al., 2012; Arkema et al., 2013, 2017; Neumann et al., 2015; Sovacool et al., 2015; Sutton-Grier et al., 2015; Betzold and Mohamed, 2017		Bell et al., 2011; Smith et al., 2013; Orchard et al., 2015; Béné et al., 2016; Jennings et al., 2016; Mycoo, 2017; Ahmed et al., 2018
	Employment and productivity enhancement potential		Ingalls and Dwyer, 2016; Spencer et al., 2017; Turnhout et al., 2017	NE		NE			Sánchez et al., 2002; De Silva and Davy, 2010; Ahmed et al., 2014; Boonstra and Hanh, 2015; Lacoue-Labarthe et al., 2016; Asiedu et al., 2017a

Technological	Technical resource availability		Ingalls and Dwyer, 2016; Spencer et al., 2017; Turnhout et al., 2017		Nadeau et al., 2015; Schmitz et al., 2015; Thomas and Gillingham, 2015; K.R. Jones et al., 2016; Urban et al., 2016; Milman and Jagannathan, 2017; Reside et al., 2017b		Arkema et al., 2013; Bosello and De Cian, 2014; Smajgl et al., 2015; Hauer et al., 2016; Betzold and Mohamed, 2017; Williams et al., 2018		UNEP, 2013; Ahmed et al., 2014, 2018; Brillant, 2014; Edwards, 2015; Lucas, 2015; Fidelman et al., 2017
	Risks mitigation potential	LE	Spencer et al., 2017; Turnhout et al., 2017	LE			Firth et al., 2014; Sovacool et al., 2015; André et al., 2016; Cashman and Nagdee, 2017; Brown et al., 2018; Storlazzi et al., 2018; Williams et al., 2018		Boonstra and Hanh, 2015; Blanchard et al., 2017
Institutional	Political acceptability		Sunderlin et al., 2014; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017	LE	Milman and Jagannathan, 2017; Essl and Mauerhofer, 2018		Duvat, 2013; Nordstrom, 2014; Sovacool et al., 2015; Betzold and Mohamed, 2017		Brander, 2007; Bell et al., 2011; Bell and Taylor, 2015; FAO, 2016; Weatherdon et al., 2016; Asiedu et al., 2017a; Ertör and Ortega-Cerdà, 2017
	Legal and regulatory acceptability	LE	Sunderlin et al., 2014; Turnhout et al., 2017		Dallimer and Strange, 2015; K.R. Jones et al., 2016; Drielsma et al., 2017; Essl and Mauerhofer, 2018; Monahan and Theobald, 2018; Triviño et al., 2018	NE		LE	Broitman et al., 2017; Fidelman et al., 2017
	Institutional capacity and administrative feasibility		Jagger et al., 2014; Sunderlin et al., 2014; Wallbott, 2014; Atela et al., 2015; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Spencer et al., 2017; Turnhout et al., 2017; Well and Carrapatoso, 2017; Wehkamp et al., 2018a		Dallimer and Strange, 2015; Thomas and Gillingham, 2015; K.R. Jones et al., 2016; Essl and Mauerhofer, 2018; Monahan and Theobald, 2018		Hallegatte et al., 2013; Spalding et al., 2014; Mills et al., 2016; Estrada et al., 2017	LE	Ahmed et al., 2014; Broitman et al., 2017; Fidelman et al., 2017
	Transparency and accountability potential		Jagger et al., 2014; Sunderlin et al., 2014; Atela et al., 2015; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017;	LE		NE		NE	

			Turnhout et al., 2017; Well and Carrapatoso, 2017; Wehkamp et al., 2018a						
Socio-cultural	Social co-benefits (health, education)		Sunderlin et al., 2014; Jagger et al., 2014; Atela et al., 2015; Elmqvist et al., 2015; Camps-Calvet et al., 2016; Ingalls and Dwyer, 2016; McPhearson et al., 2016; Turnhout et al., 2017; Collas et al., 2017; Li et al., 2017; Ngendakumana et al., 2017; Spencer et al., 2017		Rodrigues et al., 2009; Berrang-Ford et al., 2012; Pullin et al., 2013; Brockington and Wilkie, 2015; Oldekop et al., 2016; Clark and Tilman, 2017; Terraube et al., 2017; Essl and Mauerhofer, 2018		Sovacool et al., 2015; Sutton-Grier et al., 2015; Arkema et al., 2017; Betzold and Mohamed, 2017	LE	Weatherdon et al., 2016; Fidelman et al., 2017
	Socio-cultural acceptability		Sunderlin et al., 2014; Wallbott, 2014; Atela et al., 2015; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Spencer et al., 2017		Pullin et al., 2013; Brockington and Wilkie, 2015; Oldekop et al., 2016; Milman and Jagannathan, 2017		Sovacool et al., 2015; Gibbs, 2016; Morris et al., 2016; Betzold and Mohamed, 2017; Marengo et al., 2017	LE	Asiedu et al., 2017a; Fidelman et al., 2017
	Social and regional inclusiveness	LE	Ingalls and Dwyer, 2016; Spencer et al., 2017		Pullin et al., 2013; Brockington and Wilkie, 2015; Oldekop et al., 2016; Milman and Jagannathan, 2017; Terraube et al., 2017	NA		NE	
	Intergenerational equity		Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Spencer et al., 2017	NE		NE		NA	
Environmental/ecological	Ecological capacity		Sunderlin et al., 2014; Spencer et al., 2017; Turnhout et al., 2017		Rodrigues et al., 2009; Virkkala et al., 2014; Thomas and Gillingham, 2015; Gillingham et al., 2015; Nadeau et al., 2015; Schmitz et al., 2015; Feeley and Silman, 2016; Gaüzère et al., 2016; Greenwood et al., 2016; Gómez-Aíza et al., 2017; Mingarro and Lobo, 2018; Monahan and Theobald, 2018		Bilkovic and Mitchell, 2013; Spalding et al., 2014; Joffre et al., 2015; Sutton-Grier et al., 2015		David et al., 2015; Joffre et al., 2015; Blanchard et al., 2017; Broitman et al., 2017; Ahmed et al., 2018

	Adaptive capacity/resilien ce		Sunderlin et al., 2014; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Spencer et al., 2017; Turnhout et al., 2017		Rodrigues et al., 2009; Pullin et al., 2013; Oldekop et al., 2016; Gómez-Aíza et al., 2017; Terraube et al., 2017; Monahan and Theobald, 2018	LE	Spalding et al., 2014; Orchard et al., 2015; Fidelman et al., 2017		Boonstra and Hanh, 2015; Orchard et al., 2015; Blanchard et al., 2017; Fidelman et al., 2017; Cinner et al., 2018
Geophysical	Physical feasibility		Dang Phan et al., 2014; Sunderlin et al., 2014; Ngendakumana et al., 2017; Spencer et al., 2017; Turnhout et al., 2017	NE			Duvat, 2013; Hinkel et al., 2014; Smith et al., 2015; André et al., 2016; Cooper et al., 2016; Vousdoukas et al., 2016; Arkema et al., 2017		David et al., 2015; S. Adhikari et al., 2018; Ahmed et al., 2018
	Land use change enhancement potential		Dang Phan et al., 2014; Sunderlin et al., 2014; Ingalls and Dwyer, 2016; Ngendakumana et al., 2017; Turnhout et al., 2017; Houghton and Nassikas, 2018; Wehkamp et al., 2018a	LE	Schmitz et al., 2015; Reside et al., 2017a, b	LE	Sutton-Grier et al., 2015	LE	Mialhe et al., 2016
	Hazard risk reduction potential		Ingalls and Dwyer, 2016; Spencer et al., 2017	NE			Luisetti et al., 2013; Firth et al., 2014; Spalding et al., 2014; Barbier, 2015b; Sutton-Grier et al., 2015; André et al., 2016; Narayan et al., 2016; Arkema et al., 2017; Fu and Song, 2017		Joffre et al., 2015; Blanchard et al., 2017; Daly et al., 2017; Hung et al., 2018

4.SM.4.3.3 Feasibility Assessment of Adaptation Options in Urban and Infrastructure System Transitions

Table 4.SM.19: Feasibility assessment of urban and infrastructure transition adaptation options: sustainable land use and urban planning, and sustainable water management. For methodology, see 4.SM.4.1.

		Sustainable Land Use and Urban Planning		**Sustainable Water Management**	
	Evidence	Medium		Robust	
	Agreement	Medium		Medium	
Economic	Microeconomic viability		Eberhard et al., 2011, 2016; Kiunsi, 2013; Watkins, 2015; Archer, 2016; Eisenberg, 2016; Ewing et al., 2016; Ziervogel et al., 2016a, 2017; Hess and Kelman, 2017; Mavhura et al., 2017		Liu et al., 2014; Lamond et al., 2015; Voskamp and Van de Ven, 2015; Xue et al., 2015; Costa et al., 2016; Mguni et al., 2016; Poff et al., 2016; Ossa-Moreno et al., 2017; Vincent et al., 2017; Xie et al., 2017
	Macroeconomic viability		Eberhard et al., 2011, 2016; Measham et al., 2011; Aerts et al., 2014; Jaglin, 2014; Beccali et al., 2015; Boughedir, 2015; Watkins, 2015; Ziervogel et al., 2016a, 2017; Chu et al., 2017; Hess and Kelman, 2017	NE	
	Socio-economic vulnerability reduction potential		Measham et al., 2011; Eberhard et al., 2011, 2016; Kiunsi, 2013; Aerts et al., 2014; Jaglin, 2014; Boughedir, 2015; Broto et al., 2015; Carter et al., 2015; Archer, 2016; Shi et al., 2016; Ziervogel et al., 2016a, 2017; Hetz, 2016; Mavhura et al., 2017		Villarroel Walker et al., 2014; Ziervogel and Joubert, 2014; Brown and McGranahan, 2016; Chu et al., 2016; Chant et al., 2017; Dodman et al., 2017a, b; Ossa-Moreno et al., 2017; Gunasekara et al., 2018
	Employment and productivity enhancement potential		Eberhard et al., 2011, 2016; Measham et al., 2011; Watkins, 2015; Archer, 2016; Ziervogel et al., 2016a	NE	
Technological	Technical resource availability		Aerts et al., 2014; Kettle et al., 2014; Beccali et al., 2015; Boughedir, 2015; Archer, 2016; Woodruff and Stults, 2016; Mavhura et al., 2017; Siders, 2017; Stults and Woodruff, 2017		Liu et al., 2014; Lamond et al., 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; Mguni et al., 2016; Soz et al., 2016; Xie et al., 2017
	Risks mitigation potential		Measham et al., 2011; Kiunsi, 2013; Aerts et al., 2014; Boughedir, 2015; Eisenberg, 2016; Siders, 2017; Stults and Woodruff, 2017		Liu et al., 2014; Lamond et al., 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; Mguni et al., 2016; Xie et al., 2017; Gunasekara et al., 2018
Institutional	Political acceptability		Measham et al., 2011; Aerts et al., 2014; Rivera and Wamsler, 2014; Boughedir, 2015; Carter et al., 2015; Landauer et al., 2015; Araos et al., 2016b; Woodruff and Stults, 2016; Hetz,		Leck et al., 2015; Padawangi and Douglass, 2015; Chen and Chen, 2016; Mguni et al., 2016

			2016; Siders, 2017; Chu et al., 2017; Di Gregorio et al., 2017b; Mahlkow and Donner, 2017		
	Legal and regulatory acceptability		Measham et al., 2011; Eberhard et al., 2011, 2016; Aerts et al., 2014; Rivera and Wamsler, 2014; Boughedir, 2015; Landauer et al., 2015; Carter et al., 2015; King et al., 2016; Eisenberg, 2016; Dhar and Khirfan, 2017; Di Gregorio et al., 2017b; Francesch-Huidobro et al., 2017; Hess and Kelman, 2017		Bettini et al., 2015; Deng and Zhao, 2015; Hill Clarvis and Engle, 2015; Leck et al., 2015; Lemos, 2015; Margerum and Robinson, 2015; Padawangi and Douglass, 2015; Chen and Chen, 2016
	Institutional capacity and administrative feasibility		Eberhard et al., 2011, 2016; Measham et al., 2011; Kiunsi, 2013; Aerts et al., 2014; Jaglin, 2014; Rivera and Wamsler, 2014; Archer et al., 2014; Landauer et al., 2015; Boughedir, 2015; Broto et al., 2015; Carter et al., 2015; Araos et al., 2016b; Hetz, 2016; Archer, 2016; Shi et al., 2016; Woodruff and Stults, 2016; Ziervogel et al., 2016a; Campos et al., 2016; Di Gregorio et al., 2017b; Francesch-Huidobro et al., 2017; Mahlkow and Donner, 2017; Mavhura et al., 2017; Siders, 2017; Tait and Euston-Brown, 2017; Chu et al., 2017; Dhar and Khirfan, 2017		Ziervogel and Joubert, 2014; Bettini et al., 2015; Deng and Zhao, 2015; Hill Clarvis and Engle, 2015; Lamond et al., 2015; Lemos, 2015; Margerum and Robinson, 2015)
	Transparency and accountability potential		Eberhard et al., 2011, 2016; Measham et al., 2011; Kettle et al., 2014; Broto et al., 2015; Landauer et al., 2015; Shi et al., 2016; Woodruff and Stults, 2016; Chu et al., 2017; Stults and Woodruff, 2017	NE	
Socio-cultural	Social co-benefits (health, education)		Eberhard et al., 2011, 2016; Archer et al., 2014; Kettle et al., 2014; Parnell, 2015; Watkins, 2015; Beccali et al., 2015; Landauer et al., 2015; Archer, 2016; Ziervogel et al., 2016a, 2017; Campos et al., 2016; Hess and Kelman, 2017; Chu et al., 2018		Liu et al., 2014; Lamond et al., 2015; Leck et al., 2015; Padawangi and Douglass, 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; Mguni et al., 2016; Nur and Shrestha, 2017; Xie et al., 2017; Gunasekara et al., 2018
	Socio-cultural acceptability		Kiunsi, 2013; Aerts et al., 2014; Jaglin, 2014; Kettle et al., 2014; Archer et al., 2014; Parnell, 2015; Watkins, 2015; Broto et al., 2015; Carter et al., 2015; Archer, 2016; Newman et al., 2016; Shi et al., 2016; Ziervogel et al., 2016a, 2017; Campos et al., 2016; Eberhard et al., 2016; Ewing et al., 2016; Siders, 2017; Stults and Woodruff, 2017; Chu et al., 2017, 2018		Lamond et al., 2015; Leck et al., 2015; Padawangi and Douglass, 2015; Nur and Shrestha, 2017; Xie et al., 2017
	Social and regional inclusiveness		Eberhard et al., 2011, 2016; Jaglin, 2014; Kettle et al., 2014; Archer et al., 2014; Parnell, 2015; Watkins, 2015; Broto et al., 2015; Araos et al., 2016b; Archer, 2016; King et al., 2016; Shi et al., 2016; Ziervogel et al., 2016a, 2017; Campos et al., 2016; Mahlkow and Donner, 2017; Mavhura et al., 2017; Chu et al., 2017, 2018; Dhar and Khirfan, 2017		Rasul and Sharma, 2016

	Intergenerational equity		Parnell, 2015; King et al., 2016; Shi et al., 2016; Chu et al., 2017; Ziervogel et al., 2017		Tacoli et al., 2013; Xue et al., 2015; Poff et al., 2016
Environmental/ ecological	Ecological capacity		Kiunsi, 2013; Aerts et al., 2014; Kettle et al., 2014; King et al., 2016; Ziervogel et al., 2016a; Mavhura et al., 2017		Ziervogel and Joubert, 2014; Lamond et al., 2015; Soz et al., 2016
	Adaptive capacity/ resilience		Eberhard et al., 2011, 2016; Kiunsi, 2013; Aerts et al., 2014; Kettle et al., 2014; Rivera and Wamsler, 2014; Archer et al., 2014; Jaglin, 2014; Parnell, 2015; Watkins, 2015; Carter et al., 2015; Archer, 2016; King et al., 2016; Shi et al., 2016; Ziervogel et al., 2016a, 2017; Hetz, 2016; Stults and Woodruff, 2017; Chu et al., 2017; Hess and Kelman, 2017		Angotti, 2015; Bell et al., 2015; Biggs et al., 2015; Gwedla and Shackleton, 2015; Lwasa et al., 2015; Chen and Chen, 2016; Yang et al., 2016; Sanesi et al., 2017; Gunasekara et al., 2018
Geophysical	Physical feasibility		Aerts et al., 2014; Boughedir, 2015; Hetz, 2016; King et al., 2016; Newman et al., 2016; Woodruff and Stults, 2016; Ziervogel et al., 2016a; Stults and Woodruff, 2017		Ziervogel and Joubert, 2014; Lamond et al., 2015; Soz et al., 2016
	Land use change enhancement potential		Kiunsi, 2013; Landauer et al., 2015; Parnell, 2015; Hetz, 2016; Newman et al., 2016; Mavhura et al., 2017		Lamond et al., 2015; Leck et al., 2015; Padawangi and Douglass, 2015; Rasul and Sharma, 2016; Soz et al., 2016
	Hazard risk reduction potential		Kiunsi, 2013; Aerts et al., 2014; Watkins, 2015; Boughedir, 2015; Archer, 2016; Woodruff and Stults, 2016; Eisenberg, 2016; Hetz, 2016; King et al., 2016; Mahlkow and Donner, 2017; Mavhura et al., 2017; Stults and Woodruff, 2017		Liu et al., 2014; Angotti, 2015; Bell et al., 2015; Voskamp and Van de Ven, 2015; Biggs et al., 2015; Gwedla and Shackleton, 2015; Lamond et al., 2015; Lwasa et al., 2015; Mguni et al., 2016; Yang et al., 2016; Chen and Chen, 2016; Costa et al., 2016; Sanesi et al., 2017; Xie et al., 2017; Gunasekara et al., 2018

Table 4.SM.20: Feasibility assessment of urban and infrastructure transition adaptation options: green infrastructure and ecosystem services, and building codes and standards. For methodology, see 4.SM.4.1.

		Green Infrastructure and Ecosystem Services		**Building Codes and Standards**	
	Evidence	Medium		Limited	
	Agreement	High		Medium	
Economic	Microeconomic viability		Elmqvist et al., 2015; Soderlund and Newman, 2015; McPhearson et al., 2016; Zinia and McShane, 2018		Steenhof and Sparling, 2011; Bendito and Barrios, 2016; Ruparathna et al., 2016; Mavhura et al., 2017; Wells et al., 2018
	Macroeconomic viability	LE	Culwick and Bobbins, 2016		Steenhof and Sparling, 2011; Aerts et al., 2014; Späth and Rohracher, 2015; Chandel et al., 2016; Shapiro, 2016; Hess and Kelman, 2017; Wells et al., 2018
	Socio-economic vulnerability reduction potential		Tallis et al., 2011; Elmqvist et al., 2015; Soderlund and Newman, 2015; Camps-Calvet et al., 2016; McPhearson et al., 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Li et al., 2017; R. White et al., 2017; Zinia and McShane, 2018		Steenhof and Sparling, 2011; FEMA, 2014; Bendito and Barrios, 2016; Hess and Kelman, 2017; Reckien et al., 2017
	Employment and productivity enhancement potential	NE		NE	
Technological	Technical resource availability	NA			Steenhof and Sparling, 2011; Aerts et al., 2014; Bendito and Barrios, 2016; Chandel et al., 2016; Ruparathna et al., 2016; Garsaball and Markov, 2017; Tait and Euston-Brown, 2017; Wells et al., 2018
	Risks mitigation potential (stranded assets, unforeseen impacts)		Tallis et al., 2011; Elmqvist et al., 2013b, 2015; Buckeridge, 2015; Soderlund and Newman, 2015; Camps-Calvet et al., 2016; McPhearson et al., 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; R. White et al., 2017; Li et al., 2017; Zinia and McShane, 2018		Aerts et al., 2014; Ruparathna et al., 2016
Institutional	Political acceptability	LE	Brown and McGranahan, 2016; Ziervogel et al., 2016b		Aerts et al., 2014; Späth and Rohracher, 2015; Chandel et al., 2016; Eisenberg, 2016; Shapiro, 2016; Tait and Euston-Brown, 2017; Wells et al., 2018
	Legal and regulatory acceptability		Brown and McGranahan, 2016; Ziervogel et al., 2016b; Collas et al., 2017; Li et al., 2017; Sirakaya et al., 2018		Steenhof and Sparling, 2011; Burch et al., 2014; Späth and Rohracher, 2015; Eisenberg, 2016; Ruparathna et al., 2016; Shapiro, 2016; Hess and Kelman, 2017; Stults and Woodruff, 2017

	Institutional capacity and administrative feasibility		Brown and McGranahan, 2016; Culwick and Bobbins, 2016; Ziervogel et al., 2016b; Collas et al., 2017; Li et al., 2017; Prudencio and Null, 2018		Aerts et al., 2014; Chandel et al., 2016; Eisenberg, 2016; Shapiro, 2016; Garsaball and Markov, 2017; Hess and Kelman, 2017; Mavhura et al., 2017; Stults and Woodruff, 2017; Tait and Euston-Brown, 2017
	Transparency and accountability potential	LE	Li et al., 2017		Steenhof and Sparling, 2011; Aerts et al., 2014; Späth and Rohracher, 2015; Chandel et al., 2016; Shapiro, 2016
Socio-cultural	Social co-benefits (health, education)		Beatley, 2011; Tallis et al., 2011; Elmqvist et al., 2013b, 2015; Liu et al., 2014; Demuzere et al., 2014; Lamond et al., 2015; Mullaney et al., 2015; Norton et al., 2015; Skougaard Kaspersen et al., 2015; Soderlund and Newman, 2015; Voskamp and Van de Ven, 2015; Buckeridge, 2015; Beaudoin and Gosselin, 2016; Green et al., 2016; McPhearson et al., 2016; Mguni et al., 2016; Brown and McGranahan, 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Camps-Calvet et al., 2016; Costa et al., 2016; Culwick and Bobbins, 2016; Li et al., 2017; Lin et al., 2017; Xie et al., 2017; Collas et al., 2017; Zinia and McShane, 2018	NE	
	Socio-cultural acceptability		Beatley, 2011; Elmqvist et al., 2015; Beaudoin and Gosselin, 2016; Brown and McGranahan, 2016; Camps-Calvet et al., 2016; McPhearson et al., 2016; Ziervogel et al., 2016b; Collas et al., 2017; Li et al., 2017; Zinia and McShane, 2018		Späth and Rohracher, 2015; Bendito and Barrios, 2016; Eisenberg, 2016; Tait and Euston-Brown, 2017
	Social and regional inclusiveness		Tallis et al., 2011; Elmqvist et al., 2013b, 2015; Buckeridge, 2015; Beaudoin and Gosselin, 2016; Brown and McGranahan, 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Ziervogel et al., 2016b; Camps-Calvet et al., 2016; Culwick and Bobbins, 2016; McPhearson et al., 2016; R. White et al., 2017; Collas et al., 2017; Li et al., 2017; Prudencio and Null, 2018		Parnell, 2015; Shapiro, 2016; Mavhura et al., 2017; Reckien et al., 2017
	Intergenerational equity		Elmqvist et al., 2013b, 2015; Liu et al., 2014; Lamond et al., 2015; Skougaard Kaspersen et al., 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; McPhearson et al., 2016; Mguni et al., 2016; Xie et al., 2017	NE	
Environmental/ecological	Ecological capacity		Liu et al., 2014; Lamond et al., 2015; Skougaard Kaspersen et al., 2015; Costa et al., 2016; Mguni et al., 2016; Xie et al., 2017	NE	
	Adaptive capacity/ resilience		Beatley, 2011; Elmqvist et al., 2013b, 2015; Voskamp and Van de Ven, 2015; Beaudoin and Gosselin, 2016; Brown and		Steenhof and Sparling, 2011; Aerts et al., 2014; Bendito and Barrios, 2016

			McGranahan, 2016; Camps-Calvet et al., 2016; McPhearson et al., 2016; Panagopoulos et al., 2016; Collas et al., 2017; Li et al., 2017; Zinia and McShane, 2018		
Geophysical	Physical feasibility		Liu et al., 2014; Lamond et al., 2015; Skougaard Kaspersen et al., 2015; Voskamp and Van de Ven, 2015; Costa et al., 2016; Mguni et al., 2016; Collas et al., 2017; Xie et al., 2017	NE	
	Land use change enhancement potential		Tallis et al., 2011; Elmqvist et al., 2013b; Buckeridge, 2015; Culwick and Bobbins, 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Collas et al., 2017; R. White et al., 2017		Bendito and Barrios, 2016; Reckien et al., 2017
	Hazard risk reduction potential		Nowak et al., 2006; Tallis et al., 2011; Elmqvist et al., 2013b, 2015; Buckeridge, 2015; Soderlund and Newman, 2015; Brown and McGranahan, 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; Ziervogel et al., 2016b; Camps-Calvet et al., 2016; Culwick and Bobbins, 2016; McPhearson et al., 2016; R. White et al., 2017; Collas et al., 2017; Li et al., 2017; Zinia and McShane, 2018		Steenhof and Sparling, 2011; FEMA, 2014; Bendito and Barrios, 2016; Garsaball and Markov, 2017; Reckien et al., 2017

4.SM.4.3.4 Feasibility Assessment of Adaptation Options in Industrial System Transitions

Table 4.SM.21: Feasibility assessment of industrial system transition adaptation option: intensive industry infrastructure resilience and water management. For methodology, see 4.SM.4.1.

		Intensive Industry Infrastructure Resilience and Water Management	
	Evidence	Limited	
	Agreement	High	
Economic	Microeconomic viability	NE	
	Macroeconomic viability	NE	
	Socio-economic vulnerability reduction potential		
	Employment and productivity enhancement potential	NE	
Technological	Technical resource availability		Koch and Vögele, 2009; Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015
	Risks mitigation potential		Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015
Institutional	Political acceptability	LE	Murrant et al., 2015
	Legal and regulatory acceptability	NE	
	Institutional capacity and administrative feasibility	LE	Eisenack and Stecker, 2012; Murrant et al., 2015
	Transparency and accountability potential	NE	
Socio-cultural	Social co-benefits (health, education)	NA	
	Socio-cultural acceptability	NE	
	Social and regional inclusiveness	NA	

	Intergenerational equity	NA	
Environmental/ecological	Ecological capacity		Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015
	Adaptive capacity/resilience		Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015
Geophysical	Physical feasibility		Eisenack and Stecker, 2012; Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015
	Land use change enhancement potential	LE	Jahandideh-Tehrani et al., 2014; Parkinson and Djilali, 2015
	Hazard risk reduction potential		Jahandideh-Tehrani et al., 2014; Murrant et al., 2015; Parkinson and Djilali, 2015

4.SM.4.3.5 Feasibility Assessment of Overarching Adaptation Options

Table 4.SM.22: Feasibility assessment of overarching adaptation options: disaster risk management, risk spreading and sharing, climate services and indigenous knowledge. For methodology, see 4.SM.4.1.

		Disaster Risk Management		**Risk Spreading and Sharing**		**Climate Services**		**Indigenous Knowledge**	
	Evidence	Medium		Medium		Medium		Medium	
	Agreement	High		Medium		High		High	
Economic	Microeconomic viability		IPCC, 2012; Mavhura et al., 2013; Yu and Gillis, 2014; Johnson and Abe, 2015; Mawere and Mubaya, 2015; Archer, 2016; Kull et al., 2016; Rose, 2016; Watanabe et al., 2016		Panda et al., 2013; Weinhofer and Busch, 2013; Thornton and Herrero, 2014; Falco et al., 2014; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Annan and Schlenker, 2015; Bogale, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Akter et al., 2016, 2017; Jin et al., 2016; Surminski et al., 2016; Patel et al., 2017; Shively, 2017; Farzaneh et al., 2017; Glaas et al., 2017; Jensen and Barrett, 2017		Vaughan and Dessai, 2014; Snow et al., 2016; Lechthaler and Vinogradova, 2017; Webber, 2017; Ouédraogo et al., 2018		Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Pearce et al., 2015; Mapfumo et al., 2016; Altieri and Nicholls, 2017; Nunn et al., 2017; Ruiz-Mallén et al., 2017; Crate et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017
	Macroeconomic viability		IPCC, 2012; Hinkel et al., 2014; Anacona et al., 2015; Johnson and Abe, 2015; Boughedir, 2015;		Cook and Dowlatabadi, 2011; Falco et al., 2014; García Romero and		Brasseur and Gallardo, 2016; Rodrigues et al., 2016		Berkes et al., 2000; Leonard et al., 2013; Mapfumo et al., 2016; Ingty, 2017; Magni,

			Howes et al., 2015; Archer, 2016; Kull et al., 2016; Rose, 2016; Diaz, 2016; Haeberli et al., 2016, 2017; Kelman, 2017; de Leon and Pittock, 2017		Molina, 2015; Joyette et al., 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Wolfrom and Yokoi-Arai, 2015; Surminski et al., 2016; Glaas et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017				2017; Nunn et al., 2017; Ruiz-Mallén et al., 2017
	Socio-economic vulnerability reduction potential		IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Boeckmann and Rohn, 2014; Anacona et al., 2015; Howes et al., 2015; Johnson and Abe, 2015; Kelman et al., 2015; Mawere and Mubaya, 2015; Boughedir, 2015; Archer, 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; Watanabe et al., 2016; Diaz, 2016; Haeberli et al., 2016, 2017; Wallace, 2017; de Leon and Pittock, 2017; Granderson, 2017; Nahayo et al., 2018; Brundiers, 2018		Mills, 2007; Panda et al., 2013; Thornton and Herrero, 2014; Falco et al., 2014; Annan and Schlenker, 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Bogale, 2015; Wolfrom and Yokoi-Arai, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Jin et al., 2016; O'Hare et al., 2016; Surminski et al., 2016; Akter et al., 2017; Patel et al., 2017; Surminski and Thieken, 2017; Farzaneh et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017		Kadi et al., 2011; Jancloes et al., 2014; Vaughan and Dessai, 2014; Lobo et al., 2017		Berkes and Jolly, 2002; Forbes et al., 2009; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Ford et al., 2014; MacDonald et al., 2015b; Pearce et al., 2015; Harper et al., 2015; Mapfumo et al., 2016; Mistry and Berardi, 2016; Clark et al., 2016; Altieri and Nicholls, 2017; Archer et al., 2017; Magni, 2017; Nunn et al., 2017; Ruiz-Mallén et al., 2017; Russell-Smith et al., 2017; Thornton and Comberti, 2017; Williams et al., 2017; Ingty, 2017; Kihila, 2017

	Employment and productivity enhancement potential		Terrier et al., 2011, 2015; IPCC, 2012; Mavhura et al., 2013; Yu and Gillis, 2014; Johnson and Abe, 2015; Mawere and Mubaya, 2015; Archer, 2016; Haeberli et al., 2016, 2017; Kull et al., 2016; Rose, 2016		Panda et al., 2013; Falco et al., 2014; Thornton and Herrero, 2014; Bogale, 2015; Greatrex et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Hansen et al., 2017; Jensen and Barrett, 2017	NE			Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; Pearce et al., 2015; Harper et al., 2015; Clark et al., 2016; Altieri and Nicholls, 2017; Archer et al., 2017; Ruiz-Mallén et al., 2017; Russell-Smith et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017
Technological	Technical resource availability		IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Yu and Gillis, 2014; Boeckmann and Rohn, 2014; Anacona et al., 2015; Johnson and Abe, 2015; Mawere and Mubaya, 2015; Boughedir, 2015; Howes et al., 2015; Allen et al., 2016; Kaya et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Archer, 2016; Diaz, 2016; Haeberli et al., 2016, 2017; Wang et al., 2018		Falco et al., 2014; García Romero and Molina, 2015; Joyette et al., 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Akter et al., 2016; Surminski et al., 2016; Adiku et al., 2017; Jensen and Barrett, 2017		Dinku et al., 2014; Jancloes et al., 2014; Gebru et al., 2015; Weisse et al., 2015; Brasseur and Gallardo, 2016; Cortekar et al., 2016; Singh et al., 2016; Snow et al., 2016; Vaughan et al., 2016; Kihila, 2017		Berkes et al., 2000; Ford et al., 2010; Nakashima et al., 2012; Cunsolo Willox et al., 2013; Leonard et al., 2013; Pearce et al., 2015; Johnson et al., 2015; MacDonald et al., 2015a; Sherman et al., 2016; Altieri and Nicholls, 2017; Magni, 2017; Nunn et al., 2017; Russell-Smith et al., 2017; Inamara and Thomas, 2017; Ingty, 2017; Kihila, 2017
	Risks mitigation potential		IPCC, 2012; Mavhura et al., 2013; Yu and Gillis, 2014; Boughedir, 2015; Mawere and Mubaya, 2015; Howes et al., 2015; Johnson and Abe, 2015; Kelman et al.,		Mills, 2007; Cook and Dowlatabadi, 2011; Panda et al., 2013; Weinhofer and Busch, 2013; Thornton and Herrero, 2014; Falco		Rogers and Tsirkunov, 2010; WMO, 2015		Nakashima et al., 2012; McNamara and Prasad, 2014; Mapfumo et al., 2016; Kihila, 2017; Magni, 2017

			2015; Archer, 2016; Muñoz et al., 2016; Rose, 2016; Haeberli et al., 2016, 2017; Kull et al., 2016; Wallace, 2017; Kita, 2017		et al., 2014; Annan and Schlenker, 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Fabian, 2015; Wolfrom and Yokoi-Arai, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Surminski et al., 2016; Jin et al., 2016; Surminski and Eldridge, 2017; Surminski and Thieken, 2017; Farzaneh et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017				
Institutional	Political acceptability		Carey, 2005, 2008; IPCC, 2012; Boughedir, 2015; Johnson and Abe, 2015; Archer, 2016; Kull et al., 2016; Muñoz et al., 2016; Haeberli et al., 2016; Ruiz-Rivera and Lucatello, 2017; Granderson, 2017; Kelman, 2017; Kita, 2017; Rosendo et al., 2018		García Romero and Molina, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Glaas et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017		Gebru et al., 2015; Vincent et al., 2015; Cortekar et al., 2016; Singh et al., 2016; Snow et al., 2016; Harjanne, 2017; Webber, 2017		Nakashima et al., 2012; Leonard et al., 2013; Ford et al., 2015; Hooli, 2016; Mistry and Berardi, 2016; Fernández-Llamazares et al., 2017; Russell-Smith et al., 2017; Williams et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017; Ruiz-Mallén et al., 2017
	Legal and regulatory acceptability		IPCC, 2012; Boughedir, 2015; Howes et al., 2015; Johnson and Abe,		Falco et al., 2014; Thornton and Herrero, 2014;		Mantilla et al., 2014; Coulibaly et		Berkes et al., 2000; Nakashima et al., 2012; Leonard et al.,

			2015; Kelman et al., 2015; Kull et al., 2016; Muñoz et al., 2016; van der Keur et al., 2016; Haeberli et al., 2016, 2017; Kaya et al., 2016; de Leon and Pittock, 2017; Kita, 2017; Ruiz-Rivera and Lucatello, 2017; Serrao-Neumann et al., 2017; Wallace, 2017; Kelman, 2017; Rosendo et al., 2018		Wolfrom and Yokoi-Arai, 2015; García Romero and Molina, 2015; Joyette et al., 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Surminski et al., 2016; Adiku et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017		al., 2015; Lobo et al., 2017		2013; Hiwasaki et al., 2014; Ford et al., 2015; Hooli, 2016; Ruiz-Mallén et al., 2017; Russell-Smith et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017; Mccubbin et al., 2017
	Institutional capacity and administrative feasibility		Carey, 2008; IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Boughedir, 2015; Kelman et al., 2015; Mawere and Mubaya, 2015; Howes et al., 2015; Johnson and Abe, 2015; Archer, 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; van der Keur et al., 2016; Watanabe et al., 2016; Haeberli et al., 2016, 2017; Kita, 2017; Ruiz-Rivera and Lucatello, 2017; Serrao-Neumann et al., 2017; Wallace, 2017; Granderson, 2017; Kelman, 2017; Nahayo et al., 2018; Rosendo et al., 2018		Cook and Dowlatabadi, 2011; Weinhofer and Busch, 2013; Thornton and Herrero, 2014; Falco et al., 2014; Joyette et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Wolfrom and Yokoi-Arai, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Akter et al., 2016; Surminski et al., 2016; Adiku et al., 2017; Surminski and Eldridge, 2017; Glaas et al., 2017; Hansen et al., 2017; Jenkins		Dinku et al., 2014; Wood et al., 2014; Jancloes et al., 2014; Vaughan and Dessai, 2014; Vincent et al., 2015; Brasseur and Gallardo, 2016; Vaughan et al., 2016; Lourenço et al., 2016; Snow et al., 2016; Trenberth et al., 2016; Harjanne, 2017; Räsänen et al., 2017; Singh et al., 2017		Berkes et al., 2000; Nakashima et al., 2012; Hiwasaki et al., 2014, 2015; Oteros-Rozas et al., 2015; Ford et al., 2015; Johnson et al., 2015; Sherman et al., 2016; Mistry and Berardi, 2016; Fernández-Llamazares et al., 2017; Ruiz-Mallén et al., 2017; Russell-Smith et al., 2017; Williams et al., 2017; Granderson, 2017; Kihila, 2017; Magni, 2017

					et al., 2017; Jensen and Barrett, 2017					
	Transparency and accountability potential		Carey, 2005; IPCC, 2012; Howes et al., 2015; Johnson and Abe, 2015; Kaya et al., 2016; Kita, 2017; Ruiz-Rivera and Lucatello, 2017; Rosendo et al., 2018		Thornton and Herrero, 2014; García Romero and Molina, 2015; Greatrex et al., 2015; Joyette et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Jin et al., 2016; Adiku et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017		Vaughan and Dessai, 2014; Harjanne, 2017; Hewitson et al., 2017		Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; Green and Minchin, 2014; Hiwasaki et al., 2014; Ford et al., 2015; Johnson et al., 2015; Oteros-Rozas et al., 2015; Mistry and Berardi, 2016; Russell-Smith et al., 2017; Magni, 2017; Rapinski et al., 2018
Socio-cultural	Social co-benefits (health, education)		IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Samaddar et al., 2015; Mawere and Mubaya, 2015; Archer, 2016; Watanabe et al., 2016; Haeberli et al., 2016; Kull et al., 2016; Rose, 2016; Brundiers, 2018; Nahayo et al., 2018		Panda et al., 2013; Thornton and Herrero, 2014; Greatrex et al., 2015; Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Adiku et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017		Rogers and Tsirkunov, 2010; Kadi et al., 2011; Hunt et al., 2017		Ford, 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Ford et al., 2014; Green and Minchin, 2014; Cunsolo Willox et al., 2015; Durkalec et al., 2015; MacDonald et al., 2015a, b; Harper et al., 2015; Hiwasaki et al., 2015; Mapfumo et al., 2016; Mistry and Berardi, 2016; Hooli, 2016; Magni, 2017; Kihila, 2017
	Socio-cultural acceptability		Carey, 2005; IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Anacona et al., 2015; Mawere and Mubaya, 2015;		Lashley and Warner, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Bogale, 2015; García Romero and		Sivakumar et al., 2014; Vincent et al., 2015; Brasseur and Gallardo, 2016; Cortekar et al., 2016; Carr and		Natcher et al., 2007; Ford et al., 2010; Cunsolo Willox et al., 2012; Nakashima et al., 2012; Adger et al., 2013; Leonard et al.,

			Samaddar et al., 2015; Archer, 2016; Muñoz et al., 2016; Rose, 2016; van der Keur et al., 2016; Watanabe et al., 2016; Kaya et al., 2016; Kull et al., 2016; Serrao-Neumann et al., 2017; de Leon and Pittock, 2017; Granderson, 2017; Kita, 2017		Molina, 2015; Greatrex et al., 2015; Jin et al., 2016; Adiku et al., 2017; Akter et al., 2017; Farzaneh et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017		Onzere, 2017; Singh et al., 2017; Webber and Donner, 2017; Guido et al., 2018		2013; Green and Minchin, 2014; MacDonald et al., 2015a; Hiwasaki et al., 2015; Johnson et al., 2015; Mapfumo et al., 2016; Hooli, 2016; Tschakert et al., 2017; Kihila, 2017; Flynn et al., 2018
	Social and regional inclusiveness		Carey, 2005; IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Samaddar et al., 2015; Mawere and Mubaya, 2015; Archer, 2016; Rose, 2016; Watanabe et al., 2016; Kaya et al., 2016; Kull et al., 2016; de Leon and Pittock, 2017; Granderson, 2017; Kita, 2017; Nahayo et al., 2018		Falco et al., 2014; Bogale, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Joyette et al., 2015; Akter et al., 2016; Surminski et al., 2016; Jin et al., 2016; Shively, 2017; Farzaneh et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017		Expert judgement Sivakumar et al., 2014; Carr and Onzere, 2017; Webber and Donner, 2017		Berkes et al., 2000; Nakashima et al., 2012; Adger et al., 2013; Leonard et al., 2013; Green and Minchin, 2014; McNamara and Prasad, 2014; MacDonald et al., 2015a; Mistry and Berardi, 2016; Hooli, 2016; Nunn et al., 2017; Ruiz-Mallén et al., 2017; Ingty, 2017; Magni, 2017; Flynn et al., 2018
	Intergenerational equity		IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Mawere and Mubaya, 2015; Archer, 2016; Kaya et al., 2016; Granderson, 2017; Nahayo et al., 2018		Linnerooth-Bayer and Hochrainer-Stigler, 2015; O’Hare et al., 2016; Jensen and Barrett, 2017	NA			Berkes et al., 2000; Ford et al., 2010; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Hiwasaki et al., 2015; MacDonald et al., 2015a; Tschakert et al., 2017; Kihila,

									2017; Magni, 2017; Nunn et al., 2017
Environmental/ecological	Ecological capacity		IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Kelman et al., 2015; Mawere and Mubaya, 2015; Archer, 2016; Haeberli et al., 2016; Kull et al., 2016	NA		NA			Berkes et al., 2000; Forbes et al., 2009; Leonard et al., 2013; McNamara and Prasad, 2014; MacDonald et al., 2015b; Altieri and Nicholls, 2017; Russell-Smith et al., 2017; Tschakert et al., 2017; Ingty, 2017; Kihila, 2017; Magni, 2017; Nunn et al., 2017
	Adaptive capacity/ resilience		IPCC, 2012; Mavhura et al., 2013; McNamara and Prasad, 2014; Boeckmann and Rohn, 2014; Yu and Gillis, 2014; Anacona et al., 2015; Johnson and Abe, 2015; Kelman et al., 2015; Mawere and Mubaya, 2015; Howes et al., 2015; Archer, 2016; Kaya et al., 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; Watanabe et al., 2016; Haeberli et al., 2016, 2017; Kelman, 2017; Wallace, 2017; de Leon and Pittock, 2017; Granderson, 2017; Brundiers, 2018		Mills, 2007; Panda et al., 2013; Thornton and Herrero, 2014; Falco et al., 2014; Bogale, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Nicola, 2015; Wolfrom and Yokoi-Arai, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Lashley and Warner, 2015; O'Hare et al., 2016; Surminski et al., 2016; Jin et al., 2016; Adiku et al., 2017; Hansen et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017		L. Jones et al., 2016; Lourenço et al., 2016; Singh et al., 2017; C.J. White et al., 2017		Berkes et al., 2000; Forbes et al., 2009; Ford et al., 2010; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Pearce et al., 2015; Hiwasaki et al., 2015; Savo et al., 2016; Sherman et al., 2016; Mapfumo et al., 2016; Altieri and Nicholls, 2017; Nunn et al., 2017; Russell-Smith et al., 2017; Kihila, 2017; Magni, 2017; Mccubbin et al., 2017

Geophysical	Physical feasibility		IPCC, 2012; Yu and Gillis, 2014; McNamara and Prasad, 2014; Anacona et al., 2015; Boughedir, 2015; Kelman et al., 2015; Archer, 2016; Muñoz et al., 2016; Diaz, 2016; Haeberli et al., 2016, 2017; Kull et al., 2016	NA			Sivakumar et al., 2014; Snow et al., 2016; C.J. White et al., 2017	NE	
	Land use change enhancement potential	NA			Panda et al., 2013; Annan and Schlenker, 2015; Greatrex et al., 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Hansen et al., 2017; Jenkins et al., 2017; Jensen and Barrett, 2017	NA			Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; McNamara and Prasad, 2014; Pearce et al., 2015; Hiwasaki et al., 2015; MacDonald et al., 2015b; Reyes-García et al., 2016; Mistry and Berardi, 2016; Altieri and Nicholls, 2017; Kihila, 2017; Magni, 2017
	Hazard risk reduction potential		Carey, 2005, 2008; IPCC, 2012; Mavhura et al., 2013; Boeckmann and Rohn, 2014; McNamara and Prasad, 2014; Yu and Gillis, 2014; Anacona et al., 2015; Howes et al., 2015; Johnson and Abe, 2015; Kelman et al., 2015; Mawere and Mubaya, 2015; Boughedir, 2015; Archer, 2016; Kaya et		Mills, 2007; Falco et al., 2014; Annan and Schlenker, 2015; Linnerooth-Bayer and Hochrainer-Stigler, 2015; Wolfrom and Yokoi-Arai, 2015; García Romero and Molina, 2015; Greatrex et al., 2015; Lashley and Warner, 2015; Surminski et al., 2016; Jin et al., 2016; Patel et al.,		Rogers and Tsirkunov, 2010; Lourenço et al., 2016; Singh et al., 2017		Berkes et al., 2000; Nakashima et al., 2012; Leonard et al., 2013; Mistry and Berardi, 2016; Altieri and Nicholls, 2017; Magni, 2017; Nunn et al., 2017; Russell-Smith et al., 2017

			al., 2016; Kull et al., 2016; Muñoz et al., 2016; Rose, 2016; Watanabe et al., 2016; Diaz, 2016; Haeberli et al., 2016, 2017; Kelman, 2017; Kita, 2017; Milner et al., 2017; Wallace, 2017; Brundiers, 2018		2017; Surminski and Eldridge, 2017; Surminski and Thieken, 2017; Farzaneh et al., 2017; Glaas et al., 2017; Hansen et al., 2017; Jensen and Barrett, 2017				

Table 4.SM.23: Feasibility assessment of overarching adaptation options: education and learning, population health and health system adaptation, social safety nets and human migration. For methodology, see 4.SM.4.1.

		Education and Learning		Population Health and Health System Adaptation		Social Safety Nets		Human Migration	
	Evidence	Medium		Medium		Medium		Medium	
	Agreement	High		High		Medium		Low	
Economic	Microeconomic viability		Rumore et al., 2016; Lutz and Muttarak, 2017		Toloo et al., 2013; Burton et al., 2014; Hoy et al., 2014; Paterson et al., 2014; K.R. Smith et al., 2014; Confalonieri et al., 2015; Araos et al., 2016a; Hess and Ebi, 2016; Ebi and del Barrio, 2017; Gilfillan et al., 2017; Paavola, 2017		Shiferaw et al., 2014; Devereux et al., 2015		Birk and Rasmussen, 2014; Betzold, 2015; Ionesco et al., 2016; Musah-Surugu et al., 2018
	Macroeconomic viability		Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017		Ebi et al., 2004; Hess et al., 2012; Hosking and Campbell-Lendrum, 2012; Lesnikowski et al., 2013; Toloo et al., 2013; Bowen et al., 2013; K.R. Smith et al., 2014; Hoy et al., 2014; Austin et al., 2015; Watts et al., 2015; WHO, 2015; Araos et al., 2016a; Paz et al., 2016; Hess and Ebi, 2016; Nitschke et al., 2017; Paavola, 2017; Ebi and del Barrio, 2017; Gilfillan et al., 2017		Devereux et al., 2015		Grecequet et al., 2017; Hino et al., 2017
	Socio-economic vulnerability reduction potential		Frankenberg et al., 2013; K.C., 2013; Striessnig et al., 2013; van der Land and Hummel, 2013; Muttarak and Lutz, 2014; Rumore et al., 2016; Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017		Ebi et al., 2004, 2016; Hess et al., 2012; Hosking and Campbell-Lendrum, 2012; Panic and Ford, 2013; Toloo et al., 2013; Bowen et al., 2013; K.R. Smith et al., 2014; Boeckmann and Rohn, 2014; Austin et al., 2015; Watts et al., 2015; WHO, 2015; Confalonieri et al., 2015; Araos et al., 2016a; Hess and Ebi, 2016; Paz et al., 2016; Benmarhnia et al., 2016; Gilfillan et al., 2017; Nitschke et al., 2017;		Davies et al., 2013; Weldegebriel and Prowse, 2013; Berhane et al., 2014; Eakin et al., 2014; Leichenko and Silva, 2014; Devereux, 2016; Lemos et al., 2016; Godfrey-Wood and Flower, 2017; Schwan and Yu, 2017		Birk and Rasmussen, 2014; Adger et al., 2015; Betzold, 2015; Grecequet et al., 2017; Melde et al., 2017; World Bank, 2017

					Paavola, 2017; Sen et al., 2017; Ebi and del Barrio, 2017; Ebi and Hess, 2017				
	Employment and productivity enhancement potential		van der Land and Hummel, 2013; Muttarak and Lutz, 2014; Lutz and Muttarak, 2017		Bowen et al., 2013; Toloo et al., 2013; Burton et al., 2014; Hoy et al., 2014; K.R. Smith et al., 2014; Benmarhnia et al., 2016; Paz et al., 2016; Gilfillan et al., 2017; Nitschke et al., 2017		Davies et al., 2013; Berhane et al., 2014; Shiferaw et al., 2014	NA	
Technological	Technical resource availability		Chaudhury et al., 2013; Baird et al., 2014; Cloutier et al., 2015; Rumore et al., 2016		Hess et al., 2012; Lesnikowski et al., 2013; Panic and Ford, 2013; Toloo et al., 2013; Bowen et al., 2013; Hoy et al., 2014; Paterson et al., 2014; Rumsey et al., 2014; K.R. Smith et al., 2014; Burton et al., 2014; Austin et al., 2015; WHO, 2015; Confalonieri et al., 2015; Araos et al., 2016a; Paz et al., 2016; Benmarhnia et al., 2016; Ebi et al., 2016; Hess and Ebi, 2016; Nitschke et al., 2017; Paavola, 2017; Sheehan et al., 2017; Ebi and del Barrio, 2017; Ebi and Hess, 2017		Kim and Yoo, 2015		Birk and Rasmussen, 2014; Gemenne and Blocher, 2017; Melde et al., 2017
	Risks mitigation potential		Wamsler et al., 2012; Frankenberg et al., 2013; K.C., 2013; Striessnig et al., 2013; van der Land and Hummel, 2013; Muttarak and Lutz, 2014; Harteveld and Suarez, 2015; Lutz and Muttarak, 2017		Boeckmann and Rohn, 2014; Paterson et al., 2014; Benmarhnia et al., 2016; Hess and Ebi, 2016; Nitschke et al., 2016; Ebi and del Barrio, 2017; Ebi and Hess, 2017		Davies et al., 2013; Rurinda et al., 2014; Shiferaw et al., 2014; Devereux, 2016		Adger et al., 2015; Grecequet et al., 2017; Tadgell et al., 2017
Institutional	Political acceptability	LE	Butler et al., 2015, 2016b; Cloutier et al., 2015		Hess et al., 2012; Lesnikowski et al., 2013; Bowen et al., 2013; Hoy et al., 2014; Rumsey et al., 2014; K.R. Smith et al., 2014; Burton et al., 2014; Austin et al., 2015; Watts et		Porter et al., 2014; Rurinda et al., 2014; Wilhite et al., 2014; Brooks, 2015; Kim and Yoo, 2015; Ravi and		Kothari, 2014; Methmann and Oels, 2015; Brzoska and Fröhlich, 2016; Gemenne and Blocher, 2017; Grecequet et al.,

					al., 2015; WHO, 2015; Confalonieri et al., 2015; Araos et al., 2016a; Hess and Ebi, 2016; Benmarhnia et al., 2016; Ebi et al., 2016; Sen et al., 2017; Ebi and del Barrio, 2017; Gilfillan et al., 2017; Green et al., 2017		Engler, 2015; Schwan and Yu, 2017)		2017; Yamamoto et al., 2017; Matthews and Potts, 2018
	Legal and regulatory acceptability	NE			Hess et al., 2012; Lesnikowski et al., 2013; Burton et al., 2014; Austin et al., 2015; Watts et al., 2015; WHO, 2015; Araos et al., 2016a; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Shimamoto and McCormick, 2017; Ebi and del Barrio, 2017; Gilfillan et al., 2017		Rurinda et al., 2014; Devereux et al., 2015		Wilmsen and Webber, 2015; Tadgell et al., 2017; Ahmed, 2018; World Bank, 2018
	Institutional capacity and administrative feasibility		Wamsler et al., 2012; Chaudhury et al., 2013; Odemerho, 2014; Cloutier et al., 2015; Butler et al., 2016a, b		Ebi et al., 2004, 2016; Hess et al., 2012; Lesnikowski et al., 2013; Panic and Ford, 2013; Toloo et al., 2013; Bowen et al., 2013; Hoy et al., 2014; Nigatu et al., 2014; Paterson et al., 2014; Rumsey et al., 2014; Burton et al., 2014; Austin et al., 2015; Watts et al., 2015; WHO, 2015; Confalonieri et al., 2015; Araos et al., 2016a; Hess and Ebi, 2016; Benmarhnia et al., 2016; Paz et al., 2016; Xiao et al., 2016; Gilfillan et al., 2017; Green et al., 2017; Nitschke et al., 2017; Sheehan et al., 2017; Shimamoto and McCormick, 2017; Ebi and del Barrio, 2017; Ebi and Hess, 2017		Davies et al., 2013; Rurinda et al., 2014; Wilhite et al., 2014; Ravi and Engler, 2015; Schwan and Yu, 2017		Betzold, 2015; Methmann and Oels, 2015; Brzoska and Fröhlich, 2016; Gemenne and Blocher, 2017; Grecequet et al., 2017; Yamamoto et al., 2017; Matthews and Potts, 2018; Thomas and Benjamin, 2018
	Transparency and accountability potential		Chaudhury et al., 2013; Odemerho, 2014; Ensor and Harvey, 2015; Harteveld and Suarez, 2015; Chung Tiam Fook, 2017; Myers et al., 2017; Flynn et al., 2018		Hess et al., 2012; Hosking and Campbell-Lendrum, 2012; Lesnikowski et al., 2013; Panic and Ford, 2013; Hoy et al., 2014; Boeckmann and Rohn, 2014; Austin et al., 2015; Araos et al., 2016a;		Masud-All-Kamal and Saha, 2014; Devereux et al., 2015; Masiero, 2015; Ravi and Engler, 2015; Schwan and Yu, 2017		Methmann and Oels, 2015; Brzoska and Fröhlich, 2016; Tadgell et al., 2017

					Benmarhnia et al., 2016; Ebi et al., 2016; Sheehan et al., 2017; Ebi and del Barrio, 2017; Ebi and Hess, 2017; Gilfillan et al., 2017				
Socio-cultural	Social co-benefits (health, education)		Wamsler et al., 2012; Frankenberg et al., 2013; K.C., 2013; van der Land and Hummel, 2013; Muttarak and Lutz, 2014; Chung Tiam Fook, 2017; Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017		Bowen et al., 2013; K.R. Smith et al., 2014; Hoy et al., 2014; Austin et al., 2015; Watts et al., 2015; Confalonieri et al., 2015; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Paavola, 2017; Shimamoto and McCormick, 2017		Berhane et al., 2014; Leichenko and Silva, 2014; Rurinda et al., 2014; Shiferaw et al., 2014; Verguet et al., 2015; Devereux, 2016; Lemos et al., 2016		Kothari, 2014; Bettini et al., 2016; Gioli et al., 2016; Bhagat, 2017; Melde et al., 2017; Schwan and Yu, 2017; World Bank, 2018
	Socio-cultural acceptability		Chaudhury et al., 2013; Sharma et al., 2013; Demuzere et al., 2014; Odemerho, 2014; Ensor and Harvey, 2015; Butler et al., 2016a; Myers et al., 2017; Flynn et al., 2018		Hess et al., 2012; Bowen et al., 2013; Toloo et al., 2013; K.R. Smith et al., 2014; Hoy et al., 2014; Confalonieri et al., 2015; Watts et al., 2015; WHO, 2015; Ebi et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Nitschke et al., 2017; Sen et al., 2017	LE	Rurinda et al., 2014; Wilhite et al., 2014		Martin et al., 2014; Brzoska and Fröhlich, 2016; Jha et al., 2017; Kelman et al., 2017; Huntington et al., 2018
	Social and regional inclusiveness		Wamsler et al., 2012; Muttarak and Lutz, 2014; Suarez et al., 2014; Ensor and Harvey, 2015; Ford et al., 2016, 2018		Hosking and Campbell-Lendrum, 2012; Bowen et al., 2013; Panic and Ford, 2013; Toloo et al., 2013; K.R. Smith et al., 2014; Burton et al., 2014; Hoy et al., 2014; Watts et al., 2015; WHO, 2015; Confalonieri et al., 2015; Benmarhnia et al., 2016; Paz et al., 2016; Ebi et al., 2016; Hess and Ebi, 2016; Sen et al., 2017; Ebi and del Barrio, 2017; Paavola, 2017	NA			Kothari, 2014; Kelman, 2015; Schwan and Yu, 2017; Matthews and Potts, 2018; World Bank, 2018
	Intergenerational equity	LE	Striessnig et al., 2013		Ebi et al., 2004; Confalonieri et al., 2015; Benmarhnia et al., 2016; Ebi and del Barrio, 2017; Paavola, 2017)	NA			Wilmsen and Webber, 2015
Environm	Ecological capacity	NA		NA		NA			Niven and Bardsley, 2013; Birk and Rasmussen, 2014
	Adaptive capacity/resilience		K.C., 2013; Sharma et al., 2013; Striessnig et al., 2013;		Hess et al., 2012; Toloo et al., 2013; K.R. Smith et al., 2014; Confalonieri		Davies et al., 2013; Weldegebriel and		Birk and Rasmussen, 2014; Adger et al., 2015;

			Frankenberg et al., 2013; Baird et al., 2014; Lutz et al., 2014; Muttarak and Lutz, 2014; Suarez et al., 2014; Tschakert et al., 2014; Butler and Adamowski, 2015; Oteros-Rozas et al., 2015; Pearce et al., 2015; Ensor and Harvey, 2015; Janif et al., 2016; Butler et al., 2016a, b; Star et al., 2016; Vinke-de Kruijf and Pahl-Wostl, 2016; Harvey et al., 2017; Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017; Myers et al., 2017; Chung Tiam Fook, 2017; Cochrane et al., 2017; Flynn et al., 2018; Ford et al., 2018		et al., 2015; Watts et al., 2015; WHO, 2015; Benmarhnia et al., 2016; Hess and Ebi, 2016; Paz et al., 2016; Ebi and del Barrio, 2017; Nitschke et al., 2017; Paavola, 2017; Sen et al., 2017		Prowse, 2013; Eakin et al., 2014; Rurinda et al., 2014; Shiferaw et al., 2014; Lemos et al., 2016; Schwan and Yu, 2017		Grecequet et al., 2017; Melde et al., 2017; Tadgell et al., 2017; World Bank, 2018
Geophysical	Physical feasibility	NA		NA		NA			Niven and Bardsley, 2013; Hino et al., 2017; Matthews and Potts, 2018
	Land use change enhancement potential	NA		NA		NA		LE	Matthews and Potts, 2018
	Hazard risk reduction potential		Wamsler et al., 2012; Frankenberg et al., 2013; K.C., 2013; Striessnig et al., 2013; Muttarak and Lutz, 2014; Suarez et al., 2014; Harteveld and Suarez, 2015; Hoffmann and Muttarak, 2017; Lutz and Muttarak, 2017	NA			Jones et al., 2010; Davies et al., 2013		Birk and Rasmussen, 2014; Cattaneo and Peri, 2016; Grecequet et al., 2017; Tadgell et al., 2017; Crnčević and Orlović Lovren, 2018; World Bank, 2018

4.SM.5 Adaptation and Mitigation Synergies and Trade-offs as Discussed in Section 4.5.4

Mitigation options may affect the feasibility of adaptation options, and the other way around. Table 4.SM.24 provides examples of possible positive impacts (synergies) and negative impacts (trade-offs) of mitigation options for adaptation. Table 4.SM.25 lists examples of synergies and trade-offs of adaptation options for mitigation.

4.SM.5.1 Mitigation Options with Adaptation Synergies and Trade-offs

Table 4.SM.24: Mitigation options with adaptation synergies and trade-offs identified.

System	Mitigation Option	Synergies	Trade-offs
Energy system transitions	Wind energy (on-shore and off-shore)	Resilience can be increased by wind, solar and bioenergy due to distributed grids (Parkinson and Djilali, 2015), given that energy security standards are in place (Almeida Prado et al., 2016). The use of residential batteries can increase resilience, especially after extreme weather events (Qazi and Young Jr., 2014; Liu et al., 2017). A shift from coal-generated to natural gas-generated electricity could decrease water consumption (DeNooyer et al., 2016).	Renewable energy infrastructure that does not follow security standards can increase vulnerability (Ley, 2017).
	Solar photovoltaic (PV)		
	Bioenergy		
	Electricity storage		
	Power sector CCS	NE	Some renewable energy technologies, carbon dioxide capture and storage (CCS), and concentrating solar power technologies have substantial water demand associated with their operation (Fricko et al., 2016). In particular, lower power plant efficiency due to CCS increases the vulnerability to water constraints in most regions (McCollum et al., 2013; van Vliet et al., 2016).
	Nuclear energy	Increased safety and protection standards can improve the climate risk profiles (Schneider et al., 2017).	Increased safety and protection standards will increase costs, making some electricity systems less reliable (Jacobson and Delucchi, 2009; Lovins et al., 2018).
Land and ecosystem transitions	Reduced food wastage and efficient food production	Reducing food loss and waste can decrease pressure of deforestation (FAO, 2013a), pressure on land use for agriculture (Foley et al., 2011; Hiç et al., 2016), and provide long-term food security (Bajželj et al., 2014).	NA
	Dietary shifts	Shift from animal- to plant-related diets can significantly decrease land use and biodiversity loss due to a decrease in pressure on land use by livestock production (Newbold et al., 2015; Ramankutty et al., 2018; Sparovek et al., 2018) along with health benefits (Tilman and Clark,	Shift from animal- to plant-related diets will require improvement of mixed crop-livestock systems, which are more difficult to manage well and need higher capital to be established (Ramankutty et al., 2018).

		2014; Westhoek et al., 2014; Hallström et al., 2017; Song et al., 2017).	
	Sustainable intensification of agriculture	Agroforestry practices increase soil carbon stocks and above-ground biomass as well as diversify incomes, reducing financial risk, and provide shade for protection from rising temperatures (Harvey et al., 2014). Agroforestry can sustain or increase food production in some systems, increasing farmers' resilience to climate change (Jones et al., 2012). Mixed agroforestry systems may simultaneously meet the water, food, energy and income needs of densely populated rural and peri-urban areas (van Noordwijk et al., 2016).	Sustainable intensification can increase offsite impacts from fertilizer, herbicide and pesticide use (Stevens and Quinton 2009), increase costs and increase climate risk. No-tillage without pairing with other agronomic practices can reduce crop yields. No-till agriculture can reduce GHG emissions but increase pesticide concentrations (Stevens and Quinton, 2009). Adaptation gains made through improved irrigation efficiency can be undermined by shifts to water-intensive crops for mitigation (e.g., shifting to bioenergy crops) (Chaturvedi et al., 2015). Conservation agriculture reduces yields 3–5 years after adoption, but enhances productivity and carbon sequestration over longer periods (Harvey et al., 2014). Agroforestry can, in some dry environments, increase competition with crops and pastures, decreasing productivity, and reduce catchment water yield (Schrobback et al., 2011). Fast-growing tree monocultures or biofuel crops may enhance carbon stocks but reduce downstream water availability and decrease availability of agricultural land (Harvey et al., 2014). Agricultural intensification that improves crop productivity can increase incomes but undermine local livelihoods and well-being as seen in shifts to intensified sugarcane production in Ethiopia or more intensive land use in Southeast Asia (Liao and Brown, 2018).
	Ecosystem restoration	Sustainable water management – restored/healthy ecosystems provide water storage and filtration services (Jones et al., 2012). Restoration of mangroves and coastal wetlands to sequester (blue) carbon increases carbon sinks, reduces coastal erosion and protects from storm surges, and otherwise mitigates impacts of sea level rise and extreme weather along the coast line (Alongi, 2008; Siikamäki et al.,	A focus on mitigation, for example, through REDD+, can result in conservation-priority sites with lower carbon densities to end up without REDD+ protection (Phelps et al., 2012; Murray et al., 2015; Turnhout et al., 2017; Reside et al., 2018). Potential conflict with biodiversity goals in habitat restoration and forest production efforts (Felton et al., 2016).

		2012; Romañach et al., 2018). Blue biofuels do not compete for land and water and are not global food staples (posing less of a food security issue). Most farms do not use fertilizer and could even remove excess nutrients, decreasing eutrophication (Turner et al., 2009; Duarte et al., 2013). Stabilization and support of fisheries can add value to marine biodiversity (Turner et al., 2009). Carbon offset funds provide opportunities for protection and restoration of native ecosystems, with corresponding gains for biodiversity and reductions in carbon (Reside et al., 2017). Coupled with biodiversity and conservation interventions, ecosystem restoration and avoided deforestation can complement habitat provision (Felton et al., 2016). Forests (through REDD+) can support economies dependent on climate-sensitive sectors including agriculture, fisheries and energy (Somorin et al., 2016; Few et al., 2017). REDD+ has the potential to promote sustainable development activities through the cash-flow from donors/international funds to local forest stakeholders (West, 2016). Tropical reforestation for climate change mitigation can help to protect rural economies from impacts of climate variation, reduce impacts of climatic variation on water cycle and associated human uses, reduce local impacts of extreme weather events and reduce climate impacts on biodiversity (Locatelli et al., 2015b).	Some projects worldwide do not target REDD+ projects on adaptation or resilience, nor local contexts, in some cases leaving negative livelihoods impacts (McElwee et al., 2016; Few et al., 2017). In some cases, there is a perception of the inability to reconcile development and environmental interests (Pham et al., 2017). Local benefits, especially for indigenous communities, will only be accrued if land tenure is respected and legally protected, which is not often the case for indigenous communities (Brugnach et al., 2017).
	Novel technologies	Breeding animals with lower emissions per unit of dry matter intake can reduce GHG emissions; when integrated within broader breeding programmes, this can offer synergies with breeding for improved adaptation to local conditions (Pickering et al., 2015; Nguyen et al., 2016).	May have consumer health concerns that need evaluation and addressing (Barrows et al., 2014; Fraser et al., 2016).

Urban and infrastructure system transitions	Land-use and urban planning	Potential for synergies in urban planning at policy, organizational and practical levels (e.g., urban regeneration, retrofitting, urban greening) (Landauer et al., 2015). Spatial planning can enhance adaptation, mitigation and sustainable development (Hurlimann and March, 2012; Davidse et al., 2015; King et al., 2016; Francesch-Huidobro et al., 2017). Through the use of integrated approaches there is potential synergy in land-use planning (e.g., maintenance of urban forests, urban greening) (Newman et al., 2017). Urban densification to reduce emissions can go along with regenerative qualities for green spaces and reduced urban heat islands and flooding impacts by employing biophilic urbanism design (Beatley, 2011; Newman et al., 2017).	Potential conflicts include urban densification to reduce emissions which can intensify heat island effects and increase surface run-off, and may compete with a desire to expand green space and restore local ecosystems (Landauer et al., 2015; Di Gregorio et al., 2017b; Endo et al., 2017; Ürge-Vorsatz et al., 2018), though demonstrations of biophilic urbanism show this can be managed (Beatley, 2011; Newman et al., 2017). In water-scarce regions, there may be trade-offs between mitigation measures that require water – such as localized cooling – and the population's water needs (Georgescu et al., 2015).
	Sustainable and resilient transport systems	Cities can re-urbanize in ways that promote transport sector adaptation and mitigation (Newman et al., 2017; Salvo et al., 2017; Gota et al., 2018). Cities that reduce the use of private cars and develop sustainable transport systems can simultaneously benefit from reduced air pollution, congestion and road fatalities while reducing overall energy intensity in the urban transport sector (Goodwin and Van Dender, 2013; Newman and Kenworthy, 2015; Wee, 2015). Non-motorized transport use is associated with lower emissions and better public health in cities. Urbanization and improved access to basic services correlate with lower short-term morbidity, such as fever, cough and diarrhea (Ahmad et al., 2017). Promoting energy-efficient mobility systems, for instance by a 10% increase in bicycling, could lower chronic conditions like diabetes and cardio-vascular diseases for 0.3 million people while also abating emissions (Ahmad et al., 2017).	In middle and low income countries urban density of informal settlements is typically associated with a range of water and vector-borne health risks that undermine benefits of energy efficiency; these may provide a notable exception to the adaptive advantages of urban density (Mitlin and Satterthwaite, 2013; Lilford et al., 2017) unless new approaches using leapfrog technology are used to upgrade slums in situ (Teferi and Newman, 2017).
	Sharing schemes in transportation	Greater use of sharing schemes can make transportation from vulnerable areas more equitable and ordered (Gomez et al., 2015; Ambrosino et al., 2016; Kent and Dowling, 2016).	Highly ICT-dependent sharing schemes may not be resilient during disasters, but this can be managed via local shared

			mobility systems related to local social capital (Mathbor, 2007; Bhakta Bhandari, 2014; McCloud et al., 2014).
	Public transport	Greater use of public transport enables more mass exit strategies from disasters (Wolshon et al., 2013).	Highly ICT-dependent public transport may not be resilient during disasters but this can be managed via local shared mobility systems related to local social capital (Mathbor, 2007; Bhakta Bhandari, 2014; McCloud et al., 2014).
	Smart grids	Greater resilience in electricity due to system feedback to damaged areas and other grid enhancements due to more localised data (Blaabjerg et al., 2004; IRENA, 2013; IEA, 2017c; Majzoobi and Khodaei, 2017).	NA
	Efficient appliances	Energy efficiency appliances (including lighting and ICT) reduce energy consumption and improve grid reliability (Chaturvedi and Shukla, 2014). They can provide demand response to absorb variation in the electricity supply due to disruption. In addition, when coupled with PV and storage, efficient appliances can secure energy supply when energy networks are down due to storms, hurricanes and other climate-induced events.	NA
	Low/zero-energy buildings	Building codes not only improve energy efficiency through insulation and air-tightness in buildings but also make them more capable of maintaining an indoor temperature during heat waves or power losses, to shelter people from heat waves and provide structural capability to withstand extreme weather and flooding (Houghton, 2011; King et al., 2016). Other examples of synergies are green roofs that provide insulation, cooling and rain water harvesting (Razzaghmanesh et al., 2016).	NE
Industrial system transitions	Energy efficiency	Reduced competition for resources (Hennessey et al., 2017).	Water-energy trade-offs exist in the production process adjustment, which is conventionally promoted as a key energy-saving measure in the iron and steel industry (C. Wang et al., 2017).
	Bio-based and circularity	Reduced competition for resources (Hennessey et al., 2017). Biomass production for industry, if well-managed, can diversify local livelihoods, enhance incomes and strengthen local institutions (Locatelli et al., 2015b).	NE
	Electrification and hydrogen	NA	Greater reliance on variable and weather-dependent sources of electricity (Philibert, 2017).
	Industrial CCUS	NA	Cooling requirements for carbon dioxide capture put pressure on adaptation (Magneschi et al., 2017).

Carbon dioxide removal	Bioenergy with CCS (BECCS)	Bioenergy, if well-managed, can diversify local livelihoods, enhance incomes and strengthen local institutions (Locatelli et al., 2015b). Combining BECCS with soil carbon management, agroforestry and afforestation can remove carbon dioxide, while limiting adverse impacts on water, food and biodiversity (Burns and Nicholson, 2017; Stoy et al., 2018).	Bioenergy plantations can decrease food security, compete for land and provide short-term benefits for only a few stakeholders (Locatelli et al., 2015a).
	Afforestation and reforestation	Reforestation connecting fragmented forests reduces exposure to forest edge disturbances (Pütz et al., 2014). Reforestation and coastal restoration are associated with improved water filtration, ground water recharge and flood control (Ellison et al., 2017; Griscom et al., 2017). Reduce flooding through decreased peak river flow, improved water quality and groundwater recharge (Berry et al., 2015). Increase diversity and habitat availability (when properly managed) (Berry et al., 2015). Tree planting led to more resilient livestock by providing shade and shelter (Hayman et al., 2012). Forestry, if well-managed, can diversify local livelihoods, enhance incomes and strengthen local institutions (Locatelli et al., 2015a). Afforestation of degraded areas can produce large synergies between mitigation and adaptation through their impact on farmer livelihoods (Rahn et al., 2014).	Water: increases water demand, reducing catchment yield (Berry et al., 2015). Biodiversity: species and habitat loss due to monocultures, chemical inputs or forest management (Berry et al., 2015). Loss of agricultural land (Berry et al., 2015). Forest plantations can decrease food security, compete for land and provide short-term benefits for only a few stakeholders (Locatelli et al., 2015a). Local benefits, especially for indigenous communities, will only be accrued if land tenure is respected and legally protected, which is not often the case for indigenous communities (Brugnach et al., 2017).
	Soil carbon sequestration and biochar	With agroforestry, carbon dioxide is sequestered through the additional trees planted, and tree products provide livelihood to communities (Verchot et al., 2007; Nair et al., 2009; Branca et al., 2013; Lasco et al., 2014; Mbow et al., 2014a; P. Smith et al., 2014). Soil organic carbon may foster crop resilience to climate change (Aguilera et al., 2013). Biochar application to soil sequesters carbon dioxide and at the same time increases crop productivity by up to 10% (Jeffery et al., 2011) and	Biochar amendments lead to plant growth and thus may down-regulate plant defence genes, increasing the vulnerability against insects, pathogens and drought (Viger et al., 2015).

		can improve the soil's water balance (Bamminger et al., 2016).	
	Enhanced weathering	NE	Potential adverse health effects because of air particles (Taylor et al., 2016).

4.SM.5.2 Adaptation Options with Mitigation Synergies and Trade-Offs

Table 4.SM.25: Adaptation options with mitigation synergies and trade-offs identified.

System	Adaptation Option	Synergies	Trade-offs
Energy system transitions	Power infrastructure, including water	Some adaptation options can help improve system efficiency and reliability (Cortekar and Groth, 2015; van Vliet et al., 2016). Synergies with Sustainable Development Goals, poverty and well-being (Dagnachew et al., 2018; Fuso Nerini et al., 2018; Gi et al., 2018).	A shift from open-loop to closed-loop cooling technologies could decrease withdrawals, with the trade-off of increasing water consumption for power generation (DeNooyer et al., 2016).
Land and ecosystem transitions	Conservation agriculture	Agroecological practices can reduce farm-scale carbon footprint significantly (Rakotovao et al., 2017). Practices, such as improved soil conservation practices in coffee agroforestry systems and improved slash and mulch agroforestry in bean-maize cultivation, have low carbon footprint reduction potential and medium carbon sequestration potential (Rahn et al., 2014). Land and water management adaptation measures have mitigation co-benefits through soil/atmospheric carbon sequestration, reduced emissions, soil nitrification and reduced use of inorganic fertilisers (Chandra et al., 2016). Conservation agriculture reduces yields 3–5 years after adoption, but enhances productivity and carbon sequestration over longer periods (Harvey et al., 2014). For conservation agriculture and efficient irrigation, synergies are regionally differentiated (Lobell et al., 2013).	Technologies enhancing farm productivity (such as adding fertilizers) might improve adaptive capacity through higher incomes but at the same time drive GHG emissions (Harvey et al., 2014; Thornton et al., 2017). In some cases, conservation agriculture practices can increase emissions (Gupta et al., 2016).
	Efficient irrigation	Improving irrigation efficiency has adaptation and mitigation co-benefits (Zou et al., 2012; Adenle et al., 2015; Suckall et al., 2015; Win et al., 2015). Efficient irrigation practices such as drip irrigation have, on average, 80% lower N_2O emissions than sprinkler systems. Drip irrigation combined with optimized fertilization reduces direct N_2O emissions by up to 50% (Sanz-	Micro-irrigation technologies such as drip and sprinkler irrigation increase irrigation efficiency but increase energy demand (Rasul and Sharma, 2016). Biomass production for biofuels may contribute to regional water shortages, salinization and water logging (Beringer et al., 2011).

		Cobena et al., 2017). Solar-powered drip irrigation significantly increases household income and nutritional intake, enables households to meet daily water needs and saves 0.86 tons of carbon emissions each year against a liquid fuel (e.g., kerosene) alternative (Suckall et al., 2015).	
	Efficient livestock systems	Strong synergies between climate change adaptation and mitigation in the livestock sector (Weindl et al., 2015; Rivera-Ferre et al., 2016) but these are differentiated by region and type of livestock system (Locatelli et al., 2015a; Thornton et al., 2017). For example, shifting from grazing to mixed livestock systems increase productivity while reducing GHG emissions, by gains in feed and forage productivity through more intensive inputs and management (Rivera-Ferre et al., 2016). Shifting towards mixed crop-livestock systems is a resource- and cost-efficient option (Herrero et al., 2015; Weindl et al., 2015; Thornton et al., 2018). Reducing livestock diseases can improve the productivity of livestock systems and increase their resilience to stresses while reducing the emissions intensity of livestock production (Bartley et al., 2016; FAO and NZAGRC, 2017). Adaptation through livestock supplementation and reducing stocking densities can reduce methane emissions (Locatelli et al., 2015a). Improved grassland management and appropriate stocking density can help to increase soil carbon stocks (Rivera-Ferre et al., 2016; Thornton et al., 2017).	Increased productivity of livestock systems generally increases overall food production and absolute GHG emissions, albeit at lower emissions per unit of food (Gerber et al., 2013; FAO and NZAGRC, 2017). Shifting to rangeland for feed can strongly increase tropical deforestation (Weindl et al., 2015). Shifting to mixed crop-livestock systems is expected to cause additional GHG emissions (Weindl et al., 2015). Providing cooling and ventilation systems for livestock (as an adaptation to higher temperatures) can increase GHG emissions (Locatelli et al., 2015a). Some adaptation options such as interregional livestock trading can increase carbon dioxide emissions through transportation (Rivera-Ferre et al., 2016).
	Agroforestry	Sequesters carbon through accumulation in woody biomass and soil (Lasco et al., 2014). Reduces GHG emissions through reduced deforestation and fossil fuel consumption (Lasco et al., 2014). Coupling native forest regeneration in concert with sugarcane bioethanol production can significantly increase carbon storage in the bioenergy production system and preserve biodiversity (Rodrigues et al., 2009; Buckeridge et al., 2012). The use of fertilizer-fixing trees can improve soil fertility through nitrogen	Lower carbon sequestration potential compared with natural forest and secondary forest (Lasco et al., 2014).

		fixation, by increasing supply of nutrients for crop production (Coulibaly et al., 2017). Integrating crop, livestock and forestry systems, such as in Brazil (Gil et al., 2015), can come with significant benefits for local farmers and ecosystems, for example, by rehabilitation of degraded pasturelands, which can also decrease emissions.	
	Food loss and waste management	Waste materials can be transformed into products with marketable value (Papargyropoulou et al., 2014), improving economic gain and stimulating decrease of food waste and loss.	NA
	Community-based adaptation	NE. Most literature addresses synergies with sustainable development, poverty and equity.	NE. Most literature addresses trade-offs with sustainable development, poverty and equity.
	Ecosystem restoration and avoided deforestation	Tropical reforestation as an adaptation measure can also result in significant carbon storage under climate-smart strategies (Locatelli et al., 2015b). Habitat restoration, afforestation and reforestation and urban trees and greenspace all lead to carbon sequestration (Berry et al., 2015).	Failure to consider mitigation in adaptation initiatives may lead to adaptation measures that increase GHG emissions, which is one type of maladaptation (Porter et al., 2014b; Kongsager et al., 2016).
	Biodiversity management	Biodiversity has value in terms of ecosystem services as well as protection/defence against invading species and disease organisms. Maintaining for high levels of biodiversity also recognises the fact that many species, biological processes and molecules in nature are as yet unexplored, yet have potential to provide enormous benefits to human beings (Knowlton et al., 2010; Pereira et al., 2010; Onaindia et al., 2013; Pistorious and Kiff, 2017; Price et al., 2018).	Areas with greatest potential for protecting biodiversity may not overlap with areas with most potential for carbon sequestration (Phelps et al., 2012; Essl and Mauerhofer, 2018).
	Coastal defence and hardening	NE	An alternative strategy is not to 'defend' using hardening structures along coastlines, but rather to retreat as sea levels rise and storm surges go further inland. The strategy of 'retreat' tends to make economic sense while at the same time accommodating the transition from terrestrial to marine systems (e.g., migration of salt marsh, mangroves and seagrass towards the land as sea levels rise) (C.J. Brown et al., 2016; Mills et al., 2016). There has been an increasing focus on natural barriers to storm surge and erosion, such as mangroves, oyster banks, coral reefs and seagrass meadows. Within these broad options, there are trade-offs that involve direct human intervention (e.g., coastal hardening, seawalls and artificial reefs) (Rinkevich, 2014, 2015; André et al., 2016; Cooper et al.,

			2016; Narayan et al., 2016), while there are others that exploit the opportunities for increasing coastal protection by involving naturally occurring oyster banks, coral reefs, mangroves, seagrass and other ecosystems (UNEP-WCMC, 2006; Scyphers et al., 2011; Zhang et al., 2012; Ferrario et al., 2014; Cooper et al., 2016). Protection using materials such as concrete to provide a barrier against the ocean. These structures can be installed quickly but the trade-off is that they have a range of negative consequences such as being expensive, interrupting natural ecosystems (Mills et al., 2016; Wernberg et al., 2016), being short-term solutions to the long-term problem of sea level rise and intensifying storm systems (Brooke et al., 1992; Building Futures and ICE, 2010; Mills et al., 2016).
	Sustainable aquaculture	NE	Regulating and avoiding loss of coastal ecosystems such as mangroves and seagrass, while at the same time developing food materials that have much lower impact on the environment (Schlag, 2010; Asiedu et al., 2017a, b).
	Fisheries restoration	Development of more sustainable practices also has benefits for ocean ecosystems in general. Fish play a crucial role in everything from maintaining ecological balances through their feeding habits to playing important roles within nutrient cycles in a range of habitats (Holmlund and Hammer, 1999).	NE
	Coastal and marine biodiversity management	NE	Planning for multiple objectives (e.g., biodiversity protection and carbon sequestration) increases the complexity of planning processes and data needs, accompanied by an increase in technical capacity by planners .
	Integrated coastal zone management	Mangroves serve as sinks for carbon, through accumulation of living biomass and through litter and dead wood deposition, including the trapping of sediments delivered from the uplands (Romañach et al., 2018).	NE
Urban and infrastructure system transitions	Sustainable land-use and urban planning	Potential for synergies in urban planning at policy, organizational and practical levels, for example, urban regeneration or retrofitting policies and urban greening (Landauer et al., 2015; Ürge-Vorsatz et al., 2018), including generating a shared sense of risks and promoting local participation (Archer et al., 2014; Kettle et al., 2014; Campos et al., 2016; Siders, 2017).	Promotion of green spaces to reduce flood risk and heat island effects may reduce potential for the promotion of urban densification (Landauer et al., 2015; Di Gregorio et al., 2017b; Endo et al., 2017; Ürge-Vorsatz et al., 2018).

		Urban planning can enhance adaptation, mitigation and sustainable development (Hurlimann and March, 2012; Davidse et al., 2015; King et al., 2016; Francesch-Huidobro et al., 2017). Land-use management for co-benefits can result in carbon sequestration (Duguma et al., 2014; Woolf et al., 2018).	
	Sustainable water management	Strong co-benefits to the implementation of demand-side management measures, such as reducing leakages and water loss (Wang et al., 2011; Deng and Zhao, 2015), while minimizing the need to address the environmental and energy implications of supply measures such as desalination (Miller et al., 2015).	Increasing water quality is linked to increasing energy use in the water sector (Rothausen and Conway, 2011; Mamais et al., 2015).
	Green infrastructure and ecosystem services	Urban canopy is a cooling mechanism that can help decrease heat and water stress (Hines, 2017).	Not considering the role green cover and vegetation has within the heat-water-vegetation nexus can worsen heat and water stress (Hines, 2017).
	Building codes and standards	Sustainable construction materials, reduced building energy consumption and construction designed to reduce the urban heat island effects can have adaptation and mitigation benefits (Steenhof and Sparling, 2011; Aerts et al., 2014; Stewart, 2015; Shapiro, 2016; Ürge-Vorsatz et al., 2018).	NE
Industrial system transitions	Intensive industry infrastructure resilience and water management	Some adaptation options can help improve system efficiency when implementing water management and cooling practices.	NE
Overarching adaptation options	Disaster risk management	Incorporating environmental considerations into recovery decision-making (Amin Hosseini et al., 2016), implementing disaster risk management plans and increasing ex-ante resilience to disasters are important to reduce the extent of rebuilding following disasters, and the emissions associated with recovery. Post-disaster recovery can help rebuild in a more resilient way with less GHG emissions, or to 'build back better', particularly where immediate impact is substantial but not overwhelming (Guarnacci, 2012; Mochizuki and Chang, 2017). Effective disaster risk management may reduce the need for international	The urgency of recovery and the surge in demand for construction materials have been observed to promote unsustainable behaviours, including deforestation (Nazara and Resosudarmo, 2007; Chang et al., 2010) or uncontrolled extraction of sand and gravel (Abrahams, 2014). 'Build back better' requires capacity, time and mechanisms for balancing competing desires and perspectives that are not necessarily available after severe disasters, and may be challenged by both local and external influences in the rebuilding process (Abrahams, 2014; O'Hare et al., 2016; Paidakaki and Moulaert,

		transport of materials and other forms of aid, which can be emissions-intensive (Abrahams, 2014).	2017).
	Risk spreading and sharing	In response to the substantial risk posed to the insurance industry by climate change (Bank of England, 2015; Glaas et al., 2017), insurance companies are mobilizing their role as investment managers to promote climate mitigation; for example, in 2014, insurance companies pledged to invest 420 billion USD over five years in renewable energy, energy efficiency and sustainable agriculture projects (Fabian, 2015; Webster and Clarke, 2017).	Agricultural insurance may have unintended impacts, promoting the intensification of land use in some cases (Annan and Schlenker, 2015; Müller and Kreuer, 2016; Müller et al., 2017).
	Climate services	Climate services aid adaptation decision-making and can help mitigate GHGs through improving farm practices (e.g., matching fertilizer use with existing weather conditions so that less GHGs are emitted) (Thornton et al., 2017).	NE
	Indigenous knowledge	Revitalization of traditional management of agriculture may simultaneously increase resilience, improve biodiversity and reduce emissions by eliminating agrochemical inputs production to food production (Nyong et al., 2007; Niggli et al., 2009; Altieri and Nicholls, 2017). Recognizing and supporting indigenous management of blue carbon habitats (Vierros, 2017) and grasslands (Dong, 2017; Russell-Smith et al., 2017) and utilizing new technologies to revitalize traditional forms of energy provision (Thornton and Comberti, 2017) can provide mitigation and adaptation benefits.	Projects that use a single dimension of indigenous knowledge (e.g., savannah burning for carbon sequestration) without considering the full context of that knowledge risk limiting associated adaptation-mitigation synergies and losing the complexities of indigenous knowledge systems (Mistry et al., 2016).
	Population health and health system	Forest retention and urban agricultural land are forms of urban green infrastructure that can simultaneously mediate floods, promote healthy lifestyles and reduce emissions and air pollution. (Nowak et al., 2006; Tallis et al., 2011; Elmqvist et al., 2013a; Buckeridge, 2015; Culwick and Bobbins, 2016; Panagopoulos et al., 2016; Stevenson et al., 2016; R. White et al., 2017).	The use of air conditioners to meet health standards could result in increased emissions (Ürge-Vorsatz et al., 2018).
	Social safety nets	Public work programmes structured to address climate risks; for example, Ethiopia's Productive Safety Net Programme has been used to employ locals suffering from food insecurity to work on watershed management interventions, sequestering carbon in the soil and reducing GHG emissions (Jirka et al., 2015).	Where cash transfers to households to build adaptive capacity are not conditional, limited increases in purchasing power can prompt families to invest in additional consumption, transport or agricultural equipment as part of a general risk reduction strategy (Lemos et al., 2016; Nelson et al., 2016); aggregated, these individual investments could lead to increased emissions.

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