Annex A: Glossary

Date of Draft: 6/01/2020

Note: This Glossary defines some specific terms as the Lead Authors intend them to be interpreted in the context of this report.

2030 Agenda for Sustainable Development
A UN resolution in September 2015 adopting a plan of action for people, planet and prosperity in a new global development framework anchored in 17 Sustainable Development Goals (UN, 2015).

Acceptability of policy or system change
The extent to which a policy or system change is evaluated unfavourably or favourably, or rejected or supported, by members of the general public (public acceptability) or politicians or governments (political acceptability). Acceptability may vary from totally unacceptable/fully rejected to totally acceptable/fully supported; individuals may differ in how acceptable policies or system changes are believed to be.

Adaptation
In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.

Adaptation limits
The point at which an actors objectives (or system needs) cannot be secured from intolerable risks through adaptive actions. Hard adaptation limit - No adaptive actions are possible to avoid intolerable risks. Soft adaptation limit - Options may exist but are currently not available to avoid intolerable risks through adaptive action.

Incremental adaptation
Adaptation that maintains the essence and integrity of a system or process at a given scale (Park et al., 2012). In some cases, incremental adaptation can accrue to result in transformational adaptation (Tàbara et al., 2018; Termeer et al., 2017). Incremental adaptations to change in climate are understood as extensions of actions and behaviours that already reduce the losses or enhance the benefits of natural variations in extreme weather / climate events.

Transformational adaptation
Adaptation that changes the fundamental attributes of a social-ecological system in anticipation of climate change and its impacts.

See also *Adaptation options, Adaptive capacity,* and *Maladaptive actions (Maladaptation)*

Adaptation options
The array of strategies and measures that are available and appropriate for addressing adaptation. They include a wide range of actions that can be categorised as structural, institutional, ecological or behavioural.

Adaptive capacity

The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences (IPCC, 2014; MA, 2005).

Adverse side-effect
The negative effects that a policy or measure aimed at one objective might have on other objectives, without yet evaluating the net effect on overall social welfare. Adverse side-effects are often subject to uncertainty and depend on, among others, local circumstances and implementation practices.

See also *Co-benefits* and *Risk*

Affluence
In general, personal disposable income is used as a common indicator of affluence, but it also implies property ownership, wealth, and access to education, opportunities, and political power (Roy et al., 2012; Gilens, 2012)

Afforestation
Conversion to forest of land that historically has not contained forests. [Note: For a discussion of the term forest and related terms such as afforestation, reforestation and deforestation, in the context of reporting and accounting Article 3.3 and 3.4 activities under the Kyoto Protocol, see 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol.]

See also *Deforestation, Reducing Emissions from Deforestation and Forest Degradation (REDD+),* and *Reforestation*

Agency
[Placeholder for SOD]

Agreement
In this report, the degree of agreement within the scientific body of knowledge on a particular finding is assessed based on multiple lines of evidence (e.g., mechanistic understanding, theory, data, models, expert judgement) and expressed qualitatively (Mastrandrea et al., 2010).

See also *Confidence, Likelihood, and Uncertainty*

Agriculture, Forestry and Other Land Use (AFOLU)
In the context of national greenhouse gas (GHG) inventories under the United Nations Convention on Climate Change (UNFCCC), AFOLU is the sum of the GHG inventory sectors Agriculture and Land Use, Land-Use Change and Forestry (LULUCF); see the 2006 IPCC Guidelines for National GHG Inventories for details. Given the difference in estimating the (CO_2) removals between countries and the global modelling community, the land-related net GHG emissions from global models included in this report are not necessarily directly comparable with LULUCF estimates in national GHG Inventories.

See also Land *use, land-use change and forestry (LULUCF)*and *Land-use change (LUC)*

Air pollution
Degradation of air quality with negative effects on human health, the natural or built environment, due to the introduction by natural processes or human activity in the atmosphere of substances (gases, aerosols) which have a direct (primary pollutants) or indirect (secondary pollutants) harmful effect.

See also *Short-lived climate forcers (SLCF)*

Albedo
The proportion of sunlight (solar radiation) reflected by a surface or object, often expressed as a percentage. Clouds, snow and ice usually have high albedo; soil surfaces cover the albedo range from high to low; vegetation in the dry season and/or in arid zones can have high albedo, whereas photosynthetically active vegetation and the ocean have low albedo. The Earth's planetary albedo changes mainly through varying cloudiness, snow, ice, leaf area and land cover changes.

Anomaly
The deviation of a variable from its value averaged over a reference period.

Anthropogenic
Resulting from or produced by human activities.

Anthropogenic removals
The withdrawal of greenhouse gases (GHGs) from the atmosphere as a result of deliberate human activities. These include enhancing biological sinks of CO_2 and using chemical engineering to achieve long term removal and storage. Carbon capture and storage (CCS) from industrial and energy-related sources, which alone does not remove CO_2 from the atmosphere, can help reduce atmospheric CO2 if it is combined with bioenergy production (BECCS). [Note: In the 2006 IPCC Guidelines for national GHG Inventories, which are used in reporting of emissions to the UNFCCC, anthropogenic land-related GHG fluxes are defined as all those occurring on managed land, i.e. where human interventions and practices have been applied to perform production, ecological or social functions. However, some removals (e.g. removals associated with CO_2 fertilisation and N deposition) are not considered as anthropogenic, or are referred to as indirect anthropogenic effects, in some of the scientific literature assessed in this report. As a consequence, the land-related net GHG emission estimates from global models included in this report are not necessarily directly comparable with LULUCF estimates in national GHG Inventories.]

See also *Anthropogenic emission, Bioenergy with carbon dioxide capture and storage (BECCS), Carbon dioxide capture and storage (CCS)* and *Land use, land-use change and forestry (LULUCF)*

Asset information model (AIM)
[Placeholder for SOD]

Atmosphere
The gaseous envelope surrounding the earth, divided into five layers - the troposphere which contains half of the Earths atmosphere, the stratosphere, the mesosphere, the thermosphere, and the exosphere, which is the outer limit of the atmosphere. The dry atmosphere consists almost entirely of nitrogen (78.1% volume mixing ratio) and oxygen (20.9% volume mixing ratio), together with a number of trace gases, such as argon (0.93 % volume mixing ratio), helium and radiatively active greenhouse gases (GHGs) such as carbon dioxide (CO_2) (0.04% volume mixing ratio) and ozone (O_3). In addition, the atmosphere contains the GHG water vapour (H2O), whose amounts are highly variable but typically around 1% volume mixing ratio. The atmosphere also contains clouds and aerosols.

See also *Carbon dioxide (CO_2), Greenhouse gases (GHG); Hydrological cycle; Ozone (O_3); Stratosphere;* and *Troposphere*

Behavioural change
In this report, behavioural change refers to alteration of human decisions and actions in ways that mitigate climate change and/or reduce negative consequences of climate change impacts.

Human behavioural change

A transformation or modification of human actions. Behaviour change efforts can be planned in ways that mitigate climate change and/or reduce negative consequences of climate change impacts.

Behavioural measures
Policies and measures designed to create an environment which enables and supports individuals to take actions that reduce their carbon footprint or the carbon footprint of their community or organisation.

Biochar
Relatively stable, carbon-rich material produced by heating biomass in an oxygen-limited environment. Biochar is distinguished from charcoal by its application: biochar is used as a soil amendment with the intention to improve soil functions and to reduce greenhouse gas (GHG) emissions from biomass that would otherwise decompose rapidly (IBI, 2018).

Biodiversity
Biodiversity or biological diversity means the variability among living organisms from all sources including, among other things, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems (UN, 1992).

See also *Ecosystem*, and *Ecosystem services*

Bioenergy
Energy derived from any form of biomass or its metabolic by-products.

See also *Biofuel* and *Biomass*

Bioenergy with carbon dioxide capture and storage (BECCS)
Carbon dioxide capture and storage (CCS) technology applied to a bioenergy facility. Note that depending on the total emissions of the BECCS supply chain, carbon dioxide (CO_2) can be removed from the atmosphere.

See also *Bioenergy; Carbon dioxide capture and storage (CCS)*

Biofuel
A fuel, generally in liquid form, produced from biomass. Biofuels include bioethanol from sugarcane, sugar beet or maize, and biodiesel from canola or soybeans.

See also *Bioenergy*, and *Biomass*

Biomass
Organic material excluding the material that is fossilised or embedded in geological formations. Biomass may refer to the mass of organic matter in a specific area (ISO, 2014).

Traditional biomass
The combustion of wood, charcoal, agricultural residues and/or animal dung for cooking or heating in open fires or in inefficient stoves as is common in low-income countries.

See also *Bioenergy*, and *Biofuel*

Black carbon (BC)

A relatively pure form of carbon, also known as soot, arising from the incomplete combustion of fossil fuels, biofuel, and biomass. It only stays in the atmosphere for days or weeks. BC is a climate forcing agent with strong warming effect, both in the atmosphere and when deposited on snow or ice.

See also *Aerosol; Atmosphere*

Blue carbon
All biologically-driven carbon fluxes and storage in marine systems that are amenable to management can be considered as blue carbon. Coastal blue carbon focuses on rooted vegetation in the coastal zone, such as tidal marshes, mangroves and seagrasses. These ecosystems have high carbon burial rates on a per unit area basis and accumulate carbon in their soils and sediments. They provide many non-climatic benefits and can contribute to ecosystem-based adaptation. If degraded or lost, coastal blue carbon ecosystems are likely to release most of their carbon back to the atmosphere. There is current debate regarding the application of the blue carbon concept to other coastal and non-coastal processes and ecosystems, including the open ocean.

See also *Ecosystem services* and *Sequestration*

Building information modelling (BIM)
[Placeholder for SOD]

Business as usual (BAU)
See *Baseline Scenario*

Capital markets
[Placeholder for SOD]

Carbon budget
Refers to three concepts in the literature: (1) an assessment of carbon cycle sources and sinks on a global level, through the synthesis of evidence for fossil-fuel and cement emissions, land-use change emissions, ocean and land CO_2 sinks, and the resulting atmospheric carbon dioxide (CO_2) growth rate. This is referred to as the global carbon budget; (2) the estimated cumulative amount of global carbon dioxide emissions that that is estimated to limit global surface temperature to a given level above a reference period, taking into account global surface temperature contributions of other greenhouse gases (GHGs) and climate forcers; (3) the distribution of the carbon budget defined under (2) to the regional, national, or sub-national level based on considerations of equity, costs or efficiency.

See also *Remaining carbon budget, Historical carbon budget* and *Contemporary carbon budget*

Carbon cycle
The flow of carbon (in various forms, e.g., as carbon dioxide (CO_2), carbon in biomass, and carbon dissolved in the ocean as carbonate and bicarbonate) through the atmosphere, hydrosphere, terrestrial and marine biosphere and lithosphere. In this report, the reference unit for the global carbon cycle is $GtCO_2$ or GtC (one Gigatonne = 1 Gt = 10¹⁵ grams; 1GtC corresponds to 3.667 $GtCO_2$).

Carbon dioxide (CO_2)
A naturally occurring gas, CO_2 is also a by-product of burning fossil fuels (such as oil, gas and coal), of burning biomass, of land use changes (LUC) and of industrial processes (e.g., cement production). It is the principal anthropogenic greenhouse gas (GHG) that affects the Earth's radiative balance. It is the reference gas against which other GHGs are measured and therefore has a Global Warming Potential (GWP) of 1.

See also *Greenhouse gases (GHG); Land use; Land-use change (LUC)*

Carbon dioxide capture and storage (CCS)
A process in which a relatively pure stream of carbon dioxide (CO_2) from industrial and energy-related sources is separated (captured), conditioned, compressed and transported to a storage location for long-term isolation from the atmosphere. Sometimes referred to as Carbon Capture and Storage.

See also *Bioenergy with carbon dioxide capture and storage (BECCS); Carbon dioxide capture and utilisation (CCU); Sequestration*

Carbon dioxide capture and utilisation (CCU)
A process in which carbon dioxide (CO_2) is captured and then used to produce a new product. If the CO_2 is stored in a product for a climate-relevant time horizon, this is referred to as carbon dioxide capture, utilisation and storage (CCUS). Only then, and only combined with CO_2 recently removed from the atmosphere, can CCUS lead to carbon dioxide removal. CCU is sometimes referred to as Carbon dioxide capture and use.

See also *Carbon dioxide capture and storage (CCS)*

Carbon dioxide removal (CDR)
Anthropogenic activities removing carbon dioxide (CO_2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological or geochemical CO_2 and direct air capture and storage, but excludes natural CO_2 uptake not directly caused by human activities.

See also *Direct air carbon dioxide capture and storage (DACCS); Greenhouse gas removal (GGR); Mitigation (of climate change); Negative emissions; Sink*

Carbon footprint
Measure of the exclusive total amount of emissions of carbon dioxide (CO_2) that is directly and indirectly caused by an activity or is accumulated over the lifecycle stages of a product (Wiedmann and Minx, 2008).

Household carbon footprint
The carbon footprint of an individual household, inclusive of the direct and indirect CO_2 emissions associated with home energy use, transportation, food provision, and consumption of other goods and services associated with household expenditures.

Carbon intensity
The amount of emissions of carbon dioxide (CO_2) released per unit of another variable such as gross domestic product (GDP), output energy use or transport.

Carbon leakage
See *Leakage*

Carbon price
The price for avoided or released carbon dioxide (CO_2) or CO_2 -equivalent emissions. This may refer to the rate of a carbon tax, or the price of emission permits. In many models that are used to assess the economic costs of mitigation, carbon prices are used as a proxy to represent the level of effort in mitigation policies.

See also *Mitigation (of climate change)*

Carbon sink
See *Sink*

Carbon stock
The quantity of carbon in a carbon pool.

See also *Pool, carbon and nitrogen*

Circular economy
There are more than 100 different definitions of the circular economy. The concept of circular economy conceives of a production and consumption system with minimal losses of materials and energy through extensive reuse, recycling, and recovery. One of the most comprehensive and inclusive models for circular economy defines ten strategies for circularity: Refuse (R0), Rethink (R1), Reduce (R2), Reuse (R3), Repair (R4), Refurbish (R5), Remanufacture (R6), Repurpose (R7), Recycle (R8), Recover energy (R9). More commonly, the circular economy is depicted as a combination of reduce, reuse and recycle activities, and focussed on economic benefits. (Kirchherr et al 2017; Haupt et al. 2017; Potting et al. 2018; Korhonen et al. 2018; Giessdoerfer et al. 2017).

Citizen science
A voluntary participation of the public in the collection and/or processing of data as part of a scientific study (Silvertown, 2009).

Clean Development Mechanism (CDM)
A mechanism defined under Article 12 of the Kyoto Protocol through which investors (governments or companies) from developed (Annex B) countries may finance greenhouse gas (GHG) emission reduction or removal projects in developing countries (Non-Annex B), and receive Certified Emission Reduction Units (CERs) for doing so. The CERs can be credited towards the commitments of the respective developed countries. The CDM is intended to facilitate the two objectives of promoting sustainable development (SD) in developing countries and of helping industrialised countries to reach their emissions commitments in a cost-effective way.

Climate
Climate in a narrow sense is usually defined as the average weather -or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities- over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization (WMO). The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.

Climate change
A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes.

See also *Climate variability; Detection and attribution; Global warming; Ocean acidification (OA)*

Climate extreme (extreme weather or climate event)
The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. By definition, the

characteristics of what is called extreme weather may vary from place to place in an absolute sense. When a pattern of extreme weather persists for some time, such as a season, it may be classified as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., high temperature, drought, or heavy rainfall over a season). For simplicity, both extreme weather events and extreme climate events are referred to collectively as 'climate extremes'.

Climate finance
There is no agreed definition of climate finance. The term 'climate finance' is applied both to the financial resources devoted to addressing climate change globally and to financial flows to developing countries to assist them in addressing climate change. The literature includes several concepts in these categories, among which the most commonly used include:

Incremental costs
The cost of capital of the incremental investment and the change of operating and maintenance costs for a mitigation or adaptation project in comparison to a reference project. It can be calculated as the difference of the net present values of the two projects.

Incremental investment
The extra capital required for the initial investment for a mitigation or adaptation project in comparison to a reference project.

Total climate finance
All financial flows whose expected effect is to reduce net greenhouse gas (GHG) emissions and/or to enhance resilience to the impacts of climate variability and the projected climate change. This covers private and public funds, domestic and international flows and expenditures for mitigation and adaptation to current climate variability as well as future climate change.

Total climate finance flowing to developing countries
The amount of the total climate finance invested in developing countries that comes from developed countries. This covers private and public funds.

Private climate finance flowing to developing countries
Finance and investment by private actors in/from developed countries for mitigation and adaptation activities in developing countries.

Public climate finance flowing to developing countries
Finance provided by developed countries' governments and bilateral institutions as well as by multilateral institutions for mitigation and adaptation activities in developing countries. Most of the funds provided are concessional loans and grants.

Climate funds
[Placeholder for SOD]

Climate model
A qualitative or quantitative representation of the climate system based on the physical, chemical and biological properties of its components, their interactions and feedback processes and accounting for some of its known properties. The climate system can be represented by models of varying complexity; that is, for any one component or combination of components a spectrum or hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical or biological processes are explicitly represented, or the level at which empirical parametrisations are involved. There is an evolution towards more complex models with interactive chemistry and biology. Climate models are applied as a research tool to study and simulate the climate and for operational purposes, including monthly, seasonal and interannual climate predictions.

Climate policy
A public policy and/or law linked to the parameters of climate science.

See also *Policies (for climate change mitigation and adaptation)*

Climate projection
Simulated response of the climate system to a scenario of future emissions or concentrations of greenhouse gases (GHGs) and aerosols and changes in land use, generally derived using climate models. Climate projections depend on an emission / concentration / radiative forcing scenario, which is in turn based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realised.

Climate sensitivity
The change in the annual global mean surface temperature (GMST) in response to a change in the atmospheric carbon dioxide (CO_2) concentration or other radiative forcing.

Effective climate sensitivity
An estimate of the global mean surface temperature response to a doubling of the atmospheric carbon dioxide (CO_2) concentration that is evaluated from model output or observations for evolving non-equilibrium conditions. It is a measure of the strengths of the climate feedbacks at a particular time and may vary with forcing history and climate state, and therefore may differ from equilibrium climate sensitivity.

Transient climate response
The change in the global mean surface temperature, averaged over a 20-year period, centred at the time of atmospheric carbon dioxide (CO_2) doubling, in a climate model simulation in which CO_2 increases at 1% yr-1 from pre-industrial. It is a measure of the strength of climate feedbacks and the timescale of ocean heat uptake.

Climate services
Information and products that enhance users' knowledge and understanding about the impacts of climate change and/or climate variability so as to aid decision-making of individuals and organizations and enable preparedness and early climate change action. Such services involve high-quality data from national and international databases on temperature, rainfall, wind, soil moisture and ocean conditions, as well as maps, risk and vulnerability analyses, assessments, and long-term projections and scenarios. Depending on the users needs, these data and information products may be combined with non-meteorological data, such as agricultural production, health trends, population distributions in high-risk areas, road and infrastructure maps for the delivery of goods, and other socio-economic variables (WMO, 2019).

Climate system
Global system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the lithosphere and the biosphere and the interactions between them. The climate system changes in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations, orbital forcing, and anthropogenic forcings such as the changing composition of the atmosphere and land use change.

Climate target
A temperature limit, concentration level, or emissions reduction goal used towards the aim of avoiding dangerous anthropogenic interference with the climate system. For example, national climate targets may aim to reduce greenhouse gas emissions by a certain amount over a given time horizon, for example those under the Kyoto Protocol.

Climate-resilient development pathways (CRDPs)
Trajectories that strengthen sustainable development and efforts to eradicate poverty and reduce inequalities while promoting fair and cross-scalar adaptation to and resilience in a changing climate. They raise the ethics, equity, and feasibility aspects of the deep societal transformation needed to drastically reduce emissions to limit global warming (e.g., to well below 2°C) and achieve desirable and liveable futures and wellbeing for all.

Climate-resilient pathways
Iterative processes for managing change within complex systems in order to reduce disruptions and enhance opportunities associated with climate change.

See also *Climate-resilient development pathways (CRDPs); Development pathways; Pathways; Transformation pathways*

CO_2 equivalent (CO_2-eq) emission
The amount of carbon dioxide (CO_2) emission that would cause the same integrated radiative forcing or temperature change, over a given time horizon, as an emitted amount of a greenhouse gas (GHG) or a mixture of GHGs. There are a number of ways to compute such equivalent emissions and choose appropriate time horizons. Most typically, the CO_2-equivalent emission is obtained by multiplying the emission of a GHG by its global warming potential (GWP) for a 100-year time horizon. For a mix of GHGs it is obtained by summing the CO_2-equivalent emissions of each gas. CO_2-equivalent emission is a common scale for comparing emissions of different GHGs but does not imply equivalence of the corresponding climate change responses. There is generally no connection between CO_2-equivalent emissions and resulting CO_2-equivalent concentrations.

Co-benefits
The positive effects that a policy or measure aimed at one objective might have on other objectives, thereby increasing the total benefits for society or the environment. Co-benefits are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. Co-benefits are also referred to as ancillary benefits.

Committed-emissions
[Placeholder for SOD]

Conference of the Parties (COP)
The supreme body of UN conventions, such as the United Nations Framework Convention on Climate Change (UNFCCC), comprising parties with a right to vote that have ratified or acceded to the convention.

Confidence
The robustness of a finding based on the type, amount, quality and consistency of evidence (e.g., mechanistic understanding, theory, data, models, expert judgment) and on the degree of agreement across multiple lines of evidence. In this Special Report, confidence is expressed qualitatively (Mastrandrea et al., 2010).

Coping capacity
The ability of people, institutions, organizations, and systems, using available skills, values, beliefs, resources, and opportunities, to address, manage, and overcome adverse conditions in the short to medium term. (UNISDR, 2009; IPCC, 2012a)

See also *Resilience*

Cost-benefit analysis

Monetary assessment of all negative and positive impacts associated with a given action. Cost-benefit analysis enables comparison of different interventions, investments or strategies and reveal how a given investment or policy effort pays off for a particular person, company or country. Cost-benefit analyses representing society's point of view are important for climate change decision-making, but there are difficulties in aggregating costs and benefits across different actors and across timescales.

See also *Discounting*

Cost-effectiveness analysis (CEA)
A tool based on constrained optimization for comparing policies designed to meet a prespecified target.

Cumulative emissions
The total amount of emissions released over a specified period of time.

See also *Carbon budget; Transient climate response to cumulative CO_2 emissions (TCRE)*

Deadheading
In the context of shared mobility, deadheading stands for the movement of vehicles without passengers, for example motorcycle or services providing drivers on their way to pick up passengers, or automated vehicles driving around empty in search for parking places.

Decarbonisation
Process by which countries, individuals or other entities aim to achieve zero fossil carbon existence. Typically refers to a reduction of the carbon emissions associated with electricity, industry and transport.

Decent Living Standard
A set of essential material preconditions for human well-being which includes nutrition, shelter, basic amenities, healthcare, transportation, information, education, and public space (Rao and Min, 2018; Rao and Baer 2012; O'Neill et al., 2018).

Decoupling
[Placeholder for SOD]

Deforestation
Conversion of forest to non-forest. [Note: For a discussion of the term forest and related terms such as afforestation, reforestation and deforestation in the context of reporting and accounting Article 3.3 and 3.4 activities under the Kyoto Protocol, see 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol.]

See also *Reducing Emissions from Deforestation and Forest Degradation (REDD+)*

Demand
Disciplinary approaches use the term in different ways. In economics, demand by a consumer is willingness and ability to purchase in a market place. However, the motivation for purchase may vary and can include economic utility, welfare, Decent standard of living (DSL), or for the good/services.

Demand- and supply-side measures
Demand-side measures
Policies and programmes for influencing the demand for goods and/or services. In the energy sector, demand-side management aims at reducing the demand for electricity and other forms of energy required to deliver energy services.

Supply-side measures
Policies and programmes for influencing how a certain demand for goods and/or services is met. In the energy sector, for example, supply-side mitigation measures aim at reducing the amount of greenhouse gas (GHG) emissions emitted per unit of energy produced.

Demand-side management
Policies and programmes for influencing the demand for goods and/or services. In the energy sector, demand-side management aims at reducing the demand for electricity and other forms of energy required to deliver energy services.

Desertification
Land degradation in arid, semi-arid, and dry sub-humid areas resulting from many factors, including climatic variations and human activities (UNCCD, 1994).

Developed / developing countries (Industrialised / developed / developing countries)
There is a diversity of approaches for categorising countries on the basis of their level of development, and for defining terms such as industrialised, developed, or developing. Several categorisations are used in this Special Report. (1) In the United Nations (UN) system, there is no established convention for the designation of developed and developing countries or areas. (2) The UN Statistics Division specifies developed and developing regions based on common practice. In addition, specific countries are designated as least developed countries, landlocked developing countries, small island developing states (SIDS), and transition economies. Many countries appear in more than one of these categories. (3) The World Bank uses income as the main criterion for classifying countries as low, lower middle, upper middle, and high income. (4) The UN Development Programme (UNDP) aggregates indicators for life expectancy, educational attainment, and income into a single composite Human Development Index (HDI) to classify countries as low, medium, high, or very high human development.

Diet
The kinds of food that follow a particular pattern that a person or community eats (FAO, 2014).

See also *Dietary patterns*

Dietary and nutrition transitions
Modernization, urbanisation, economic development, and increased wealth lead to predictable shifts in diet, referred to as nutrition transitions (Misra and Khurana, 2008; Popkin, 2006). Over historical time there have been a number of dietary transitions but in recent decades the prime transition has been associated with changes from subsistence towards eating diets rich in calories and relatively poor in nutrition (the westernised diet) that are obesogenic. From a public health perspective, a new dietary transition is in focus, from the obesogenic diet to one promoting health.

Direct emissions
Emissions that physically arise from activities within well-defined boundaries of, for instance, a region, an economic sector, a company, or a process.

See also *Indirect emissions*

Direct and indirect services
Direct services
Services (e.g., passenger mobility) required by end-users (consumers)

Indirect services
Services required (e.g., goods transport, manufacturing) for provisioning systems of direct services.

Disaster
A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts (UNISDR, 2017).

See also *Exposure; Hazard; Risk; Vulnerability*

Disaster risk management (DRM)
Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of current and future disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, prevention and protection, response, and recovery practices, with the explicit purpose of increasing human security, wellbeing, quality of life, and sustainable development (SD).

Discount rate
See *Discounting*

Discounting
A mathematical operation that aims to make monetary (or other) amounts received or expended at different times (years) comparable across time. The discounter uses a fixed or possibly time-varying discount rate from year to year that makes future value worth less today (if the discount rate is positive). The choice of discount rate(s) is debated as it is a judgement based on hidden and/or explicit values.

Displacement
In land system science, displacement denotes the increasing spatial separation between the location of agricultural and forestry production and the place of consumption of these products, as it occurs with trade. Displacement disconnects spatially environmental impacts from their socioeconomic drivers.

Divestment
[Placeholder for SOD]

Drought
A period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought is a relative term; therefore any discussion in terms of precipitation deficit must refer to the particular precipitation-related activity that is under discussion. For example, shortage of precipitation during the growing season impinges on crop production or ecosystem function in general (due to soil moisture drought, also termed agricultural drought) and during the runoff and percolation season primarily affects water supplies (hydrological drought). Storage changes in soil moisture and groundwater are also affected by increases in actual evapotranspiration in addition to reductions in precipitation. A period with an abnormal precipitation deficit is defined as a meteorological drought.

Dynamic uncertainty
[Placeholder for SOD]

Ecosystem
A functional unit consisting of living organisms, their non-living environment and the interactions within and between them. The components included in a given ecosystem and its spatial boundaries depend on the purpose for which the ecosystem is defined: in some cases they are relatively sharp, while in others they are diffuse. Ecosystem boundaries can change over time. Ecosystems are nested within other ecosystems and their scale can range from very small to the entire biosphere. In the current era, most ecosystems either contain people as key organisms, or are influenced by the effects of human activities in their environment.

See also *Ecosystem services*

Ecosystem services
Ecological processes or functions having monetary or non-monetary value to individuals or society at large. These are frequently classified as (1) supporting services such as productivity or biodiversity maintenance, (2) provisioning services such as food or fibre, (3) regulating services such as climate regulation or carbon sequestration, and (4) cultural services such as tourism or spiritual and aesthetic appreciation.

See also *Ecosystem*

Embodied (embedded) [emissions, water, land]
The total emissions [water use, land use] generated [used] in the production of goods and services regardless of the location and timing of those emissions [water use, land use] in the production process. This includes emissions [water use, land use] within the country used to produce goods or services for the countrys own use, but also includes the emissions [water use, land use] related to the production of such goods or services in other countries that are then consumed in another country through imports. Such emissions [water, land] are termed embodied or embedded emissions, or in some cases (particularly with water) as virtual water use (David and Caldeira, 2010; Allan, 2005; MacDonald et al., 2015).

Emissions
Anthropogenic emissions
Emissions of greenhouse gases (GHGs), precursors of GHGs and aerosols caused by human activities. These activities include the burning of fossil fuels, deforestation, land use and land use changes (LULUC), livestock production, fertilisation, waste management, and industrial processes.

Emission factor/Emissions intensity
The emissions released per unit of activity.

Emission trajectories
A projected development in time of the emission of a greenhouse gas (GHG) or group of GHGs, aerosols, and GHG precursors.

See also *Pathways*

Emission trends
[Placeholder for SOD]

Emissions transfer
[Placeholder for SOD]

Enabling conditions (for adaptation and mitigation options)
Conditions that affect the feasibility of adaptation and mitigation options, and can accelerate and scale-up systemic transitions that would limit temperature increase and enhance capacities of systems and societies to adapt to the associated climate change, while achieving sustainable development, eradicating poverty and reducing inequalities. Enabling conditions include finance, technological innovation, strengthening policy instruments, institutional capacity, multi-level governance, and changes in human behaviour and lifestyles. They also include inclusive processes, attention to power asymmetries and unequal opportunities for development and reconsideration of values.

Energy access

Access to clean, reliable and affordable energy services for cooking and heating, lighting, communications, and productive uses (with special reference to Sustainable Development Goal 7) (AGECC, 2010).

See also *Traditional biomass*

Energy efficiency
The ratio of output or useful energy or energy services or other useful physical outputs obtained from a system, conversion process, transmission or storage activity to the input of energy (measured as kWh kWh-1, tonnes kWh-1 or any other physical measure of useful output like tonne-km transported). Energy efficiency is often described by energy intensity. In economics, energy intensity describes the ratio of economic output to energy input. Most commonly energy efficiency is measured as input energy over a physical or economic unit, i.e., kWh USD-1 (energy intensity), kWh tonne-1. For buildings, it is often measured as kWh m-2, and for vehicles as km liter-1 or liter km-1. Very often in policy energy efficiency is intended as the measures to reduce energy demand through technological options such as insulating buildings, more efficient appliances, efficient lighting, efficient vehicles, etc.

Energy innovation system
[Placeholder for SOD]

Energy poverty
'The absence of sufficient choice in accessing adequate, affordable, reliable, high quality, safe and environmentally benign energy services to support economic and human development' (Reddy, 2000).

See also *Fuel poverty*

Energy security
The goal of a given country, or the global community as a whole, to maintain an adequate, stable and predictable energy supply. Measures encompass safeguarding the sufficiency of energy resources to meet national energy demand at competitive and stable prices and the resilience of the energy supply; enabling development and deployment of technologies; building sufficient infrastructure to generate, store and transmit energy supplies and ensuring enforceable contracts of delivery.

Energy services
A benefit or amenity (for example, mobility, communication, thermal comfort) received as a result of energy or other resources use.

Enhanced weathering
A proposed method to increase the natural rate of removal of carbon dioxide (CO_2) from the atmosphere using silicate and carbonate rocks. The active surface area of these minerals is increased by grinding, before they are actively added to soil, beaches or the open ocean.

(Model) Ensemble
A group of parallel model simulations characterising historical climate conditions, climate predictions, or climate projections. Variation of the results across the ensemble members may give an estimate of modelling-based uncertainty. Ensembles made with the same model but different initial conditions only characterise the uncertainty associated with internal climate variability, whereas multi-model ensembles including simulations by several models also include the impact of model differences. Perturbed parameter ensembles, in which model parameters are varied in a systematic manner, aim to assess the uncertainty resulting from internal model specifications within a single model. Remaining sources of uncertainty unaddressed with model ensembles are related to systematic

model errors or biases, which may be assessed from systematic comparisons of model simulations with observations wherever available.

Equality
A principle that ascribes equal worth to all human beings, including equal opportunities, rights, and obligations, irrespective of origins.

Inequality
Uneven opportunities and social positions, and processes of discrimination within a group or society, based on gender, class, ethnicity, age, and (dis)ability, often produced by uneven development. Income inequality refers to gaps between highest and lowest income earners within a country and between countries.

See also *Equity* and *Fairness*

Equity
The principle of being fair and impartial, and a basis for understanding how the *impacts* and responses to *climate change*, including costs and benefits, are distributed in and by society in more or less equal ways. Often aligned with ideas of *equality*, *fairness* and *justice* and applied with respect to equity in the responsibility for, and distribution of, *climate* impacts and policies across society, generations, and gender, and in the sense of who participates and controls the processes of decision-making.

Distributive equity
Equity in the consequences, outcomes, costs and benefits of actions or policies. In the case of climate change or climate policies for different people, places and countries, including equity aspects of sharing burdens and benefits for mitigation and adaptation.

Gender equity
Equity between women and men with regard to their rights, resources and opportunities. In the case of climate change, gender equity recognises that women are often more vulnerable to the impacts of climate change and may be disadvantaged in the process and outcomes of climate policy.

Inter-generational equity
Equity between generations. In the context of climate change, inter-generational equity acknowledges that the effects of past and present emissions, vulnerabilities and policies impose costs and benefits for people in the future and of different age groups.

Evidence
Data and information used in the scientific process to establish findings. In this report, the degree of evidence reflects the amount, quality and consistency of scientific/technical information on which the Lead Authors are basing their findings.

See also *Agreement*, *Confidence*, *Likelihood* and *Uncertainty*

Exergy
Capacity of energy flows to perform useful work. Exergy is a quality (versatility) indicator of energy flows which ranges from low (e.g., low-temperature heat, biomass) to high (e.g., electricity). Exergy efficiency describes how much useful work can be performed by a particular energy flow in relation to the thermodynamic maximum possible. It can be determined for all energy flows and energy conversion steps including also alternative service delivery systems. (Grubler et al., 2012)

Expenditure group
[Placeholder for SOD]

Ex-post evaluation
[Placeholder for SOD]

Exposure
The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.

Extreme weather event
See Climate extreme (extreme weather or climate event)

Fairness
Impartial and just treatment without favouritism or discrimination in which each person is considered of equal worth with equal opportunity.

See also *Equality; Equity*

Feasibility
The degree to which climate goals and response options are considered possible and/or desirable. Feasibility depends on geophysical, ecological, technological, economic, social and institutional conditions for change. Conditions underpinning feasibility are dynamic, spatially variable, and may vary between different groups.

See also *Enabling conditions (for adaptation and mitigation options)*

Finance flows
[Placeholder for SOD]

Financial instruments
[Placeholder for SOD]

Financing gap
[Placeholder for SOD]

Financing needs
[Placeholder for SOD]

Flood
The overflowing of the normal confines of a stream or other water body, or the accumulation of water over areas that are not normally submerged. Floods can be caused by unusually heavy rain, for example during storms and cyclones. Floods include river (fluvial) floods, flash floods, urban floods, rain (pluvial) floods, sewer floods, coastal floods, and glacial lake outburst floods (GLOFs).

Food loss and waste
The decrease in quantity or quality of food. Food waste is part of food loss and refers to discarding or alternative (non-food) use of food that is safe and nutritious for human consumption along the entire food supply chain, from primary production to end household consumer level; Food waste is recognised as a distinct part of food loss because the drivers that generate it and the solutions to it are different from those of food losses (FAO, 2015b).

Food security
A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2001). [Note: Whilst the term food security explicitly includes nutrition within

it dietary needs …for an active and healthy life, in the past the term has sometimes privileged the supply of calories (energy), especially to the hungry. Thus, the term food and nutrition security is often used (with the same definition as food security) to emphasise that the term food covers both energy and nutrition (FAO, 2009).]

Food system
All the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the output of these activities, including socio-economic and environmental outcomes (HLPE, 2017). [Note: Whilst there is a global food system (encompassing the totality of global production and consumption), each locations food system is unique, being defined by that places mix of food produced locally, nationally, regionally or globally.]

Forest
A vegetation type dominated by trees. Many definitions of the term forest are in use throughout the world, reflecting wide differences in biogeophysical conditions, social structure and economics. [Note: For a discussion of the term forest in the context of National GHG inventories, see the 2006 IPCC Guidelines for National GHG Inventories and information provided by the United Nations Framework Convention on Climate Change (UNFCCC, 2019).]

See also *Afforestation, Deforestation,* and *Reforestation*

Fossil fuels
Carbon-based fuels from fossil hydrocarbon deposits, including coal, oil, and natural gas.

Fuel poverty
A condition in which a household is unable to guarantee a certain level of consumption of domestic energy services (especially heating) or suffers disproportionate expenditure burdens to meet these needs.

See also *Energy poverty*

Geographic information system (GIS)
[Placeholder for SOD]

Gini coefficient
A statistical measure of dispersion in a distribution and degree of mathematical measure of inequality. For example, it can be used for measuring inequality in income, wealth, carbon emissions, and access to well-being defining services. The dimensionless GINI coefficient ranges between 0 (absolute equality) and 1 (absolute inequality).

Global mean surface air temperature (GSAT)
Global average of near-surface air temperatures over land and oceans. Changes in GSAT are often used as a measure of global temperature change in climate models but are not observed directly.

Global mean surface temperature (GMST)
Estimated global average of near-surface air temperatures over land and sea ice, and sea surface temperature (SST) over ice-free ocean regions, with changes normally expressed as departures from a value over a specified reference period. When estimating changes in GMST, near-surface air temperatures over both land and oceans are also used.

Global warming
An increase in global mean surface temperature (GMST) averaged over a 30-year period, or the 30-year period centred on a particular year or decade, expressed relative to pre-industrial levels unless

otherwise specified. For 30-year periods that span past and future years, the current multi-decadal warming trend is assumed to continue.

See also *Climate change*, and *Climate variability*

Global-cumulative carbon budget
[Placeholder for SOD]

Governance
A comprehensive and inclusive concept of the full range of means for deciding, managing, implementing and monitoring policies and measures. Whereas government is defined strictly in terms of the nation-state, the more inclusive concept of governance recognises the contributions of various levels of government (global, international, regional, sub-national and local) and the contributing roles of the private sector, of nongovernmental actors, and of civil society to addressing the many types of issues facing the global community, and the local context where the effectiveness of policies and measures are determined.

Climate governance
Purposeful mechanisms and measures aimed at steering social systems towards preventing, mitigating, or adapting to the risks posed by climate change (Jagers and Stripple, 2003).

Deliberative governance
Involves decision making through inclusive public conversation which allows opportunity for developing policy options through public discussion rather than collating individual preferences through voting or referenda (although the latter governance mechanisms can also be proceeded and legitimated by public deliberation processes).

Flexible governance
Strategies of governance at various levels, which prioritise the use of social learning and rapid feedback mechanisms in planning and policy making, often through incremental, experimental and iterative management processes.

Multilateral governance
Negotiated, non-hierarchical exchanges between institutions at the transnational, national, regional and local levels.

Participatory governance
A governance system that enables direct public engagement in decision-making using a variety of techniques for example, referenda, community deliberation, citizen juries or participatory budgeting. The approach can be applied in formal and informal institutional contexts from national to local, but is usually associated with devolved decision making (Fung and Wright, 2003; Sarmiento and Tilly, 2018).

Polycentric governance
Involves multiple centres of decision-making with overlapping jurisdictions. While the centres have some degree of autonomy, they also take each other into account, coordinating their actions and seeking to resolve conflicts (Carlisle and Gruby, 2017; Jordan et al., 2018; McGinnis and Ostrom, 2012).

Governance capacity
The ability of governance institutions, leaders, and non-state and civil society to plan, co-ordinate, fund, implement, evaluate and adjust policies and measures over the short, medium and long term, adjusting for uncertainty, rapid change and wide-ranging impacts and multiple actors and demands.

Grazing land
The sum of rangelands and pastures not considered as cropland,andsubject to livestock grazing or hay production.It includes a wide range of ecosystems, e.g. systems with vegetation that fall below the threshold used in the forest land category, silvo-pastoral systems, as well as natural, managed grasslands and semideserts.

Green bonds
[Placeholder for SOD]

Green Climate Fund (GCF)
The Green Climate Fund was established by the 16th Session of the Conference of the Parties (COP) in 2010 as an operating entity of the financial mechanism of the United Nations Framework Convention on Climate Change (UNFCCC), in accordance with Article 11 of the Convention, to support projects, programmes and policies and other activities in developing country Parties. The Fund is governed by a Board and will receive guidance of the COP. The Fund is headquartered in Songdo, Republic of Korea.

Green infrastructure
The interconnected set of natural and constructed ecological systems, green spaces and other landscape features. It includes planted and indigenous trees, wetlands, parks, green open spaces and original grassland and woodlands, as well as possible building and street level design interventions that incorporate vegetation. Green infrastructure provides services and functions in the same way as conventional infrastructure (Culwick and Bobbins, 2016).

Greenhouse gas removal (GGR)
Withdrawal of a greenhouse gas (GHG) and/or a precursor from the atmosphere by a sink.

See also *Carbon dioxide removal (CDR),* and *Negative emissions*

Greenhouse gases (GHG)
Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary GHGs in the Earth's atmosphere. Moreover, there are a number of entirely human-made GHGs in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Beside CO_2, N_2O and CH_4, the Kyoto Protocol deals with the GHGs sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

Gross domestic product (GDP)
The sum of gross value added, at purchasers' prices, by all resident and non-resident producers in the economy, plus any taxes and minus any subsidies not included in the value of the products in a country or a geographic region for a given period, normally one year. GDP is calculated without deducting for depreciation of fabricated assets or depletion and degradation of natural resources.

Halocarbons
A collective term for the group of partially halogenated organic species, which includes the chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), halons, methyl chloride and methyl bromide. Many of the halocarbons have large global warming potentials. The chlorine and bromine-containing halocarbons are also involved in the depletion of the ozone layer.

Household emissions
[Placeholder for SOD]

Human behaviour
The way in which a person acts in response to a particular situation or stimulus. Human actions are relevant at different levels, from international, national, and sub-national actors, to NGO, firm-level actors, and communities, households, and individual actions.

Mitigation behaviour
Human actions that directly or indirectly influence mitigation.

Human rights
Rights that are inherent to all human beings, universal, inalienable, and indivisible, typically expressed and guaranteed by law. They include the right to life, economic, social, and cultural rights, and the right to development and self-determination (UNOHCHR, 2018).

Human security
A condition that is met when the vital core of human lives is protected, and when people have the freedom and capacity to live with dignity. In the context of climate change, the vital core of human lives includes the universal and culturally specific, material and non-material elements necessary for people to act on behalf of their interests and to live with dignity.

Human system
Any system in which human organisations and institutions play a major role. Often, but not always, the term is synonymous with society or social system. Systems such as agricultural systems, urban systems, political systems, technological systems, and economic systems are all human systems in the sense applied in this report.

(climate change) Impact assessment
The practice of identifying and evaluating, in monetary and/or non-monetary terms, the effects of climate change on natural and human systems.

Impacts (consequences, outcomes)
The consequences of realised risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather / climate events), exposure, and vulnerability. Impacts generally refer to effects on lives, livelihoods, health and wellbeing, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Impacts may be referred to as consequences or outcomes, and can be adverse or beneficial.

See also *Adaptation, Exposure, Hazard, Loss and Damage, and losses and damages,* and *Vulnerability*

Indigenous knowledge
The understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For many indigenous peoples, IK informs decision-making about fundamental aspects of life, from day-to-day activities to longer term actions. This knowledge is integral to cultural complexes, which also encompass language, systems of classification, resource use practices, social interactions, values, ritual and spirituality. These distinctive ways of knowing are important facets of the worlds cultural diversity (UNESCO, 2018).

See also *Local knowledge (LK)*

Indirect emissions
Emissions that are a consequence of the activities within well-defined boundaries of, for instance, a region, an economic sector, a company or process, but which occur outside the specified boundaries. For example, emissions are described as indirect if they relate to the use of heat but physically arise

outside the boundaries of the heat user, or to electricity production but physically arise outside of the boundaries of the power supply sector.

See also *Direct emissions*

Industrial revolution
A period of rapid industrial growth with far-reaching social and economic consequences, beginning in Britain during the second half of the 18th century and spreading to Europe and later to other countries including the United States. The invention of the steam engine was an important trigger of this development. The industrial revolution marks the beginning of a strong increase in the use of fossil fuels, initially coal, and hence emission of carbon dioxide (CO_2).

Institutional capacity
Building and strengthening individual organisations and providing technical and management training to support integrated planning and decision-making processes between organisations and people, as well as empowerment, social capital, and an enabling environment, including the culture, values and power relations (Willems and Baumert, 2003).

Institutions
Rules, norms and conventions held in common by social actors that guide, constrain and shape human interaction. Institutions can be formal, such as laws and policies, or informal, such as norms and conventions. Organizations - such as parliaments, regulatory agencies, private firms, and community bodies - develop and act in response to institutional frameworks and the incentives they frame. Institutions can guide, constrain and shape human interaction through direct control, through incentives, and through processes of socialisation.

See also *Institutional capacity*

Integrated assessment
A method of analysis that combines results and models from the physical, biological, economic and social sciences and the interactions among these components in a consistent framework to evaluate the status and the consequences of environmental change and the policy responses to it.

See also *Integrated assessment model (IAM)*

Integrated assessment model (IAM)
Models that integrate knowledge from two or more domains into a single framework. They are one of the main tools for undertaking integrated assessments. One class of IAM used in respect of climate change mitigation may include representations of: multiple sectors of the economy, such as energy, land use and land use change; interactions between sectors; the economy as a whole; associated greenhouse gas (GHG) emissions and sinks; and reduced representations of the climate system. This class of model is used to assess linkages between economic, social and technological development and the evolution of the climate system. Another class of IAM additionally includes representations of the costs associated with climate change impacts, but includes less detailed representations of economic systems. These can be used to assess impacts and mitigation in a cost-benefit framework and have been used to estimate the social cost of carbon.

Integrated response options
In this report, integrated response options are those options that simultaneously address more than one land challenge. These can be categorised into options that rely on a) land management, b) value chain management, and c) risk management. Integrated response options are not mutually exclusive.

Internet of Things (IoT)
The network of computing devices embedded in everyday objects such as cars, phones and computers, connected via the internet, enabling them to send and receive data.

Irreversibility
A perturbed state of a dynamical system is defined as irreversible on a given timescale if the recovery timescale from this state due to natural processes is significantly longer than the time it takes for the system to reach this perturbed state.

Kyoto Protocol
The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) is an international treaty adopted in December 1997 in Kyoto, Japan, at the Third Session of the Conference of the Parties (COP3) to the UNFCCC. It contains legally binding commitments, in addition to those included in the UNFCCC. Countries included in Annex B of the Protocol (mostly OECD countries and countries with economies in transition) agreed to reduce their anthropogenic greenhouse gas (GHG) emissions (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6)) by at least 5% below 1990 levels in the first commitment period (2008-2012). The Kyoto Protocol entered into force on 16 February 2005 and as of May 2018 had 192 Parties (191 States and the European Union). A second commitment period was agreed in December 2012 at COP18, known as the Doha Amendment to the Kyoto Protocol, in which a new set of Parties committed to reduce GHG emissions by at least 18% below 1990 levels in the period from 2013 to 2020. However, as of May 2018, the Doha Amendment had not received sufficient ratifications to enter into force.

Land
The terrestrial portion of the biosphere that comprises the natural resources (soil, near-surface air, vegetation and other biota, and water), the ecological processes, topography, and human settlements and infrastructure that operate within that system (FAO, 2007; UNCCD, 1994).

Land cover
The biophysical coverage of land (e.g., bare soil, rocks, forests, buildings and roads or lakes). Land cover is often categorised in broad land-cover classes (e.g., deciduous forest, coniferous forest, mixed forest, grassland, bare ground). [Note: In some literature assessed in this report, land cover and land use are used interchangeably, but the two represent distinct classification systems. For example, the land cover class woodland can be under various land uses such as livestock grazing, recreation, conservation, or wood harvest.]

Land cover change
Change from one land cover class to another, due to change in land use or change in natural conditions (Pongratz et al., 2018).

See also *Land management change*, and *Land-use change (LUC)*

Land degradation
A negative trend in land condition, caused by direct or indirect human-induced processes including anthropogenic climate change, expressed as long-term reduction or loss of at least one of the following: biological productivity, ecological integrity or value to humans. [Note: This definition applies to forest and non-forest land. Changes in land condition resulting solely from natural processes (such as volcanic eruptions) are not considered to be land degradation. Reduction of biological productivity or ecological integrity or value to humans can constitute degradation, but any one of these changes need not necessarily be considered degradation.]

Land degradation neutrality
A state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems (UNCCD, 2019).

Land management

Sum of land-use practices (e.g., sowing, fertilizing, weeding, harvesting, thinning, clear-cutting) that take place within broader land-use categories. (Pongratz et al., 2018)

Land management change
A change in land management that occurs within a land-use category.

Land potential
The inherent, long-term potential of the land to sustainably generate ecosystem services, which reflects the capacity and resilience of the land-based natural capital, in the face of ongoing environmental change (UNEP, 2016).

Land rehabilitation
Direct or indirect actions undertaken with the aim of reinstating a level of ecosystem functionality, where the goal is provision of goods and services rather than ecological restoration (McDonald, et al., 2016).

Land restoration
The process of assisting the recovery of land from a degraded state (IPBES, 2018; McDonald et al. 2015).

Land use
The total of arrangements, activities and inputs applied to a parcel of land. The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction, conservation and city dwelling). In national GHG inventories, land use is classified according to the IPCC land use categories of forest land, cropland, grassland, wetlands, settlements, other lands (see the 2006 IPCC Guidelines for National GHG Inventories for details).

Land use, land-use change and forestry (LULUCF)
In the context of national greenhouse gas (GHG) inventories under the United Nations Framework Convention on Climate Change (UNFCCC, 2019), LULUCF is a GHG inventory sector that covers anthropogenic emissions and removals of GHG in managed lands, excluding non- CO_2 agricultural emissions. Following the 2006 IPCC Guidelines for National GHG Inventories, anthropogenic land-related GHG fluxes are defined as all those occurring on managed land, i.e., where human interventions and practices have been applied to perform production, ecological or social functions. Since managed land may include carbon dioxide (CO_2) removals not considered as anthropogenic in some of the scientific literature assessed in this report (e.g., removals associated with CO_2 fertilisation and N deposition), the land-related net GHG emission estimates from global models included in this report are not necessarily directly comparable with LULUCF estimates in National GHG Inventories.

Land-use change (LUC)
The change from one land use category to another. [Note: in some of the scientific literature assessed in this report, land-use change encompasses changes in land-use categories as well as changes in land management.]

Indirect land-use change
Land use change outside the area of focus, that occurs as a consequence of change in use or management of land within the area of focus, such as through market or policy drivers. For example, if agricultural land is diverted to biofuel production, forest clearance may occur elsewhere to replace the former agricultural production.

See also *Afforestation; Agriculture, Forestry and Other Land Use (AFOLU), Deforestation, Land use, land-use change and forestry (LULUCF),* and *Reforestation*

Latent heat flux

The turbulent flux of heat from the Earth's surface to the atmosphere that is associated with evaporation or condensation of water vapour at the surface; a component of the surface energy budget.

See also *Atmosphere*, and *Flux*

Leakage
The effects of policies that result in a displacement of the environmental impact, thereby counteracting the intended effects of the initial policies.

Leapfrogging
The ability of developing countries to bypass intermediate technologies and jump straight to advanced clean technologies. Leapfrogging can enable developing countries to move to a low-emissions development trajectory.

Lifecycle assessment (LCA)
Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product or service throughout its life cycle (ISO, 2018).

Lifestyle
[Placeholder for SOD]

Lifestyle change
[Placeholder for SOD]

Lifestyle choices
[Placeholder for SOD]

Likelihood
The chance of a specific outcome occurring, where this might be estimated probabilistically. Likelihood is expressed in this Special Report using a standard terminology (Mastrandrea et al., 2010).

See also *Agreement, Confidence*, *Evidence,* and *Uncertainty*

Livelihood
The resources used and the activities undertaken in order for people to live. Livelihoods are usually determined by the entitlements and assets to which people have access. Such assets can be categorised as human, social, natural, physical, or financial.

Local knowledge (LK)
The understandings and skills developed by individuals and populations, specific to the places where they live. Local knowledge informs decision-making about fundamental aspects of life, from day-to-day activities to longer term actions. This knowledge is a key element of the social and cultural systems which influence observations of and responses to climate change; it also informs governance decisions (UNESCO, 2018).

See also *Indigenous knowledge*

Lock-in
A situation in which the future development of a system, including infrastructure, technologies, investments, institutions, and behavioural norms, is determined or constrained (locked in) by historic developments.

Long-lived climate forcers (LLCF)

A set of well-mixed greenhouse gases with long atmospheric lifetimes. This set of compounds includes carbon dioxide (CO_2) and nitrous oxide (N_2O), together with some fluorinated gases. They have a warming effect on climate. These compounds accumulate in the atmosphere at decadal to centennial timescales, and their effect on climate hence persists for decades to centuries after their emission. On timescales of decades to a century already emitted emissions of long-lived climate forcers can only be abated by greenhouse gas removal (GGR).

Long-term
See *Near-, mid- and long-term*

Loss and Damage, and losses and damages
Research has taken Loss and Damage (capitalised letters) to refer to political debate under the United Nations Framework Convention on Climate Change (UNFCCC) following the establishment of the Warsaw Mechanism on Loss and Damage in 2013, which is to address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change. Lowercase letters (losses and damages) have been taken to refer broadly to harm from (observed) impacts and (projected) risks (Mechler et al., 2018).

Maladaptive actions (Maladaptation)
Actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) emissions, increased vulnerability to climate change, or diminished welfare, now or in the future. Maladaptation is usually an unintended consequence.

Malnutrition
Deficiencies, excesses, or imbalances in a persons intake of energy and/or nutrients. The term malnutrition addresses three broad groups of conditions: undernutrition, which includes wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age); micronutrient-related malnutrition, which includes micronutrient deficiencies (a lack of important vitamins and minerals) or micronutrient excess; and overweight, obesity and diet-related noncommunicable diseases (such as heart disease, stroke, diabetes and some cancers) (WHO, 2018). Micronutrient deficiencies are sometimes termed hidden hunger to emphasise that people can be malnourished in the sense of deficient without being deficient in calories. Hidden hunger can apply even where people are obese.

Managed forest
Forests subject to human interventions (notably silvicultural management such as planting, pruning, thinning), timber and fuelwood harvest, protection (fire suppression, insect supression) and management for amenity values or conservation, with defined geographical boundaries (Ogle et al., 2018). [Note: For a discussion of the term forest in the context of National GHG inventories, see the 2006 IPCC Guidelines for National GHG Inventories.]

Managed grassland
Grasslands on which human interventions are carried out, such as grazing domestic livestock or hay removal.

Managed land
In the context of national greenhouse gas (GHG) inventories under the United Nations Framework Convention on Climate Change (UNFCCC), the 2006 IPCC Guidelines for National GHG Inventories (IPCC, 2006) defines managed land where human interventions and practices have been applied to perform production, ecological or social functions. The IPCC (2006) defines anthropogenic GHG emissions and removals in the LULUCF sector as all those occurring on managed land. The key rationale for this approach is that the preponderance of anthropogenic effects occurs on managed lands. [Note: More details can be found in IPCC 2006 Guidelines for National GHG Inventories, Volume 4, Chapter 1.]

Market failure
When private decisions are based on market prices that do not reflect the real scarcity of goods and services but rather reflect market distortions, they do not generate an efficient allocation of resources but cause welfare losses. A market distortion is any event in which a market reaches a market clearing price that is substantially different from the price that a market would achieve while operating under conditions of perfect competition and state enforcement of legal contracts and the ownership of private property. Examples of factors causing market prices to deviate from real economic scarcity are environmental externalities, public goods, monopoly power, information asymmetry, transaction costs, and non-rational behaviour.

Market potentials
[Placeholder for SOD]

Material substitution
Replacement of one form of energy or material by another, either out of scarcity, prices or technological change, or because of lower greenhouse gas emissions.

Measurement, Reporting and Verification (MRV)
Measurement: Processes of data collection over time, providing basic datasets, including associated accuracy and precision, for the range of relevant variables. Possible data sources are field measurements, field observations, detection through remote sensing and interviews (UN-REDD, 2009). Reporting: The process of formal reporting of assessment results to the UNFCCC, according to predetermined formats and according to established standards, especially the Intergovernmental Panel on Climate Change (IPCC) Guidelines and GPG (Good Practice Guidance); (UN REDD, 2009). Verification: The process of formal verification of reports, for example, the established approach to verify national communications and national inventory reports to the UNFCCC (UN REDD, 2009).

Measurement
Processes of data collection over time, providing basic datasets, including associated accuracy and precision, for the range of relevant variables. Possible data sources are field measurements, field observations, detection through remote sensing and interviews. (UN-REDD, 2009).

Reporting
The process of formal reporting of assessment results to the UNFCCC, according to predetermined formats and according to established standards, especially the Intergovernmental Panel on Climate Change (IPCC) Guidelines and GPG (Good Practice Guidance) (UN REDD, 2009).

Verification
The process of formal verification of reports, for example, the established approach to verify national communications and national inventory reports to the UNFCCC (UN REDD, 2009).

Methane (CH_4)
One of the six greenhouse gases (GHGs) to be mitigated under the Kyoto Protocol. Methane is the major component of natural gas and associated with all hydrocarbon fuels. Significant anthropogenic emissions also occur as a result of animal husbandry and paddy rice production. Methane is also produced naturally where organic matter decays under anaerobic conditions, such as in wetlands. Under future global warming, there is risk of increased methane emissions from thawing permafrost, coastal wetlands and sub-sea gas hydrates.

Mid-term
See *Near-, mid- and long-term*

Migrant

Any person who is moving or has moved across an international border or within a State away from his/her habitual place of residence, regardless of (1) the persons legal status; (2) whether the movement is voluntary or involuntary; (3) what the causes for the movement are; or (4) what the length of the stay is (IOM, 2018).

Migration (of humans)
Movement of a person or a group of persons, either across an international border, or within a State. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification (IOM, 2018).

Millennium Development Goals (MDGs)
A set of eight time-bound and measurable goals for combating poverty, hunger, disease, illiteracy, discrimination against women and environmental degradation. These goals were agreed at the UN Millennium Summit in 2000 together with an action plan to reach the goals by 2015.

Mitigation (of climate change)
A human intervention to reduce emissions or enhance the sinks of greenhouse gases.

Mitigation measures
In climate policy, mitigation measures are technologies, processes or practices that contribute to mitigation, for example renewable energy technologies, waste minimization processes, and public transport commuting practices.

Mitigation option
A technology or practice that reduces greenhouse gas (GHG) emissions or enhances sinks.

Mitigation potential
[Placeholder for SOD]

Service-provisioning mitigation potential
The reduction in primary energy and associated GHG emissions delivered by 'avoid, shift, or improve' strategies and modified or new service provisioning systems that enable the same or improved levels of wellbeing, relative to the current state and/or default pathway, e.g. via resource cascades, exergy efficiency, and social technologies.

Motivation (of an individual)
An individuals reason or reasons for acting in a particular way; individuals may consider various consequences of actions, including financial, social, affective, and environmental consequences. Motivation can arise from factors external or internal to the individual.

Multilateral climate change agreements
Bilateral and multilateral agreements, between countries, international agencies, civil society, academia or the private sector, within the framework of adaptation and mitigation to climate change. It also includes actions of science, policy and other mechanisms that demonstrate scientific decision-making, as well as investment processes for development.

Narratives
Qualitative descriptions of plausible future world evolutions, describing the characteristics, general logic and developments underlying a particular quantitative set of *scenarios*. Narratives are also referred to in the literature as ‘storylines’.

See also *Pathways*, and *Scenario storyline*

National innovation system
[Placeholder for SOD]

Nationally Determined Contributions (NDCs)
A term used under the United Nations Framework Convention on Climate Change (UNFCCC) whereby a country that has joined the Paris Agreement outlines its plans for reducing its emissions. Some countries NDCs also address how they will adapt to climate change impacts, and what support they need from, or will provide to, other countries to adopt low-carbon pathways and to build climate resilience. According to Article 4 paragraph 2 of the Paris Agreement, each Party shall prepare, communicate and maintain successive NDCs that it intends to achieve.

Near-, mid- and long-term
[Placeholder for SOD]

Negative emissions
Removal of greenhouse gases (GHGs) from the atmosphere by deliberate human activities, i.e., in addition to the removal that would occur via natural carbon cycle processes.

See also *Carbon dioxide removal (CDR), Greenhouse gas removal (GGR), Net negative emissions,* and *Negative CO_2 emissions*

Negative emissions technologies
An activity or mechanism that results in negative emissions.

Net negative emissions
A situation of net negative emissions is achieved when, as result of human activities, more greenhouse gases (GHG) are removed from the atmosphere than are emitted into it. Where multiple GHG are involved, the quantification of negative emissions depends on the climate metric chosen to compare emissions of different gases (such as global warming potential, global temperature change potential, and others, as well as the chosen time horizon).

See also *Negative emissions, Net zero CO_2 emissions,* and *Net zero emissions*

Net zero CO_2 emissions
Conditions in which any remaining anthropogenic carbon dioxide (CO_2) emissions are balanced by anthropogenic CO_2 removals over a specified period.

See also *Net negative emissions,* and *Net zero emissions*

Net zero emissions
Net zero emissions are achieved when [anthropogenic] emissions of greenhouse gases (GHG) to the atmosphere are balanced by anthropogenic removals [over a specified period]. Where multiple greenhouse gases are involved, the quantification of net zero emissions depends on the climate metric chosen to compare emissions of different gases (such as global warming potential, global temperature change potential, and others, as well as the chosen time horizon).

See also *Negative emissions, Net negative emissions, Net zero CO_2 emissions*, and *Greenhouse gas removal (GGR)*

Nitrous oxide (N_2O)
One of the six greenhouse gases (GHGs) to be mitigated under the Kyoto Protocol. The main anthropogenic source of N_2O is agriculture (soil and animal manure management), but important contributions also come from sewage treatment, fossil fuel combustion, and chemical industrial

processes. N_2O is also produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests.

Nutrition transition
A predictable change in dietary patterns associated with a countrys economic development whereby problems of under- and overnutrition often coexist, reflecting the trends in which an increasing proportion of people consume the types of diets associated with a number of chronic diseases (Popkin, 1994).

Offset (in climate policy)
A unit of CO_2 -equivalent emissions that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere.

Ozone (O_3)
The triatomic form of oxygen, and a gaseous atmospheric constituent. In the troposphere, O_3 is created both naturally and by photochemical reactions involving gases resulting from human activities (e.g., smog). Tropospheric O_3 acts as a greenhouse gas (GHG). In the stratosphere, O_3 is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2). Stratospheric O_3 plays a dominant role in the stratospheric radiative balance. Its concentration is highest in the ozone layer.

Pareto optimum
A state in which no one's welfare can be increased without reducing someone else's welfare.

Paris Agreement
The Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) was adopted on December 2015 in Paris, France, at the 21st session of the Conference of the Parties (COP) to the UNFCCC. The agreement, adopted by 196 Parties to the UNFCCC, entered into force on 4 November 2016 and as of May 2018 had 195 Signatories and was ratified by 177 Parties. One of the goals of the Paris Agreement is Holding the increase in the global average temperature to well below 2C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5C above pre-industrial levels; recognising that this would significantly reduce the risks and impacts of climate change. Additionally, the Agreement aims to strengthen the ability of countries to deal with the impacts of climate change. The Paris Agreement is intended to become fully effective in 2020.

See also *Kyoto Protocol*, and *Nationally Determined Contributions (NDCs)*

Pathways
The temporal evolution of natural and/or human systems towards a future state. Pathway concepts range from sets of quantitative and qualitative scenarios or narratives of potential futures to solution-oriented decision-making processes to achieve desirable societal goals. Pathway approaches typically focus on biophysical, techno-economic, and/or socio-behavioural trajectories and involve various dynamics, goals, and actors across different scales.

1.5°C pathway
A pathway of emissions of greenhouse gases and other climate forcers that provides an approximately one-in-two to two-in-three chance, given current knowledge of the climate response, of global warming either remaining below 1.5C or returning to 1.5C by around 2100 following an overshoot.

Adaptation pathways
A series of adaptation choices involving trade-offs between short-term and long-term goals and values. These are processes of deliberation to identify solutions that are meaningful to people in the context of their daily lives and to avoid potential maladaptation.

Mitigation pathways
A temporal evolution of a set of mitigation scenario features, such as greenhouse gas (GHG) emissions and socio-economic development.

Overshoot pathways
Pathways that exceed the stabilization level (concentration, forcing, or temperature) before the end of a time horizon of interest (e.g., before 2100) and then decline towards that level by that time. Once the target level is exceeded, removal by sinks of greenhouse gases (GHGs) is required.

Non-overshoot pathways
Pathways that stay below the stabilization level (concentration, forcing, or temperature) during the time horizon of interest (e.g., until 2100).

Shared socio-economic pathways (SSPs)
Shared Socio-economic Pathways (SSPs) were developed to complement the Representative Concentration Pathways (RCPs) with varying socio-economic challenges to adaptation and mitigation (ONeill et al., 2014). Based on five narratives, the SSPs describe alternative socio-economic futures in the absence of climate policy intervention, comprising sustainable development (SSP1), regional rivalry (SSP3), inequality (SSP4), fossil-fueled development (SSP5), and a middle-of-the-road development (SSP2) (ONeill et al., 2017; Riahi et al., 2017). The combination of SSP-based socio-economic scenarios and RCP-based climate projections provides an integrative frame for climate impact and policy analysis.

Transformation pathways
Trajectories describing consistent sets of possible futures of greenhouse gas (GHG) emissions, atmospheric concentrations, or global mean surface temperatures implied from mitigation and adaptation actions associated with a set of broad and irreversible economic, technological, societal, and behavioural changes. This can encompass changes in the way energy and infrastructure are used and produced, natural resources are managed and institutions are set up and in the pace and direction of technological change (TC).

See also *Scenario, Scenario storyline, Mitigation scenario, Baseline scenario*, and *Stabilisation (of GHG or CO_2-equivalent concentration)*

Peri-urban areas
Parts of a city that appear to be quite rural but are in reality strongly linked functionally to the city in its daily activities.

Policymaker
The authority that coordinates and carries out public policy.

Political economy
The set of interlinked relationships between people, the state, society and markets as defined by law, politics, economics, customs and power that determine the outcome of trade and transactions and the distribution of wealth in a country or economy.

Poverty
A complex concept with several definitions stemming from different schools of thought. It can refer to material circumstances (such as need, pattern of deprivation or limited resources), economic conditions (such as standard of living, inequality or economic position) and/or social relationships (such as social class, dependency, exclusion, lack of basic security or lack of entitlement).

See also *Poverty eradication*

Poverty eradication
A set of measures to end poverty in all its forms everywhere.

See also *Sustainable Development Goals (SDGs)*

Prebound effect
[Placeholder for SOD]

Primary production
The synthesis of organic compounds by plants and microbes, on land or in the ocean, primarily by photosynthesis using light and carbon dioxide (CO_2) as sources of energy and carbon respectively. It can also occur through chemosynthesis, using chemical energy, e.g., in deep sea vents.

Private costs
Costs carried by individuals, companies or other private entities that undertake an action, whereas social costs include additionally the external costs on the environment and on society as a whole. Quantitative estimates of both private and social costs may be incomplete, because of difficulties in measuring all relevant effect.

Production-based emissions
[Placeholder for SOD]

Projection
A potential future evolution of a quantity or set of quantities, often computed with the aid of a model. Unlike predictions, projections are conditional on assumptions concerning, for example, future socio-economic and technological developments that may or may not be realised.

See also *Climate projection*, *Pathways*, and *Scenario*

Prosumers
[Placeholder for SOD]

Public finance
[Placeholder for SOD]

Radiative forcing
The change in the net, downward minus upward, radiative flux (expressed in W m-2) at the tropopause or top of atmosphere due to a change in an [external]driver of climate change, such as a change in the concentration of carbon dioxide (CO_2), the concentration of volcanic aerosols or in the output of the Sun. The traditional radiative forcing is computed with all tropospheric properties held fixed at their unperturbed values, and after allowing for stratospheric temperatures, if perturbed, to readjust to radiative-dynamical equilibrium. Radiative forcing is called instantaneous if no change in stratospheric temperature is accounted for. The radiative forcing once rapid adjustments are accounted for is termed the effective radiative forcing. Radiative forcing is not to be confused with cloud radiative forcing, which describes an unrelated measure of the impact of clouds on the radiative flux at the top of the atmosphere.

Rebound effect
[Placeholder for SOD]

Reducing Emissions from Deforestation and Forest Degradation (REDD+)
REDD+ refers to reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (see UNFCCC decision 1/CP.16, para. 70).

Reference period
The period relative to which anomalies are computed.

See also *Anomaly*

Reforestation
Conversion to forest of land that has previously contained forests but that has been converted to some other use.[Note: For a discussion of the term forest and related terms such as afforestation, reforestation and deforestation in the context of reporting and accounting Article 3.3 and 3.4 activities under the Kyoto Protocol, see 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol.]

See also *Afforestation*, *Deforestation*, and *Reducing Emissions from Deforestation and Forest Degradation (REDD+)*

Region
A relatively large-scale land or ocean area characterised by specific geographical and climatological features. The climate of a land-based region is affected by regional and local scale features like topography, land use characteristics and large water bodies, as well as remote influences from other regions, in addition to global climate conditions. The IPCC defines a set of standard regions for analyses of observed climate trends and climate model projections (see IPCC, 2018a, Figure 3.2; IPCC 2012a).

Remaining carbon budget
Cumulative global carbon dioxide (CO_2) emissions from the start of 2018 to the time that CO_2 emissions reach net-zero that would result, at some probability, in limiting global warming to a given level, accounting for the impact of other anthropogenic emissions

See also *Carbon budget*

Resilience
The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation (Arctic Council, 2016).

See also *Hazard*, *Risk*, and *Vulnerability*

Resource cascade
Tracking resource use (materials, energy, water, etc.), efficiency and losses through all conversion steps from primary resource extraction to various conversion steps, all the way to final service delivery.

Risk
The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and wellbeing, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species.

In the context of climate change impacts, risks result from dynamic interactions between climate-related hazards with the exposure and vulnerability of the affected human or ecological system to the hazards. Hazards, exposure and vulnerability may each be subject to uncertainty in terms of

magnitude and likelihood of occurrence, and each may change over time and space due to socio-economic changes and human decision-making.

In the context of climate change responses, risks result from the potential for such responses not achieving the intended objective(s), or from potential trade-offs with, or negative side-effects on, other societal objectives, such as the Sustainable Development Goals (SDGs). Risks can arise for example from uncertainty in implementation, effectiveness or outcomes of climate policy, climate-related investments, technology development or adoption, and system transitions.

Risk assessment
The qualitative and/or quantitative scientific estimation of risks.

See also *Risk management,* and *Risk perception*

Risk management
Plans, actions, strategies or policies to reduce the likelihood and/or magnitude of adverse potential consequences, based on assessed or perceived risks.

See also *Risk assessment,* and *Risk perception*

Risk perception
The subjective judgment that people make about the characteristics and severity of a risk.

See also *Risk assessment,* and *Risk management*

Risk trade-off
The change in portfolio of risks that occurs when a countervailing risk is generated (knowingly or inadvertently) by an intervention to reduce the target risk (Wiener and Graham, 2009).

Scenario
A plausible description of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces (e.g., rate of technological change (TC), prices) and relationships. Note that scenarios are neither predictions nor forecasts, but are used to provide a view of the implications of developments and actions.

Baseline scenario
In much of the literature the term is also synonymous with the term business-as-usual (BAU) scenario, although the term BAU has fallen out of favour because the idea of business as usual in century-long socio-economic projections is hard to fathom. In the context of transformation pathways, the term baseline scenarios refers to scenarios that are based on the assumption that no mitigation policies or measures will be implemented beyond those that are already in force and/or are legislated or planned to be adopted. Baseline scenarios are not intended to be predictions of the future, but rather counterfactual constructions that can serve to highlight the level of emissions that would occur without further policy effort. Typically, baseline scenarios are then compared to mitigation scenarios that are constructed to meet different goals for greenhouse gas (GHG) emissions, atmospheric concentrations or temperature change. The term baseline scenario is often used interchangeably with reference scenario and no policy scenario.

Emission scenario
A plausible representation of the future development of emissions of substances that are radiatively active (e.g., greenhouse gases (GHGs), aerosols) based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socio-economic development, technological change, energy and land use) and their key relationships. Concentration scenarios, derived from emission scenarios, are often used as input to a climate model to compute climate projections.

Mitigation scenario
A plausible description of the future that describes how the (studied) system responds to the implementation of mitigation policies and measures.

Representative concentration pathways (RCPs)
Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use /land cover (Moss et al., 2008). The word representative signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. The term pathway emphasises the fact that not only the long-term concentration levels, but also the trajectory taken over time to reach that outcome are of interest (Moss et al., 2010). RCPs were used to develop climate projections in CMIP5. RCP2.6: One pathway where radiative forcing peaks at approximately 3 W m-2 and then declines to be limited at 2.6 W m-2 in 2100 (the corresponding Extended Concentration Pathway, or ECP, has constant emissions after 2100). RCP4.5 and RCP6.0: Two intermediate stabilisation pathways in which radiative forcing is limited at approximately 4.5 W m-2 and 6.0 W m-2 in 2100 (the corresponding ECPs have constant concentrations after 2150). RCP8.5: One high pathway which leads to >8.5 W m-2 in 2100 (the corresponding ECP has constant emissions after 2100 until 2150 and constant concentrations after 2250).

Scenario storyline
A narrative description of a scenario (or family of scenarios), highlighting the main scenario characteristics, relationships between key driving forces and the dynamics of their evolution. Also referred to as narratives in the scenario literature.

Socio-economic scenario
A scenario that describes a possible future in terms of population, gross domestic product (GDP), and other socio-economic factors relevant to understanding the implications of climate change.

See also *Pathways*

Sector
[Placeholder for SOD]

Sectoral emissions
[Placeholder for SOD]

Sequestration
The process of storing carbon in a carbon pool.

See also *Uptake*, and *Soil carbon sequestration (SCS)*

Service provisioning
Various services (such as illumination and mobility) can be provided by ‘systems’ through the use of energy, materials, and other resources comprising 1) Resource flows (e.g., energy), 2) Technologies for resource use and energy conversion (e.g., vehicles and their engines), and 3) Social/organizational forms of service delivery (e.g., publicly owned companies, or privately owned companies, e-commerce).

Services
[Placeholder for SOD]

Shared economy
Organising frameworks which allow people to share the use of material goods and related services (cars/transportation, tools/skills, travel accommodation, vacation homes, various kinds of services),

often through local peer-to-peer digital platforms which facilitate transactions among strangers (Böcker and Meelen, 2017; Frenken and Schor, 2017; Mi and Coffman, 2019).

Shared policy assumptions
[Placeholder for SOD]

Short-lived climate forcers (SLCF)
A set of compounds that are primarily composed of those with short lifetimes in the atmosphere compared to well-mixed greenhouse gases (GHGs), and are also referred to as near-term climate forcers. This set of compounds includes methane (CH_4), which is also a well-mixed greenhouse gas, as well as ozone (O_3) and aerosols, or their precursors, and some halogenated species that are not well-mixed GHGs. These compounds do not accumulate in the atmosphere at decadal to centennial timescales, and so their effect on climate is predominantly in the first decade after their emission, although their changes can still induce long-term climate effects such as sea level change. Their effect can be cooling or warming. A subset of exclusively warming SLCFs is referred to as short-lived climate pollutants.

Sink
Any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere (UNFCCC Article 1.8).

See also *Source*, and *Uptake*

Small island developing states (SIDS)
Small island developing states (SIDS), as recognised by the United Nations OHRLLS (Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States), are a distinct group of developing countries facing specific social, economic and environmental vulnerabilities (UN-OHRLLS, 2011). They were recognized as a special case both for their environment and development at the Rio Earth Summit in Brazil in 1992. Fifty-eight countries and territories are presently classified as SIDS by the UN OHRLLS, with 38 being UN member states and 20 being Non-UN Members or Associate Members of the Regional Commissions (UN-OHRLLS, 2018).

Smart building
[Placeholder for SOD]

Smart city
[Placeholder for SOD]

Smart energy technology
[Placeholder for SOD]

Smart meter and feedback system
[Placeholder for SOD]

Social cost of carbon (SCC)
The net present value of aggregate climate damages (with overall harmful damages expressed as a number with positive sign) from one more tonne of carbon in the form of carbon dioxide (CO_2), conditional on a global emissions trajectory over time.

Social costs
The full costs of an action in terms of social welfare losses, including external costs associated with the impacts of this action on the environment, the economy (GDP, employment) and on the society as a whole.

Social group
A collective of people who share similar characteristics and collectively may have a sense of unity (Forsyth 2010).

Social identity
The portion of an individual's self-concept derived from perceived membership in a relevant social group (Tajfel & Turner 1986).

Social inclusion
A process of improving the terms of participation in society, particularly for people who are disadvantaged, through enhancing opportunities, access to resources, and respect for rights (UN, DESA 2016).

Social innovation
[Placeholder for SOD]

Social learning
A process of social interaction through which people learn new behaviours, capacities, values, and attitudes.

Social norms
[Placeholder for SOD]

Social technology
[Placeholder for SOD]

Social-ecological system
An integrated system that includes human societies and ecosystems, in which humans are part of nature. The functions of such a system arise from the interactions and interdependence of the social and ecological subsystems. The systems structure is characterised by reciprocal feedbacks, emphasising that humans must be seen as a part of, not apart from, nature (Arctic Council, 2016; Berkes and Folke, 1998).

Socio-technical transitions
Where technological change is associated with social systems and the two are inextricably linked.

Soil carbon sequestration (SCS)
Land management changes which increase the soil organic carbon content, resulting in a net removal of carbon dioxide (CO_2) from the atmosphere.

Soil organic carbon
Carbon contained in soil organic matter.

Soil organic matter
The organic component of soil, comprising plant and animal residue at various stages of decomposition, and soil organisms.

Source
Any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere (UNFCCC Article 1.9).

See also *Sink*

Stabilisation (of GHG or CO_2-equivalent concentration)

A state in which the atmospheric concentration of one greenhouse gas (GHG) (e.g., carbon dioxide) or of a CO_2-equivalent basket of GHGs (or a combination of GHGs and aerosols) remains constant over time.

Stranded assets
Assets exposed to devaluations or conversion to liabilities because of unanticipated changes in their initially expected revenues due to innovations and/or evolutions of the business context, including changes in public regulations at the domestic and international levels.

Subnational actors
State/provincial, regional, metropolitan and local/municipal governments as well as non-party stakeholders, such as civil society, the private sector, cities and other subnational authorities, local communities and indigenous peoples.

Sufficiency
The adequate availability of resources required for a decent standard of living.

Energy sufficiency
The adequate availability of energy required for a decent standard of living.

Sunk cost
[Placeholder for SOD]

Sustainability
A dynamic process that guarantees the persistence of natural and human systems in an equitable manner.

Sustainable development (SD)
Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987) and balances social, economic and environmental concerns.

See also *Development pathways*, and *Sustainable Development Goals (SDGs)*

Sustainable Development Goals (SDGs)
The 17 global goals for development for all countries established by the United Nations through a participatory process and elaborated in the 2030 Agenda for Sustainable Development, including ending poverty and hunger; ensuring health and wellbeing, education, gender equality, clean water and energy, and decent work; building and ensuring resilient and sustainable infrastructure, cities and consumption; reducing inequalities; protecting land and water ecosystems; promoting peace, justice and partnerships; and taking urgent action on climate change.

See also *Sustainable development (SD)*

Sustainable forest management
The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems (Forest Europe, 1993).

Sustainable intensification (of agriculture)
Increasing yields from the same area of land while decreasing negative environmental impacts of agricultural production and increasing the provision of environmental services (CGIAR, 2019). [Note: this definition is based on the concept of meeting demand from a finite land area, but it is scale-dependent. Sustainable intensification at a given scale (e.g., global or national) may require a decrease

in production intensity at smaller scales and in particular places (often associated with previous, unsustainable, intensification) to achieve sustainability (Garnett et al., 2013).]

Sustainable land management
The stewardship and use of land resources, including soils, water, animals and plants, to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions (Adapted from WOCAT, undated).

Technological choices
[Placeholder for SOD]

Technology transfer
The exchange of knowledge, hardware and associated software, money and goods among stakeholders, which leads to the spread of technology for adaptation or mitigation. The term encompasses both diffusion of technologies and technological cooperation across and within countries.

Teleconnection
A statistical association between climate variables at widely separated, geographically-fixed spatial locations. Teleconnections are caused by large spatial structures such as basin-wide coupled modes of ocean-atmosphere variability, Rossby wave-trains, mid-latitude jets, and storm tracks.

Temperature overshoot
The temporary exceedance of a specified level of global warming, such as 1.5°C. Overshoot implies a peak followed by a decline in global warming, achieved through anthropogenic removal of carbon dioxide (CO_2) exceeding remaining CO_2 emissions globally.

See also *Pathways*

Tipping point
[Placeholder for SOD]

Trade-embodied emissions
[Placeholder for SOD]

Trade-off
[Placeholder for SOD]

Transformation
A change in the fundamental attributes of natural and human systems.

Societal (social) transformation
A profound and often deliberate shift initiated by communities toward sustainability, facilitated by changes in individual and collective values and behaviours, and a fairer balance of political, cultural, and institutional power in society.

Transient climate response to cumulative CO_2 emissions (TCRE)
The transient global average surface temperature change per unit cumulative carbon dioxide (CO_2) emissions, usually 1000 GtC. TCRE combines both information on the airborne fraction of cumulative CO_2 emissions (the fraction of the total CO_2 emitted that remains in the atmosphere, which is determined by carbon cycle processes) and on the transient climate response (TCR).

Transition
[Placeholder for SOD]

Transition theories
[Placeholder for SOD]

Transitional risk
[Placeholder for SOD]

Uncertainty
A state of incomplete knowledge that can result from a lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from imprecision in the data to ambiguously defined concepts or terminology, incomplete understanding of critical processes, or uncertain projections of human behaviour. Uncertainty can therefore be represented by quantitative measures (e.g., a probability density function) or by qualitative statements (e.g., reflecting the judgment of a team of experts) (see Moss and Schneider, 2000; IPCC, 2004; Mastrandrea et al., 2010).

See also *Confidence*, and *Likelihood*

United Nations Convention to Combat Desertification (UNCCD)
A legally binding international agreement linking environment and development to sustainable land management, established in 1994. The Conventions objective is to combat desertification and mitigate the effects of drought in countries experiencing drought and/or desertification. The Convention specifically addresses the arid, semi-arid and dry sub-humid areas, known as the drylands, and has a particular focus on Africa. As of October 2018, the UNCCD had 197 Parties.

United Nations Framework Convention on Climate Change (UNFCCC)
The UNFCCC was adopted in May 1992 and opened for signature at the 1992 Earth Summit in Rio de Janeiro. It entered into force in March 1994 and as of May 2018 had 197 Parties (196 States and the European Union). The Conventions ultimate objective is the stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The provisions of the Convention are pursued and implemented by two treaties: the Kyoto Protocol and the Paris Agreement.

Uptake
The addition of a substance of concern to a reservoir.

See also *Sequestration*

Urban green infrastructure
Public and private green spaces, including remnant native vegetation, parks, private gardens, golf courses, street trees, urban farming and engineered options such as green roofs, green walls, biofilters and raingardens (Norton et al., 2015).

Urbanisation
[Placeholder for SOD]

Urgency
[Placeholder for SOD]

Vulnerability
The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

See also *Exposure*, *Hazard*, and *Risk*

Well-being
A state of existence that fulfils various human needs, including material living conditions, meaningful social and community relationships and quality of life, as well as the ability to pursue ones goals, to thrive, and feel satisfied with ones life. Ecosystem well-being refers to the ability of ecosystems to maintain their diversity and quality.

Eudaimonic
Relational well-being concept based on the premise that experiencing life purpose, challenges and growth leads to flourishing, self-realisation, personal expression, and full functioning (Niemiec 2014; Lamb and Steinberger 2017).

Hedonic well-being
Subjective well-being concept based on the idea that attaining pleasure and avoiding pain leads to happiness (Ryan 2001).

References

Allan, J.A., 2005: Virtual water: A strategic resource global solutions to regional deficits. Groundwater, **36**(4), 545-546, doi: 10.1111/j.1745- 6584.1998.tb02825.x.

AMS, 2000: AMS Glossary of Meteorology, 2nd ed. American Meteorological Society, Boston, MA, Retrieved from: http://amsglossary.allenpress.com/ glossary/browse.

Arctic Council, 2013: Glossary of terms. In: Arctic Resilience Interim Report 2013. Stockholm Environment Institute and Stockholm Resilience Centre, Stockholm, Sweden, pp. viii.

Arctic Council, 2016: Arctic Resilience Report 2016 [M. Carson and G. Peterson (eds).]. Stockholm Environment Institute and Stockholm Resilience Centre, Stockholm, Sweden.

Berkes, F. and C. Folke, 1998: Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 459 pp.

Böcker, L., and T. Meelen, 2017: Sharing for people, planet or profit? Analysing motivations for intended sharing economy participation. *Environ. Innov. Soc. Transitions*, **23**, 28–39, doi: 10.1016/J.EIST.2016.09.004.

Carlisle, K., Gruby, R.L., 2017. Polycentric Systems of Governance: A Theoretical Model for the Commons. Policy Studies Journal 0. doi: doi.org/10.1111/psj.12212

CGIAR, 2019: Sustainable intensification of agriculture: oxymoron or real deal? The Consultative Group on International Agricultural Research (CGIAR). Retrieved from: https://wle.cgiar.org/thrive/big-questions/sustainable-intensification-agriculture-oxymoron-or-real-deal/sustainable-1 .

Culwick, C. and K. Bobbins, 2016: A Framework for a Green Infrastructure Planning Approach in the Gauteng City–Region. GCRO Research Report No. 04, Gauteng City–Region Observatory (GRCO), Johannesburg, South Africa, 127 pp.

Davis, S.J. and K. Caldeira, 2010: Consumption-based accounting of CO_2 emissions. Proceedings of the National Academy of Sciences of the United States of America, **107**(12), 5687-5692, doi:10.1073/pnas.0906974107.

Dietary Guidelines Advisory Committee, 2015: Scientific Report of the 2015 Dietary Guidelines Advisory Committee. US Department of Agriculture, Agricultural Research Service, Washington DC, United States of America.

Ellis, E.C. and N. Ramankutty, 2008: Putting people in the map: anthropogenic biomes of the world. Front. Ecol. Environ., **6**(8), 439-447,doi: 10.1890/070062.

Ellis, E.C., K.K. Goldewijk, S. Siebert, D. Lightman and N. Ramankutty, 2010: Anthropogenic transformation of the biomes, 1700 to 2000. Global Ecology and Biogeography, **19**(5), 589-606, doi:10.1111/j.1466- 8238.2010.00540.x.

EPRS, 2014: Urban and Peri-Urban Agriculture. European Parliamentary Research Service. Retrieved from: https://epthinktank.eu/2014/06/18/ urban-and-peri-urban-agriculture/

FAO, 1985: Irrigation water management: Training manual no.1 – Introduction to irrigation. eds, C. Brouwer, A. Goffeau, and M. Heibloem. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

FAO, 2000: Land cover classification system (LCCS): Classification concepts and user manual. [A. Di Gregorio and L.J.M. Jansen (eds.)]. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy, 179 pp.

FAO, 2001: Glossary. In: The State of Food Insecurity in the World 2001. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy, pp. 49–50.

FAO, 2005: Building on gender, agrobiodiversity and local knowledge: A training manual. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

FAO, 2007: Land evaluation: Towards a revised framework. Land and water discussion paper. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

FAO, 2009: Declaration of the World Summit on Food Security. WSFS 2009/2, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

FAO, 2013: Food wastage footprint: Impacts on natural resources. Summary report. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy, 63 pp.

FAO, 2015a: Agroforestry. Food and Agriculture Organization of the United Nations (FAO). Retrieved from: http://www.fao.org/forestry/ agroforestry/80338/en/.

FAO, 2015b: Food waste. Food and Agriculture Organization of the United Nations (FAO). Retrieved from: http://www.fao.org/platform-food-loss-waste/food-waste/definition/en/.

FAO, 2018: Climate–Smart Agriculture. Food and Agriculture Organization of the United Nations (FAO). Retrieved from: www.fao.org/climate–smart– agriculture.

Forest Europe, 1993: Resolution H1 General Guidelines for the Sustainable Management of Forests in Europe. Second Ministerial Conference on the Protection of Forests in Europe, Helsinki, 16-17 June 1993. Retrieved from: https://www.foresteurope.org/docs/MC/MC_helsinki_resolutionH1.pdf.

Forsyth, Donelson R. (2010): Group Dynamics (5 ed.). Belmont, CA: Wadsworth, Cengage Learning.

Frenken, K., and J. Schor, 2017: Putting the sharing economy into perspective. Environ. Innov. Soc. Transitions, 23, 3–10, doi: doi.org/10.1016/j.eist.2017.01.003.

Fung, A. and E.O. Wright (eds.), 2003: Deepening Democracy: Institutional Innovations in Empowered Participatory Governance. Verso, London, UK, 312 pp.

Garnett, T. et al, 2013: Sustainable intensification in Agriculture: Premises and Policies. Science, **341**(6141), 33. doi:10.1126/science.1234485.

Gbeckor-Kove, N. 1989: Lectures on drought, desertification, in drought and desertification. WMO, TDNo. 286, World Meteorological Organization, Geneva, Switzerland.

Gilens, M., 2012: *Affluence and Influence: Economic inequality and political power in America*. Princeton: Princeton University Press.

Grubler, A., T. B. Johansson, L. Mundaca, N. Nakicenovic, S. Pachauri, K. Riahi, H.-H. Rogner, and L. Strupeit, 2012: Chapter 1 - Energy Primer. Global Energy Assessment - Toward a Sustainable Future, 99–150.

Haupt, M., C. Vadenbo, S. Hellweg, 2017: Do we have the right performance indicators for the circular economy? Insight into the Swiss waste management system. J of Industrial Ecology, **21**(3).

HLPE, 2017: Nutrition and food systems. The High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome, Italy, 152 pp.

IBI, 2018: Frequently Asked Questions About Biochar: What is biochar? International Biochar Initiative (IBI). Retrieved from: https://biochar– international.org/faqs.

ICS, 2019: Formal subdivision of the Holocene Series/Epoch. International Commission on Stratigraphy (ICS). Retrieved from http://www.stratigraphy. org/index.php/ics-news-and-meetings/125-formal-subdivision-of-the-holocene-series-epoch.

IOM, 2018: Key Migration Terms. International Organization for Migration (IOM). Retrieved from: www.iom.int/key–migration–terms.

IPBES, 2018: The IPBES assessment report on land degradation and restoration. [Montanarella, L., Scholes, R., and Brainich, A. (eds.)]. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services, Bonn, Germany, 744 pp.

IPBES, 2019: Glossary. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services, Bonn, Germany. Retrieved from: https://www.ipbes.net/glossary.

IPCC, 2000: Land Use, Land–Use Change, and Forestry: A Special Report of the IPCC. [Watson, R.T., I.R. Noble, B. Bolin, N.H. Ravindranath, D.J. Verardo, and D.J. Dokken (eds.)]. Cambridge University Press, Cambridge, UK, 375 pp.

IPCC, 2003: Definitions and Methodological Options to Inventory Emissions from Direct Human–induced Degradation of Forests and Devegetation of Other Vegetation Types. [Penman, J., M. Gytarsky, T. Hiraishi, T. Krug, D. Kruger, R. Pipatti, L. Buendia, K. Miwa, T. Ngara, K. Tanabe, and F. Wagner (eds.)]. Institute for Global Environmental Strategies (IGES), Hayama, Kanagawa, Japan, 32 pp.

IPCC, 2004: IPCC Workshop on Describing Scientific Uncertainties in Climate Change to Support Analysis of Risk of Options. Workshop Report. Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland, 138 pp.

IPCC, 2006: 2006 IPCC Guidelines for National Greenhouse Gas Inventories. [H.S. Eggleston, L. Buendia, K. Miwa, T. Ngara, K. Tanabe (eds)]. Institute for Global Environmental Strategies (IGES), Hayama, Kanagawa, Japan, 20 pp.

IPCC, 2011: Workshop Report of the Intergovernmental Panel on Climate Change Workshop on Impacts of Ocean Acidification on Marine Biology and Ecosystems. [Field, C.B., V. Barros, T.F. Stocker, D. Qin, K.J. Mach, G.–K. Plattner, M.D. Mastrandrea, M. Tignor, and K.L. Ebi (eds.)]. IPCC Working Group II Technical Support Unit, Carnegie Institution, Stanford, California, United States of America, 164 pp.

IPCC, 2012a: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on

Climate Change (IPCC). [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.–K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 582 pp.

IPCC, 2012b: Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Geoengineering. IPCC Working Group III Technical Support Unit, Potsdam Institute for Climate Impact Research, Potsdam, Germany, 99 pp.

IPCC, 2013: 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. [Hiraishi, T., T. Krug, K. Tanabe, N. Srivastava, J. Baasansuren, M. Fukuda, and T.G. Troxler (eds).]. IPCC, Switzerland.

ISO, 2014: ISO 16559:2014(en) Solid biofuels – Terminology, definitions and descriptions. International Standards Organisation (ISO). Retrieved from: https://www.iso.org/obp/ui/#iso:std:iso:16559:ed-1:v1:en.

ISO, 2018: ISO 14044:2006. Environmental management – Life cycle assessment – Requirements and guidelines. International Standards Organisation (ISO). Retrieved from: www.iso.org/standard/38498.html.

Jagers, S.C. and J. Stripple, 2003: Climate Governance Beyond the State. Global Governance, **9**(3), 385–399, www.jstor.org/stable/27800489.

Jordan, A., Huitema, D., Asselt, H. van, Forster, J., 2018. Governing Climate Change: Polycentricity in Action? Cambridge University Press.

Kirchherr, J., Reike, D. and Hekkert, M. (2017): Conceptualizing the circular economy: An analysis of 114 definitions. Resources, Conservation and Recycling 127, 221-232, https://doi.org/10.1016/j.resconrec.2017.09.005

Korhonen, J., A. Honkasalo, and J. Seppälä, 2018: Circular Economy: The Concept and its Limitations. Ecol. Econ., 143, 37–46, https://doi.org/10.1016/j.ecolecon.2017.06.041

Lamb, W.F., and J. K. Steinberger, 2017: Human well-being and climate change mitigation. *Wiley Interdiscip. Rev. Clim. Chang.*, **8**, https://doi.org/10.1002/wcc.485.

MacDonald, G.K., K.A. Brauman, S. Sun, K.M. Carlson, E.S. Cassidy, J.S. Gerber, and P.C. West, 2015: Rethinking agricultural trade relationships in an era of globalization. BioScience, **65**(3), 275-289, doi:10.1093/biosci/biu225.

Mastrandrea, M.D. et al., 2010: Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland, 6 pp.

McDonald, T., J. Jonson, and K.W. Dixon, 2016: National standards for the practice of ecological restoration in Australia. Restoration Ecology, **24**(S1) S4-S32, doi:10.1111/rec.12359.

Mi, Z., and D. M. Coffman, 2019: The sharing economy promotes sustainable societies. Nat. Commun., 10, 5–7, doi: 10.1038/s41467-019-09260-4.

MA, 2005: Appendix D: Glossary. In: Ecosystems and Human Well–being: Current States and Trends. Findings of the Condition and Trends Working Group [Hassan, R., R. Scholes, and N. Ash (eds.)]. Millennium Ecosystem Assessment (MA). Island Press, Washington DC, USA, pp. 893–900.

McGinnis, M.D., Ostrom, E., 2012. Reflections on Vincent Ostrom, Public Administration, and Polycentricity. Public Administration Review 72, 15–25. https://doi.org/10.1111/j.1540-6210.2011.02488.x

Meinzen-Dick, R. and M. Di Gregorio, 2004: Collective Action and Property Rights for Sustainable Deveopment. International Food and Policy Research Institute. Washington DC, USA.

Mitchell, T. and S. Maxwell, 2010: Defining climate compatible development. CDKN ODI Policy Brief November 2010/A, Climate & Development Knowledge Network (CDKN), 6 pp.

Misra, A., L. Khurana, 2008: Obesity and the metabolic syndrome in developing countries. The Journal of Clinical Endocrinology & Metabolism, **93**(11), 3-30, doi: 10.1210/jc.2008-1595.

Moss, R.H. and S.H. Schneider, 2000: Uncertainties in the IPCC TAR: Recommendations to Lead Authors for More Consistent Assessment and Reporting. In: Guidance Papers on the Cross Cutting Issues of the Third Assessment Report of the IPCC [Pachauri, R., T. Taniguchi, and K. Tanaka (eds.)]. Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland, pp. 33–51

Moss, R.H. et al., 2008: Towards New Scenarios for Analysis of Emissions, Climate Change, Impacts, and Response Strategies. Technical Summary. Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland, 25 pp.

Moss, R.H. et al., 2010: The next generation of scenarios for climate change research and assessment. Nature, **463**(7282), 747–756, doi:10.1038/ nature08823.

MRFCJ, 2018: Principles of Climate Justice. Mary Robinson Foundation For Climate Justice (MRFCJ). Retrieved from: www.mrfcj.org/principles–of– climate–justice.

NDSU, 2014: Saline and Sodic Soils. North Dakota State University (NDSU). Retrieved from: https://www.ndsu.edu/soilhealth/wp-content/ uploads/2014/07/Saline-and-Sodic-Soils-2-2.pdf.

Niemiec, C. P., 2014: Eudaimonic Well-being, In *Encyclopedia of Quality of Life and Well-Being Research [A.C. Michalos (ed.)]*,. doi**:** 10.1007/978-94-007-0753-5_929.

Norton, B.A., A.M. Coutts, S.J. Livesley, R.J. Harris, A.M. Hunter, and N.S.G. Williams, 2015: Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes. Landscape and Urban Planning, **134**, 127-138, doi:10.1016/j. landurbplan.2014.10.018.

O'Neill, B.C. et al., 2014: A new scenario framework for climate change research: the concept of shared socioeconomic pathways. Climatic Change, **122**(3), 387–400, doi:10.1007/s10584–013–0905–2.

O'Neill, B.C. et al., 2017: The roads ahead: Narratives for shared socioeconomic pathways describing world futures in the 21st century. Global Environmental Change, **42**, 169–180, doi:10.1016j.gloenvcha.2015.01.004.

O'Neill, D. W., A. L. Fanning, W. F. Lamb, J. K. Steinberger, D. W. O'Neill, A. L. Fanning, W. F. Lamb, and J. K. Steinberger, 2018: A good life for all within planetary boundaries. Nat. Sustain., 1, 88–95, doi: https://doi.org/10.1038/s41893-018-0021-4.

Park, S. E. et al., 2012: Informing adaptation responses to climate change through theories of transformation. Global Environmental Change, **22**(1), 115–126. doi:10.1016/j.gloenvcha.2011.10.003.

Peters, B.G. and J. Pierre, 2001: Developments in intergovernmental relations: towards multi–level governance. Policy & Politics, **29(**2), 131–135, doi:10.1332/0305573012501251.

Popkin, B.M., 1994: The nutrition transition in low-income countries: an emerging crisis. Nutr. Rev. **52**(9), 285-298, doi: https://doi. org/10.1111/j.1753-4887.1994.tb01460.x.

Popkin, B.M., 2006: Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases. The American Journal of Clinical Nutrition, **84(**2), 289-298, doi: https://doi.org/10.1093/ ajcn/84.1.289.

Pongratz, J. et al., 2018: Models meet data: Challenges and opportunities in implementing land management in Earth system models. Global Change Biology, **24**(4) 1470-1487, doi: 10.1111/gcb.13988.

Potting, J., A. Hanemaaijer, R. Delahaye, J. Ganzevles, R. Hoekstra, and J. Lijzen, 2018: Circular Economy : What We Want To Know and Can Measure. 20 pp.

Riahi, K. et al., 2017: The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. Global Environmental Change, **42**, 153–168, doi: 10.1016/j. gloenvcha.2016.05.009.

Rao, N. D., and P. Baer, 2012: "Decent Living" Emissions: A Conceptual Framework. *Sustainability*, **4**, 656–681, doi: 10.3390/su4040656.

Rao, N. D., and J. Min, 2018: Decent Living Standards: Material Prerequisites for Human Wellbeing. Soc. Indic. Res., 138, 225–244, doi: 10.1007/s11205-017-1650-0.

Reddy, A.K.N., 2000. "Energy and social issues," in United Nations Development Programme, United Nations Department of Economic and Social Affairs and World Energy Council, *World Energy Assessment*, UPDP: New York, p. 59

Robinson, C., S. Bouzarovski, S. Lindley, 2018: Getting the measure of fuel poverty': The geography of fuel poverty indicators in England. Energy Research and Social Science, **36**, 79-93. doi: 10.1016/j.erss.2017.09.035.

Roy, J., A.M. Dowd, A. Muller, S. Pal, and N. Prata, 2012: Chapter 21- Lifestyles, well-being and energy. *Global Energy Assessment—Toward a Sustainable Future*, Cambridge University Press, 1527–1548.

Rulli, M.C. and P. D'Odorico, 2014: Food appropriation through large scale land acquisitions. Environmental Research Letters, **9**(6), doi: 10.1088/1748- 9326/9/6/064030.

Ryan, R. M., and E. L. Deci, 2001: On happiness and human potentials: a review of research on hedonic and eudaimonic well-being. Annu. Rev. Psychol., **52**, 141–166, https://doi.org/10.1146/annurev.psych.52.1.141.

Sarmiento, H. and C. Tilly, 2018: Governance Lessons from Urban Informality. Politics and Governance, **6**(1), 199–202, doi:10.17645/pag.v6i1.1169.

Silvertown, J. (2009). A new dawn for citizen science. Trends in Ecology & Evolution, **24**(9), 467-471, doi: 10.1016/J.TREE.2009.03.017.

Soulé, M.E., 2010: Conservation relevance of ecological cascades. In: Trophic Cascades: Predators, Prey, and the Changing Dynamics of Nature [J. Terborgh and J.A. Estes (eds.)]. Island Press, 337-352.

Sovacool, Benjamin K. and Dworkin, Michael H. (2014): Global energy justice: problems, principles and practices. Cambridge University Press, Cambridge. 231 pp. ISBN 9781107041950

Tabara, J.D., J. Jager, D. Mangalagiu, and M. Grasso, 2018: Defining transformative climate science to address high–end climate change. Regional Environmental Change, 1–12, doi:10.1007/s10113–018–1288–8.

Tajfel, H., & Turner, J. C. (1986): The social identity theory of intergroup behaviour. In S. Worchel & W. G. Austin (eds.). Psychology of Intergroup Relations. Chicago, IL: Nelson-Hall. pp. 7–24.

Termeer, C.J.A.M., A. Dewulf, and G.R. Biesbroek, 2017: Transformational change: governance interventions for climate change adaptation from a continuous change perspective. Journal of Environmental Planning and Management, **60**(4), 558–576, doi:10.1080/09640568.2016.1168288.

Türkeş M, 1999: Vulnerability of Turkey to desertification with respect to precipitation and aridity conditions. Turkish J. Eng. Environ. Sci., **23**, 363- 380.

Türkeş, M., 2017: General Climatology: Fundamentals of Atmosphere, Weather and Climate. Revised Second Edition, Kriter Publisher Physical Geography Series No: 4, ISBN: 978-605-9336-28-4, xxiv + 520 pp. Kriter Publisher, Berdan Matbaası: İstanbul. (In Turkish).

United Nations Secretary General's Advisory Group on Energy and Climate (AGECC), 2010: Energy for a Sustainable Future. New York, NY, USA.

UN, 1992: Article 2: Use of Terms. In: Convention on Biological Diversity. United Nations (UN), pp. 3–4.

UN, 1998: Guiding Principles on Internal Displacement. E/CN.4/1998/53/ Add.2,United Nations (UN) Economic and Social Council, 14 pp.

UN, 2015: Transforming Our World: The 2030 Agenda for Sustainable Development. A/RES/70/1, United Nations General Assembly (UNGA), New York, NY, USA, 35 pp.

UNCCD, 1994: United Nations Convention to Combat Desertification in countries experiencing serious drought and/or desertification, particularly in Africa. A/AC.241/27, United Nations General Assembly (UNGA), New York, NY, USA, 58 pp.

UNCCD, 2019: Achieving Land Degradation Neutrality. United Nations Convention to Combat Desertification (UNCCD). Retrieved from: https:// www.unccd.int/actions/achieving-land-degradation-neutrality.

UN DESA, 2016: Identifying social inclusion and exclusion. In: Leaving no one behind: the imperative of inclusive development. Report on the World Social Situation 2016. ST/ESA/362, United Nations Department of Economic and Social Affairs (UN DESA), New York, NY, USA, pp. 17–31.

UNESCO, 2018: Local and Indigenous Knowledge Systems. United Nations Educational,Scientific and Cultural Organization (UNESCO). Retrieved from: www.unesco.org/new/en/natural–sciences/priority–areas/links/ related–information/what–is–local–and–indigenous–knowledge.

UNEP, 2016: Unlocking the sustainable potential of land resources: evaluating systems, strategies and tools. Factsheet. United Nations Environment Programme (UNEP). Retrieved from: http://hdl.handle. net/20.500.11822/7711.

UNFCCC, 1992: United Nations Framework Convention on Climate Change. United Nations, New York, United States. Retrieved from: https://unfccc. int/files/essential_background/background_publications_htmlpdf/ application/pdf/conveng.pdf.

UNFCCC, 2019: Land Use, Land-Use Change and Forestry (LULUCF). United Nations Framework Convention on Climatic Change (UNFCCC), Bonn, Germany. Retrieved from: https://unfccc.int/topics/land-use/workstreams/ land-use--land-use-change-and-forestry-lulucf.

UNISDR, 2009: 2009 UNISDR Terminology on Disaster Risk Reduction. United Nations International Strategy for Disaster Reduction (UNISDR), Geneva, Switzerland, 30 pp.

UNOHCHR, 2018: What are Human rights? UN Office of the High Commissioner for Human Rights (UNOHCHR). Retrieved from: www.ohchr.org/EN/Issues/ Pages/whatarehumanrights.aspx.

UN–OHRLLS, 2011: Small Island Developing States: Small Islands Big(ger) Stakes. Office for the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN–OHRLLS), New York, NY, USA, 32 pp.

UN–OHRLLS, 2018: Small Island Developing States: Country profiles. Office for the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN–OHRLLS). Retrieved from: http://unohrlls.org/about–sids/country–profiles.

UN–REDD, 2009: Measurement, Assessment, Reporting and Verification (MARV): Issues and Options for REDD. Draft Discussion Paper, United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN– REDD), Geneva, Switzerland, 12 pp.

Vandergeten, E., H. Azadi, D. Teklemariam, J. Nyssen, F. Witlox and E. Vanhaute, 2016: Agricultural Outsourcing or Land Grabbing: A Meta-Analysis. Landscape Ecology, **31**(7), 1395-1417, doi: 10.1007/s10980-016-0365-y.

WCED, 1987: Our Common Future. World Commission on Environment and Development (WCED), Geneva, Switzerland, 400 pp., doi:10.2307/2621529.

Well, R.R. and N.C. Brady, 2016: Nature and property of soils, 15th Edition. Pearson Education Limited, Harlow, England, 420-430 pp.

Wiener, J.B. and J.D. Graham, 2009: Risk vs. risk: Tradeoffs in protecting health and the environment. Harvard University Press, Cambridge, MA, USA.

Willems, S. and K. Baumert, 2003: Institutional Capacity and Climate Actions. COM/ENV/EPOC/IEA/SLT(2003)5, Organisation for Economic Co–operation and Development (OECD) International Energy Agency (IEA), Paris, France, 50 pp.

Whitmee, S. et al., 2015: Safeguarding human health in the Anthropocene epoch: Report of the Rockefeller Foundation-Lancet Commission on planetary health. The Lancet, **366**(10007), 1973-2028.

WHO, 2018: Malnutrition. World Health Organization (WHO). Retrieved from: http://www.who.int/topics/malnutrition/en/.

WMO, 2019: What are weather/climate services? Global Framework for Climate Services, Geneva, Switzerland. Retrieved from: https://www.wmo. int/gfcs/what_are_climate_weather_services.

WOCAT, undated: Glossary. World Overview of Conservation Approaches and Technologies (WOCAT). Retrieved from: https://www.wocat.net/en/ glossary.

Young, A. 1989: Agroforestry for soil conservation. International Council for Research in Agroforestry, Nairobi, Kenya, 318p.