AI

Annex I: Glossary

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Notes:
Note that subterms are in italics beneath main terms.

This glossary defines some specific terms as the Lead Authors intend them to be interpreted in the context of this report. Blue, italicized words indicate that the term is defined in the Glossary.

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1.5°C pathway See *Pathways*.

1.5°C warmer worlds *Projected* worlds in which *global warming* has reached and, unless otherwise indicated, been limited to 1.5°C above *pre-industrial* levels. There is no single 1.5°C warmer world, and *projections* of 1.5°C warmer worlds look different depending on whether it is considered on a near-term transient trajectory or at climate equilibrium after several millennia, and, in both cases, if it occurs with or without *overshoot*. Within the 21st century, several aspects play a role for the assessment of risk and potential *impacts* in 1.5°C warmer worlds: the possible occurrence, magnitude and duration of an overshoot; the way in which emissions reductions are achieved; the ways in which policies might be able to influence the *resilience* of human and natural systems; and the nature of the regional and sub-regional risks. Beyond the 21st century, several elements of the *climate system* would continue to change even if the global mean temperatures remain stable, including further increases of sea level.

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). See also *Sustainable Development Goals (SDGs)*.

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.

Adaptability See *Adaptive capacity*.

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.

Incremental adaptation
Adaptation that maintains the essence and integrity of a system or process at a given scale. In some cases, incremental adaptation can accrue to result in *transformational adaptation* (Termeer et al., 2017; Tàbara et al., 2018).

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

Adaptation limits
The point at which an actor's 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 are currently not available to avoid intolerable risks through adaptive action.

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

Adaptation behaviour See *Human behaviour*.

Adaptation limits See *Adaptation*.

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 categorized as structural, institutional, ecological or behavioural. See also *Adaptation*, *Adaptive capacity* and *Maladaptive actions (Maladaptation).*

Adaptation pathways See *Pathways*.

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. This glossary entry builds from definitions used in previous IPCC reports and the Millennium Ecosystem Assessment (MEA, 2005). See also *Adaptation*, *Adaptation options and Maladaptive actions (Maladaptation)*.

Adaptive governance See *Governance*.

Aerosol A suspension of airborne solid or liquid particles, with a typical size between a few nanometres and 10 µm that reside in the *atmosphere* for at least several hours. The term aerosol, which includes both the particles and the suspending gas, is often used in this report in its plural form to mean aerosol particles. Aerosols may be of either natural or *anthropogenic* origin. Aerosols may influence *climate* in several ways: through both interactions that scatter and/or absorb radiation and through interactions with cloud microphysics and other cloud properties, or upon deposition on snow- or ice-covered surfaces thereby altering their *albedo* and contributing to *climate feedback*. Atmospheric aerosols, whether natural or anthropogenic, originate from two different pathways: emissions of primary particulate matter (PM), and formation of secondary PM from gaseous *precursors*. The bulk of aerosols are of natural origin. Some scientists use group labels that refer to the chemical composition, namely: sea salt, organic carbon, *black carbon (BC)*, mineral species (mainly desert dust), sulphate, nitrate, and ammonium. These labels are, however, imperfect as aerosols combine particles to create complex mixtures. See also *Short-lived climate forcers (SLCF)* and *Black carbon (BC)*.

Afforestation Planting of new *forests* on lands that historically have not contained forests. For a discussion of the term forest and related terms such as afforestation, *reforestation* and *deforestation*, see the IPCC Special Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000), information provided by the United Nations Framework Convention on Climate Change (UNFCCC, 2013) and the report on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003). See also *Reforestation*, *Deforestation*, and *Reducing Emissions from Deforestation and Forest Degradation (REDD+)*.

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 *Evidence*, *Confidence*, *Likelihood* and *Uncertainty*.

Air pollution Degradation of air quality with negative effects on human health or the natural or built environment due to the introduction, by natural processes or human activity, into the *atmosphere* of substances (gases, *aerosols*) which have a direct (primary pollutants) or indirect (secondary pollutants) harmful effect. See also *Aerosol* and *Short-lived climate forcers (SLCF)*.

Albedo The fraction of solar radiation reflected by a surface or object, often expressed as a percentage. Snow-covered surfaces have a high albedo, the surface albedo of soils ranges from high to low, and vegetation-covered surfaces and the oceans have a low albedo. The Earth's planetary albedo changes mainly through varying cloudiness and changes in snow, ice, leaf area and land cover.

Ambient persuasive technology Technological systems and environments that are designed to change human cognitive processing,

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attitudes and behaviours without the need for the user's conscious attention.

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

Anthropocene The 'Anthropocene' is a proposed new geological epoch resulting from significant human-driven changes to the structure and functioning of the Earth System, including the *climate system*. Originally proposed in the Earth System science community in 2000, the proposed new epoch is undergoing a formalization process within the geological community based on the stratigraphic *evidence* that human activities have changed the Earth System to the extent of forming geological deposits with a signature that is distinct from those of the *Holocene*, and which will remain in the geological record. Both the stratigraphic and Earth System approaches to defining the Anthropocene consider the mid-20th Century to be the most appropriate starting date, although others have been proposed and continue to be discussed. The Anthropocene concept has been taken up by a diversity of disciplines and the public to denote the substantive influence humans have had on the state, dynamics and future of the Earth System. See also *Holocene*.

Anthropogenic Resulting from or produced by human activities. See also *Anthropogenic emissions* and *Anthropogenic removals*.

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. See also *Anthropogenic* and *Anthropogenic removals*.

Anthropogenic removals Anthropogenic removals refer to the withdrawal of *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 in the atmosphere, can reduce atmospheric CO_2 if it is combined with *bioenergy* production *(BECCS)*. See also *Anthropogenic emissions*, *Bioenergy with carbon dioxide capture and storage (BECCS)* and *Carbon dioxide capture and storage (CCS)*.

Artificial intelligence (AI) Computer systems able to perform tasks normally requiring human intelligence, such as visual perception and speech recognition.

Atmosphere The gaseous envelope surrounding the earth, divided into five layers – the *troposphere* which contains half of the Earth's 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 (H_2O), whose amounts are highly variable but typically around 1% volume mixing ratio. The atmosphere also contains clouds and aerosols. See also *Troposphere*, *Stratosphere*, *Greenhouse gas (GHG)* and *Hydrological cycle*.

Atmosphere–ocean general circulation model (AOGCM) See *Climate model*.

Attribution See *Detection and attribution*.

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. See also *Emission scenario* and *Mitigation scenario*.

Battery electric vehicle (BEV) See *Electric vehicle (EV)*.

Biochar Stable, carbon-rich material produced by heating *biomass* in an oxygen-limited environment. Biochar may be added to soils to improve soil functions and to reduce *greenhouse gas* emissions from biomass and soils, and for *carbon sequestration*. This definition builds from IBI (2018).

Biodiversity Biological diversity means the variability among living organisms from all sources, including, inter alia, 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).

Bioenergy Energy derived from any form of *biomass* or its metabolic by-products. See also *Biomass* and *Biofuel*.

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* and *Carbon dioxide capture and storage (CCS)*.

Biofuel A fuel, generally in liquid form, produced from *biomass*. Biofuels currently include bioethanol from sugarcane or maize, biodiesel from canola or soybeans, and black liquor from the paper-manufacturing process. See also *Biomass* and *Bioenergy*.

Biomass Living or recently dead organic material. See also *Bioenergy* and *Biofuel*.

Biophilic urbanism Designing cities with green roofs, green walls and green balconies to bring nature into the densest parts of cities in order to provide *green infrastructure* and human health benefits. See also *Green infrastructure*.

Black carbon (BC) Operationally defined *aerosol* species based on measurement of light absorption and chemical reactivity and/or thermal stability. It is sometimes referred to as soot. BC is mostly formed by the incomplete combustion of *fossil fuels*, *biofuels* and *biomass* but it also occurs naturally. It stays in the *atmosphere* only for days or weeks. It is the most strongly light-absorbing component of particulate matter (PM) and has a warming effect by absorbing heat into the atmosphere and reducing the *albedo* when deposited on snow or ice. See also *Aerosol*.

Blue carbon Blue carbon is the carbon captured by living organisms in coastal (e.g., mangroves, salt marshes, seagrasses) and marine *ecosystems*, and stored in *biomass* and sediments.

Burden sharing (also referred to as Effort sharing) In the context of *mitigation*, burden sharing refers to sharing the effort of reducing the sources or enhancing the sinks of *greenhouse gases (GHGs)*

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from historical or *projected* levels, usually allocated by some criteria, as well as sharing the cost burden across countries.

Business as usual (BAU) See *Baseline scenario*.

Carbon budget This term 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 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 *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*.

Carbon cycle The term used to describe 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 (Gigatonne of carbon = 1 GtC = 10^{15} grams of carbon. This 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 gas (GHG)*.

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 *Carbon dioxide capture and utilisation (CCU)*, *Bioenergy with carbon dioxide capture and storage (BECCS)* and *Uptake*.

Carbon dioxide capture and utilisation (CCU) A process in which *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 capture, utilisation and storage (CCUS) See *Carbon dioxide capture and utilisation (CCU)*.

Carbon dioxide removal (CDR) *Anthropogenic* activities removing *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 sinks and direct air capture and storage, but excludes natural CO_2 *uptake* not directly caused by human activities. See also *Mitigation (of climate change)*, *Greenhouse gas removal (GGR)*, *Negative emissions*, *Direct air carbon dioxide capture and storage (DACCS)* and *Sink*.

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 neutrality See *Net zero CO_2 emissions*.

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*.

Carbon sequestration The process of storing carbon in a carbon pool. See also *Blue carbon*, *Carbon dioxide capture and storage (CCS)*, *Uptake* and *Sink*.

Carbon sink See *Sink*.

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. 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 Climate change refers to 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 *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*, *Global warming*, *Ocean acidification (OA)* and *Detection and attribution*.

Climate change commitment Climate change commitment is defined as the unavoidable future *climate change* resulting from inertia in the geophysical and socio-economic systems. Different types of climate change commitment are discussed in the literature (see subterms). Climate change commitment is usually quantified in terms of the further change in temperature, but it includes other future changes, for example in the *hydrological cycle*, in *extreme weather events*, in extreme climate events, and in sea level.

Constant composition commitment
The constant composition commitment is the remaining *climate change* that would result if atmospheric composition, and hence *radiative forcing*, were held fixed at a given value. It results from the thermal inertia of the ocean and slow processes in the cryosphere and land surface.

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Constant emissions commitment
The constant emissions commitment is the committed *climate change* that would result from keeping *anthropogenic emissions* constant.

Zero emissions commitment
The zero emissions commitment is the climate change commitment that would result from setting *anthropogenic emissions* to zero. It is determined by both inertia in physical *climate system* components (ocean, cryosphere, land surface) and *carbon cycle* inertia.

Feasible scenario commitment
The feasible scenario commitment is the *climate change* that corresponds to the lowest *emission scenario* judged feasible.

Infrastructure commitment
The infrastructure commitment is the *climate change* that would result if existing *greenhouse gas* and *aerosol* emitting infrastructure were used until the end of its expected lifetime.

Climate-compatible development (CCD) A form of development building on climate strategies that embrace development goals and development strategies that integrate climate *risk management*, *adaptation* and *mitigation*. This definition builds from Mitchell and Maxwell (2010).

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. For simplicity, both *extreme weather events* and extreme climate events are referred to collectively as 'climate extremes'. See also *Extreme weather event*.

Climate feedback An interaction in which a perturbation in one *climate* quantity causes a change in a second and the change in the second quantity ultimately leads to an additional change in the first. A negative feedback is one in which the initial perturbation is weakened by the changes it causes; a positive feedback is one in which the initial perturbation is enhanced. The initial perturbation can either be externally forced or arise as part of internal variability.

Climate governance See *Governance*.

Climate justice See *Justice*.

Climate model A numerical 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 parametrizations 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. See also *Earth system model (ESM)*.

Climate neutrality Concept of a state in which human activities result in no net effect on the *climate system*. Achieving such a state would require balancing of residual emissions with emission (*carbon dioxide*) removal as well as accounting for regional or local biogeophysical effects of human activities that, for example, affect surface *albedo* or local *climate*. See also *Net zero CO_2 emissions*.

Climate projection A climate *projection* is the simulated response of the *climate system* to a *scenario* of future emission or concentration of *greenhouse gases (GHGs)* and *aerosols*, generally derived using *climate models*. Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/*radiative forcing* scenario used, which is in turn based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized.

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 1.5°C) and achieve desirable and liveable futures and *well-being* 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 *Development pathways* (under *Pathways*), *Transformation pathways* (under *Pathways*), and *Climate-resilient development pathways (CRDPs)*.

Climate sensitivity Climate sensitivity refers to the change in the annual *global mean surface temperature* in response to a change in the atmospheric *CO_2* concentration or other radiative forcing.

Equilibrium climate sensitivity
Refers to the equilibrium (steady state) change in the annual *global mean surface temperature* following a doubling of the atmospheric *carbon dioxide (CO_2)* concentration. As a true equilibrium is challenging to define in *climate models* with dynamic oceans, the equilibrium climate sensitivity is often estimated through experiments in AOGCMs where CO_2 levels are either quadrupled or doubled from *pre-industrial* levels and which are integrated for 100-200 years. The climate sensitivity parameter (units: °C $(W\ m^{-2})^{-1}$) refers to the equilibrium change in the annual global mean surface temperature following a unit change in *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, centered at the time of atmospheric *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 Climate services refers to 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. Products can include climate data products.

Climate-smart agriculture (CSA) Climate-smart agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure *food security* in a changing *climate*. CSA aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes, *adapting* and building *resilience* to *climate change*, and reducing and/or removing *greenhouse gas* emissions, where possible (FAO, 2018).

Climate system The climate system is the highly complex system consisting of five major components: the *atmosphere*, the hydrosphere,

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the cryosphere, the lithosphere and the biosphere and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external *forcings* such as volcanic eruptions, solar variations and *anthropogenic* forcings such as the changing composition of the atmosphere and *land-use change*.

Climate target Climate target refers to 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 variability Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the *climate* on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the *climate system* (internal variability), or to variations in natural or *anthropogenic* external *forcing* (external variability). See also *Climate change*.

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.

Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC) Common but Differentiated Responsibilities and Respective Capabilities (CBDR–RC) is a key principle in the *United Nations Framework Convention on Climate Change (UNFCCC)* that recognises the different capabilities and differing responsibilities of individual countries in tacking *climate change*. The principle of CBDR–RC is embedded in the 1992 UNFCCC treaty. The convention states: "… the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions." Since then the CBDR-RC principle has guided the UN climate negotiations.

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. See also *United Nations Framework Convention on Climate Change (UNFCCC)*.

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 report, confidence is expressed qualitatively (Mastrandrea et al., 2010). See Section 1.6 for the list of confidence levels used. See also *Agreement*, *Evidence*, *Likelihood* and *Uncertainty*.

Conservation agriculture A coherent group of agronomic and soil management practices that reduce the disruption of soil structure and biota.

Constant composition commitment See *Climate change commitment*.

Constant emissions commitment See *Climate change commitment*.

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. This glossary entry builds from the definition used in UNISDR (2009) and 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 reveals 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 A measure of the cost at which policy goal or outcome is achieved. The lower the cost the greater the cost-effectiveness.

Coupled Model Intercomparison Project (CMIP) The Coupled Model Intercomparison Project (CMIP) is a climate modelling activity from the World Climate Research Programme (WCRP) which coordinates and archives *climate model* simulations based on shared model inputs by modelling groups from around the world. The CMIP3 multimodel data set includes *projections* using SRES *scenarios*. The CMIP5 data set includes projections using the *Representative Concentration Pathways (RCPs)*. The CMIP6 phase involves a suite of common model experiments as well as an ensemble of CMIP-endorsed model intercomparison projects (MIPs).

Cumulative emissions The total amount of emissions released over a specified period of time. See also *Carbon budget*, and *Transient climate response to cumulative CO_2 emissions (TCRE)*.

Decarbonization The 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.

Decoupling Decoupling (in relation to *climate change*) is where economic growth is no longer strongly associated with consumption of *fossil fuels*. Relative decoupling is where both grow but at different rates. Absolute decoupling is where economic growth happens but fossil fuels decline.

Deforestation Conversion of *forest* to non-forest. For a discussion of the term forest and related terms such as *afforestation*, *reforestation* and *deforestation*, see the IPCC Special Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000). See also information provided by the United Nations Framework Convention on Climate Change (UNFCCC, 2013) and the report on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003). See also *Afforestation*, *Reforestation* and *Reducing Emissions from Deforestation and Forest Degradation (REDD+)*.

Deliberative governance See *Governance*.

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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* emissions emitted per unit of energy produced.

See also *Mitigation measures*.

Demand-side measures See *Demand- and supply-side measures*.

Detection See *Detection and attribution*.

Detection and attribution Detection of change is defined as the process of demonstrating that *climate* or a system affected by climate has changed in some defined statistical sense, without providing a reason for that change. An identified change is detected in observations if its *likelihood* of occurrence by chance due to internal variability alone is determined to be small, for example, <10%. Attribution is defined as the process of evaluating the relative contributions of multiple causal factors to a change or event with a formal assessment of *confidence*.

Development pathways See *Pathways*.

Direct air carbon dioxide capture and storage (DACCS) Chemical process by which CO_2 is captured directly from the ambient air, with subsequent storage. Also known as direct air capture and storage (DACS).

Disaster Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery. See also *Hazard* and *Vulnerability*.

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

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.

(Internal) Displacement Internal displacement refers to the forced movement of people within the country they live in. Internally displaced persons (IDPs) are 'Persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border.' (UN, 1998). See also *Migration*.

Disruptive innovation Disruptive innovation is demand-led technological change that leads to significant system change and is characterized by strong exponential growth.

Distributive equity See *Equity*.

Distributive justice See *Justice*.

Double dividend The extent to which revenues generated by *policy* instruments, such as carbon taxes or auctioned (tradeable) emission permits can (1) contribute to *mitigation* and (2) offset part of the potential welfare losses of climate policies through recycling the revenue in the economy by reducing other distortionary taxes.

Downscaling Downscaling is a method that derives local- to regional-scale (up to 100 km) information from larger-scale models or data analyses. Two main methods exist: dynamical downscaling and empirical/statistical downscaling. The dynamical method uses the output of regional *climate models*, global models with variable spatial resolution, or high-resolution global models. The empirical/statistical methods are based on observations and develop statistical relationships that link the large-scale atmospheric variables with local/regional *climate* variables. In all cases, the quality of the driving model remains an important limitation on quality of the downscaled information. The two methods can be combined, e.g., applying empirical/statistical downscaling to the output of a regional climate model, consisting of a dynamical downscaling of a global climate model.

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. See also *Soil moisture*.

Megadrought
A megadrought is a very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more.

Early warning systems (EWS) The set of technical, financial and *institutional capacities* needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a *hazard* to prepare to act promptly and appropriately to reduce the possibility of harm or loss. Dependent upon context, EWS may draw upon scientific and/or *Indigenous knowledge*. EWS are also considered for ecological applications e.g., conservation, where the organization itself is not threatened by hazard but the *ecosystem* under conservation is (an example is coral bleaching alerts), in agriculture (for example, warnings of ground frost, hailstorms) and in fisheries (storm and tsunami warnings). This glossary entry builds from the definitions used in UNISDR (2009) and IPCC (2012a).

Earth system feedbacks See *Climate feedback*.

Earth system model (ESM) A coupled atmosphere–ocean general circulation model in which a representation of the *carbon cycle* is included, allowing for interactive calculation of atmospheric CO_2 or compatible emissions. Additional components (e.g., atmospheric chemistry, *ice sheets*, dynamic vegetation, nitrogen cycle, but also urban or crop models) may be included. See also *Climate model*.

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Ecosystem An ecosystem is 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.

Effective climate sensitivity See *Climate sensitivity*.

Effective radiative forcing See *Radiative forcing*.

El Niño-Southern Oscillation (ENSO) The term El Niño was initially used to describe a warm-water current that periodically flows along the coast of Ecuador and Peru, disrupting the local fishery. It has since become identified with warming of the tropical Pacific Ocean east of the dateline. This oceanic event is associated with a fluctuation of a global-scale tropical and subtropical surface pressure pattern called the Southern Oscillation. This coupled atmosphere–ocean phenomenon, with preferred time scales of two to about seven years, is known as the El Niño-Southern Oscillation (ENSO). It is often measured by the surface pressure anomaly difference between Tahiti and Darwin and/or the *sea surface temperatures* in the central and eastern equatorial Pacific. During an ENSO event, the prevailing trade winds weaken, reducing upwelling and altering ocean currents such that the sea surface temperatures warm, further weakening the trade winds. This phenomenon has a great impact on the wind, sea surface temperature and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world, through global teleconnections. The cold phase of ENSO is called La Niña.

Electric vehicle (EV) A vehicle whose propulsion is powered fully or mostly by electricity.

Battery electric vehicle (BEV)
A vehicle whose propulsion is entirely electric without any internal combustion engine.

Plug-in hybrid electric vehicle (PHEV)
A vehicle whose propulsion is mostly electric with batteries re-charged from an electric source but extra power and distance are provided by a hybrid internal combustion engine.

Emission pathways See *Pathways*.

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*. See also *Baseline scenario*, *Mitigation scenario*, *Socio-economic scenario*, *Scenario*, *Representative Concentration Pathways (RCPs)* (under *Pathways*), *Shared Socio-economic Pathways (SSPs)* (under *Pathways*) and *Transformation pathways* (under *Pathways*).

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 *Emission pathways* (under *Pathways*).

Emissions trading A market-based instrument aiming at meeting a *mitigation* objective in an efficient way. A cap on *GHG* emissions is divided in tradeable emission permits that are allocated by a combination of auctioning and handing out free allowances to entities within the jurisdiction of the trading scheme. Entities need to surrender emission permits equal to the amount of their emissions (e.g., tonnes of CO_2). An entity may sell excess permits to entities that can avoid the same amount of emissions in a cheaper way. Trading schemes may occur at the intra-company, domestic, or international level (e.g., the flexibility mechanisms under the *Kyoto Protocol* and the EU-ETS) and may apply to carbon dioxide (CO_2), other greenhouse gases (GHGs), or other substances.

Enabling conditions Conditions that affect the *feasibility* of *adaptation* and *mitigation* options, and can accelerate and scale-up systemic transitions that would limit temperature increase to 1.5°C 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*, *multilevel 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. See also *Feasibility*.

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 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.

Enhanced weathering Enhancing the removal of *carbon dioxide (CO_2)* from the *atmosphere* through dissolution of silicate and carbonate rocks by grinding these minerals to small particles and actively applying them to soils, coasts or oceans.

(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 characterize the uncertainty associated with internal *climate variability*, whereas multimodel 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

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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. See also *Climate projection*.

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*, *Ethics* and *Fairness*.

Equilibrium climate sensitivity See *Climate sensitivity*.

Equity Equity is the principle of *fairness* in burden sharing and is 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. It is 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
Ensuring equity in that women and men have the same rights, resources and opportunities. In the case of *climate change* gender equity recognizes 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 that 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.

Procedural equity
Equity in the process of decision-making, including recognition and inclusiveness in participation, equal representation, bargaining power, voice and equitable access to knowledge and resources to participate.

See also *Equality*, *Ethics* and *Fairness*.

Ethics Ethics involves questions of *justice* and value. Justice is concerned with right and wrong, *equity* and *fairness*, and, in general, with the rights to which people and living beings are entitled. Value is a matter of worth, benefit, or good. See also *Equality*, *Equity* and *Fairness*.

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*.

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

Extratropical cyclone Any cyclonic-scale storm that is not a *tropical cyclone*. Usually refers to a middle- or high-latitude migratory storm system formed in regions of large horizontal temperature variations. Sometimes called extratropical storm or extratropical low. See also *Tropical cyclone*.

Extreme weather event An extreme weather event is an event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations. 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 classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., *drought* or heavy rainfall over a season). See also *Heatwave* and *Climate extreme (extreme weather or climate event)*.

Extreme weather or climate 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 *Equity*, *Equality* and *Ethics*.

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*.

Feasible scenario commitment See *Climate change commitment*.

Feedback See *Climate feedback*.

Flexible governance See *Governance*.

Flood The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods.

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).

Food wastage Food wastage encompasses food loss (the loss of food during production and transportation) and food waste (the waste of food by the consumer) (FAO, 2013).

Forcing See *Radiative forcing*.

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. For a discussion of the term forest and related terms such as *afforestation*, *reforestation* and *deforestation*, see the IPCC Special Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000). See also information provided by the United Nations Framework Convention on Climate Change (UNFCCC, 2013) and the Report on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003). See also *Afforestation*, *Deforestation* and *Reforestation*.

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

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Framework Convention on Climate Change See *United Nations Framework Convention on Climate Change (UNFCCC)*.

Gender equity See *Equity*.

General purpose technologies (GPT) General purpose technologies can be or are used pervasively in a wide range of sectors in ways that fundamentally change the modes of operation of those sectors (Helpman, 1998). Examples include the steam engine, power generator and motor, *ICT*, and biotechnology.

Geoengineering In this report, separate consideration is given to the two main approaches considered as 'geoengineering' in some of the literature: *solar radiation modification (SRM)* and *carbon dioxide removal (CDR)*. Because of this separation, the term 'geoengineering' is not used in this report. See also *Carbon dioxide removal (CDR)* and *Solar radiation modification (SRM)*.

Glacier A perennial mass of ice, and possibly firn and snow, originating on the land surface by the recrystallisation of snow and showing *evidence* of past or present flow. A glacier typically gains mass by accumulation of snow, and loses mass by melting and ice discharge into the sea or a lake if the glacier terminates in a body of water. Land ice masses of continental size (>50,000 km^2) are referred to as *ice sheets*. See also *Ice sheet*.

Global climate model (also referred to as general circulation model, both abbreviated as GCM) See *Climate model*.

Global mean surface temperature (GMST) Estimated global average of near-surface air temperatures over land and sea-ice, and *sea surface temperatures* 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 temperature over both land and oceans are also used.[1] See also *Land surface air temperature*, *Sea surface temperature (SST)* and *Global mean surface air temperature (GSAT)*.

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. See also *Global mean surface temperature (GMST)* and *Land surface air temperature*.

Global warming The estimated increase in *global mean surface temperature (GMST)* averaged over a 30-year period, or the 30-year period centered 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*.

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 recognizes 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.

Adaptive governance
An emerging term in the literature for the evolution of formal and informal *institutions* of governance that prioritize *social learning* in planning, implementation and evaluation of policy through iterative social learning to steer the use and protection of natural resources, *ecosystem services* and common pool natural resources, particularly in situations of complexity and *uncertainty*.

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
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 prioritize the use of *social learning* and rapid feedback mechanisms in planning and policy making, often through incremental, experimental and iterative management processes.

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.

Multilevel governance
Multilevel governance refers to negotiated, non-hierarchical exchanges between *institutions* at the transnational, national, regional and local levels. Multilevel governance identifies relationships among governance processes at these different levels. Multilevel governance does include negotiated relationships among institutions at different institutional levels and also a vertical 'layering' of governance processes at different levels. Institutional relationships take place directly between transnational, regional and local levels, thus bypassing the state level (Peters and Pierre, 2001)

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. This definition builds from Fung and Wright (2003) and Sarmiento and Tilly (2018).

Governance capacity See *Governance*.

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. This definition builds from Culwick and Bobbins (2016).

Greenhouse gas (GHG) Greenhouse gases are those 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

[1] Past IPCC reports, reflecting the literature, have used a variety of approximately equivalent metrics of GMST change.

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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 (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). See also *Carbon dioxide (CO_2)*, *Methane (CH_4)*, *Nitrous oxide (N_2O)* and *Ozone (O_3)*.

Greenhouse gas removal (GGR) Withdrawal of a *GHG* and/or a *precursor* from the *atmosphere* by a *sink*. See also *Carbon dioxide removal (CDR)* and *Negative emissions*.

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.

Gross fixed capital formation (GFCF) One component of the *GDP* that corresponds to the total value of acquisitions, minus disposals of fixed assets during one year by the business sector, governments and households, plus certain additions to the value of non-produced assets (such as subsoil assets or major improvements in the quantity, quality or productivity of land).

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.

Hazard The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, *livelihoods*, service provision, *ecosystems* and environmental resources. See also *Disaster*, *Exposure*, *Risk*, and *Vulnerability*.

Heatwave A period of abnormally hot weather. Heatwaves and warm spells have various and in some cases overlapping definitions. See also *Extreme weather event*.

Heating, ventilation, and air conditioning (HVAC) Heating, ventilation and air conditioning technology is used to control temperature and humidity in an indoor environment, be it in buildings or in vehicles, providing thermal comfort and healthy air quality to the occupants. HVAC systems can be designed for an isolated space, an individual building or a distributed heating and cooling network within a building structure or a district heating system. The latter provides economies of scale and also scope for integration with solar heat, natural seasonal cooling/heating etc.

Holocene The Holocene is the current interglacial geological epoch, the second of two epochs within the Quaternary period, the preceding being the Pleistocene. The International Commission on Stratigraphy defines the start of the Holocene at 11,650 years before 1950. See also *Anthropocene*.

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.

Adaptation behaviour
Human actions that directly or indirectly affect the risks of climate change *impacts.*

Mitigation behaviour
Human actions that directly or indirectly influence *mitigation*.

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*.

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. Based upon the definition by the UN Office of the High Commissioner for Human Rights (UNOHCHR, 2018).

Procedural rights
Rights to a legal procedure to enforce *substantive rights*.

Substantive rights
Basic human rights, including the right to the substance of being human such as life itself, liberty and happiness.

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 organizations 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.

Hydrological cycle The cycle in which water evaporates from the oceans and the land surface, is carried over the earth in atmospheric circulation as water vapour, condenses to form clouds, precipitates as rain or snow, which on land can be intercepted by trees and vegetation, potentially accumulates as snow or ice, provides *runoff* on the land surface, infiltrates into soils, recharges groundwater, discharges into streams, flows out into the oceans, and ultimately evaporates again from the ocean or land surface. The various systems involved in the hydrological cycle are usually referred to as hydrological systems.

Ice sheet A mass of land ice of continental size that is sufficiently thick to cover most of the underlying bed, so that its shape is mainly determined by its dynamics (the flow of the ice as it deforms internally and/or slides at its base). An ice sheet flows outward from a high central ice plateau with a small average surface slope. The margins usually slope more steeply, and most ice is discharged through fast flowing ice streams or outlet *glaciers*, in some cases into the sea or into ice shelves floating on the sea. There are only two ice sheets in the modern world, one on Greenland and one on Antarctica. During glacial periods there were others. See also *Glacier*.

(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 realized risks on natural and *human systems*, where risks result from the interactions of climate-related *hazards* (including *extreme weather and climate events*), *exposure*, and *vulnerability*. Impacts generally refer to effects on lives; *livelihoods*; health and *well-being*; *ecosystems* and species; economic, social and cultural assets; services (including

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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*.

Incremental adaptation See *Adaptation*.

Indigenous knowledge Indigenous knowledge refers to the understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For many Indigenous peoples, Indigenous knowledge 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 world's cultural diversity. This definition builds on UNESCO (2018).

Indirect land-use change (iLUC) See *Land-use change (LUC)*.

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)*. See also *Pre-industrial*.

Industrialized/developed/developing countries There are a diversity of approaches for categorizing countries on the basis of their level of development, and for defining terms such as industrialized, developed, or developing. Several categorizations are used in this report. (1) In the United Nations system, there is no established convention for designation of developed and developing countries or areas. (2) The United Nations Statistics Division specifies developed and developing regions based on common practice. In addition, specific countries are designated as Least Developed Countries (LDC), landlocked developing countries, *small island developing states*, 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 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.

Inequality See Equality.

Information and communication technology (ICT) An umbrella term that includes any information and communication device or application, encompassing: computer systems, network hardware and software, cell phones, etc.

Infrastructure commitment See *Climate change commitment*.

Institution Institutions are rules and norms 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 socialization. See also *Institutional capacity*.

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

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) Integrated assessment models (IAMs) 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 *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 water resources management (IWRM) A process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital *ecosystems*.

Inter-generational equity See *Equity*.

Inter-generational justice See *Justice*.

Internal variability See *Climate variability*.

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.

Iron fertilization See *Ocean fertilization*.

Irreversibility A perturbed state of a dynamical system is defined as irreversible on a given timescale, if the recovery time scale from this state due to natural processes is substantially longer than the time it takes for the system to reach this perturbed state. See also *Tipping point*.

Justice Justice is concerned with ensuring that people get what is due to them, setting out the moral or legal principles of *fairness* and *equity* in the way people are treated, often based on the *ethics* and values of society.

Climate justice
Justice that links development and *human rights* to achieve a human-centred approach to addressing *climate change*, safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and its impacts *equitably* and *fairly*. This definition builds upon the one used by the Mary Robinson Foundation – Climate Justice (MRFCJ, 2018).

Distributive justice
Justice in the allocation of economic and non-economic costs and benefits across society.

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Inter-generational justice
Justice in the distribution of economic and non-economic costs and benefits across generations.

Procedural justice
Justice in the way outcomes are brought about including who participates and is heard in the processes of decision-making.

Social justice
Just or fair relations within society that seek to address the distribution of wealth, access to resources, opportunity, and support according to principles of justice and fairness.

See also *Equity*, *Ethics*, *Fairness*, and *Human rights*.

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 (SF_6)) 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. See also *United Nations Framework Convention on Climate Change (UNFCCC)* and *Paris Agreement*.

Land surface air temperature The near-surface air temperature over land, typically measured at 1.25–2 m above the ground using standard meteorological equipment.

Land use Land use refers to the total of arrangements, activities and inputs undertaken in a certain land cover type (a set of human actions). 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 *greenhouse gas* inventories, land use is classified according to the IPCC land use categories of forest land, cropland, grassland, wetland, settlements, other. See also *Land-use change (LUC)*.

Land-use change (LUC) Land-use change involves a change from one *land use* category to another.

Indirect land-use change (iLUC)
Refers to market-mediated or policy-driven shifts in *land use* that cannot be directly attributed to land-use management decisions of individuals or groups. For example, if agricultural land is diverted to fuel production, *forest* clearance may occur elsewhere to replace the former agricultural production.

Land use, land-use change and forestry (LULUCF)
In the context of national *greenhouse gas (GHG)* inventories under the *UNFCCC*, LULUCF is a GHG inventory sector that covers *anthropogenic emissions* and removals of GHG from carbon pools 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 CO_2 removals not considered as 'anthropogenic' in some of the scientific literature assessed in this report (e.g., removals associated with CO_2 fertilization and N deposition), the land-related net GHG emission estimates included in this report are not necessarily directly comparable with LULUCF estimates in National GHG Inventories.

See also *Afforestation*, *Deforestation*, *Reforestation*, and the IPCC Special Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000).

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

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

Likelihood The chance of a specific outcome occurring, where this might be estimated probabilistically. Likelihood is expressed in this report using a standard terminology (Mastrandrea et al., 2010). See Section 1.6 for the list of likelihood qualifiers used. See also *Agreement*, *Evidence*, *Confidence* and *Uncertainty*.

Livelihood The resources used and the activities undertaken in order 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 Local knowledge refers to 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. This definition builds on UNESCO (2018).

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) Long-lived climate forcers refer to 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 time scales, and their effect on climate hence persists for decades to centuries after their emission. On time scales of decades to a century, already emitted emissions of long-lived climate forcers can only be abated by *greenhouse gas removal (GGR)*. See also *Short-lived climate forcers (SLCF)*.

Loss and Damage, and losses and damages Research has taken Loss and Damage (capitalized letters) to refer to political debate under the *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* (see Mechler et al., in press).

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

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Market exchange rate (MER) The rate at which a currency of one country can be exchanged with the currency of another country. In most economies such rates evolve daily while in others there are official conversion rates that are adjusted periodically. See also *Purchasing power parity (PPP)*.

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.

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 IPCC [Intergovernmental Panel on Climate Change] 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)

Megadrought See *Drought*.

Methane (CH_4) One of the six *greenhouse gases (GHGs)* to be mitigated under the *Kyoto Protocol* and is the major component of natural gas and associated with all hydrocarbon fuels. Significant emissions occur as a result of animal husbandry and agriculture, and their management represents a major *mitigation* option.

Migrant See *Migration*.

Migration The International Organization for Migration (IOM) defines migration as 'The 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).

Migrant
The International Organization for Migration (IOM) defines a migrant as '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 person's 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).

See also *(Internal) Displacement*.

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 behaviour See *Human behaviour*.

Mitigation measures In climate *policy*, mitigation measures are technologies, processes or practices that contribute to *mitigation*, for example, renewable energy (RE) technologies, waste minimization processes and public transport commuting practices. See also *Mitigation option*, and *Policies (for climate change mitigation and adaptation)*.

Mitigation option A technology or practice that reduces *GHG* emissions or enhances *sinks*.

Mitigation pathways See *Pathways*.

Mitigation scenario A plausible description of the future that describes how the (studied) system responds to the implementation of *mitigation* policies and measures. See also *Emission scenario*, *Pathways*, *Socio-economic scenario* and *Stabilization (of GHG or CO_2-equivalent concentration)*.

Monitoring and evaluation (M&E) Monitoring and evaluation refers to mechanisms put in place at national to local scales to respectively monitor and evaluate efforts to reduce *greenhouse gas* emissions and/or adapt to the *impacts* of *climate change* with the aim of systematically identifying, characterizing and assessing progress over time.

Motivation (of an individual) An individual's 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 come from outside (extrinsic) or from inside (intrinsic) the individual.

Multilevel governance See *Governance*.

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 *Scenario*, *Scenario storyline* and *Pathways*.

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. In the lead up to 21st *Conference of the Parties* in Paris in 2015, countries submitted Intended Nationally Determined Contributions (INDCs). As countries join the Paris Agreement, unless they decide otherwise, this INDC becomes their first Nationally Determined Contribution (NDC). See also *United Nations Framework Convention on Climate Change (UNFCCC)* and *Paris Agreement*.

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 *Net negative emissions*, *Net zero emissions*, *Carbon dioxide removal (CDR)* and *Greenhouse gas removal (GGR)*.

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Net negative emissions A situation of net negative emissions is achieved when, as result of human activities, more *greenhouse gases* are removed from the *atmosphere* than are emitted into it. Where multiple greenhouse gases 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 emissions* and *Net zero CO_2 emissions*.

Net zero CO_2 emissions Net zero *carbon dioxide (CO_2)* emissions are achieved when *anthropogenic* CO_2 emissions are balanced globally by anthropogenic CO_2 removals over a specified period. Net zero CO_2 emissions are also referred to as carbon neutrality. See also *Net zero emissions* and *Net negative emissions*.

Net zero emissions Net zero emissions are achieved when *anthropogenic emissions* of *greenhouse gases* 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 *Net zero CO_2 emissions*, *Negative emissions* and *Net negative emissions*.

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*.

Non-CO_2 emissions and radiative forcing Non-CO_2 emissions included in this report are all *anthropogenic emissions* other than *CO_2* that result in *radiative forcing*. These include *short-lived climate forcers*, such as *methane (CH_4)*, some fluorinated gases, *ozone (O_3)* precursors, *aerosols* or aerosol *precursors*, such as *black carbon* and sulphur dioxide, respectively, as well as long-lived *greenhouse gases*, such as *nitrous oxide (N_2O)* or other fluorinated gases. The radiative forcing associated with non-CO_2 emissions and changes in surface *albedo* is referred to as non-CO_2 radiative forcing.

Non-overshoot pathways See *Pathways*.

Ocean acidification (OA) Ocean acidification refers to a reduction in the *pH* of the ocean over an extended period, typically decades or longer, which is caused primarily by uptake of *carbon dioxide (CO_2)* from the *atmosphere*, but can also be caused by other chemical additions or subtractions from the ocean. *Anthropogenic* ocean acidification refers to the component of pH reduction that is caused by human activity (IPCC, 2011, p. 37).

Ocean fertilization Deliberate increase of nutrient supply to the near-surface ocean in order to enhance biological production through which additional *carbon dioxide (CO_2)* from the *atmosphere* is sequestered. This can be achieved by the addition of micro-nutrients or macro-nutrients. Ocean fertilization is regulated by the London Protocol.

Overshoot See *Temperature overshoot*.

Overshoot pathways See *Pathways*.

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

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 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C 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 *United Nations Framework Convention on Climate Change (UNFCCC)*, *Kyoto Protocol* and *Nationally Determined Contributions (NDCs)*.

Participatory governance See *Governance*.

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 1.5°C or returning to 1.5°C by around 2100 following an *overshoot*. See also *Temperature 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*.

Development pathways
Development pathways are trajectories based on an array of social, economic, cultural, technological, *institutional* and biophysical features that characterise the interactions between human and natural systems and outline visions for the future, at a particular scale.

Emission pathways
Modelled trajectories of global *anthropogenic emissions* over the 21st century are termed emission pathways.

Mitigation pathways
A mitigation pathway is a temporal evolution of a set of *mitigation scenario* features, such as *greenhouse gas* 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* is required. See also *Temperature overshoot*.

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

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 emphasizes 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 stabilization 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).

See also *Coupled Model Intercomparison Project (CMIP)* and *Shared Socio-economic Pathways (SSPs)*.

Shared Socio-economic Pathways (SSPs)
Shared Socio-economic Pathways (SSPs) were developed to complement the RCPs with varying socio-economic challenges to *adaptation* and *mitigation* (O'Neill 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–fuelled development (SSP5) and middle-of-the-road development (SSP2) (O'Neill, 2000; O'Neill et al., 2017; Riahi et al., 2017). The combination of SSP-based socio-economic scenarios and Representative Concentration Pathway (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.

See also *Scenario*, *Scenario storyline*, *Emission scenario*, *Mitigation scenario*, *Baseline scenario*, *Stabilization (of GHG or CO_2-equivalent concentration)* and *Narratives*.

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

Permafrost Ground (soil or rock and included ice and organic material) that remains at or below 0°C for at least two consecutive years.

pH pH is a dimensionless measure of the acidity of a solution given by its concentration of hydrogen ions ($[H^+]$). pH is measured on a logarithmic scale where $pH = -\log_{10}[H^+]$. Thus, a pH decrease of 1 unit corresponds to a 10-fold increase in the concentration of H^+, or acidity.

Plug-in hybrid electric vehicle (PHEV) See *Electric vehicle (EV)*.

Policies (for climate change mitigation and adaptation) Policies are taken and/or mandated by a government – often in conjunction with business and industry within a single country, or collectively with other countries – to accelerate *mitigation* and *adaptation* measures. Examples of policies are support mechanisms for renewable energy supplies, carbon or energy taxes, fuel efficiency standards for automobiles, etc.

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 Poverty is 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)*.

Precursors Atmospheric compounds that are not *greenhouse gases (GHGs)* or *aerosols*, but that have an effect on GHG or aerosol concentrations by taking part in physical or chemical processes regulating their production or destruction rates. See also *Aerosol* and *Greenhouse gas (GHG)*.

Pre-industrial The multi-century period prior to the onset of large-scale industrial activity around 1750. The *reference period* 1850–1900 is used to approximate pre-industrial *global mean surface temperature (GMST)*. See also *Industrial revolution*.

Procedural equity See *Equity*.

Procedural justice See *Justice*.

Procedural rights See *Human rights*.

Projection A projection is 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 realized. See also *Climate projection*, *Scenario* and *Pathways*.

Purchasing power parity (PPP) The purchasing power of a currency is expressed using a basket of goods and services that can be bought with a given amount in the home country. International comparison of, for example, *gross domestic products (GDPs)* of countries can be based on the purchasing power of currencies rather than on current exchange rates. PPP estimates tend to lower the gap between the per capita GDP in *industrialized* and developing countries. See also *Market exchange rate (MER)*.

Radiative forcing Radiative forcing is 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 a driver of *climate change*, such as a change in the concentration of *carbon dioxide (CO_2)* or 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

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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.

Reasons for Concern (RFCs) Elements of a classification framework, first developed in the IPCC Third Assessment Report, which aims to facilitate judgments about what level of *climate change* may be dangerous (in the language of Article 2 of the *UNFCCC*) by aggregating risks from various sectors, considering *hazards*, *exposures*, *vulnerabilities*, capacities to adapt, and the resulting impacts.

Reducing Emissions from Deforestation and Forest Degradation (REDD+) An effort to create financial value for the carbon stored in *forests*, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to *sustainable development (SD)*. It is therefore a mechanism for *mitigation* that results from avoiding *deforestation*. REDD+ goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. The concept was first introduced in 2005 in the 11th Session of the *Conference of the Parties (COP)* in Montreal and later given greater recognition in the 13th Session of the COP in 2007 at Bali and inclusion in the Bali Action Plan, which called for 'policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries (REDD) and the role of conservation, sustainable management of forests and enhancement of forest carbon stock in developing countries.' Since then, support for REDD has increased and has slowly become a framework for action supported by a number of countries.

Reference period The period relative to which *anomalies* are computed. See also *Anomaly*.

Reference scenario See *Baseline scenario*.

Reforestation Planting of *forests* on lands that have previously contained forests but that have been converted to some other use. For a discussion of the term forest and related terms such as *afforestation*, reforestation and *deforestation*, see the IPCC Special Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000), information provided by the *United Nations Framework Convention on Climate Change* (UNFCCC, 2013), the report on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003). See also *Deforestation*, *Afforestation* and *Reducing Emissions from Deforestation and Forest Degradation (REDD+)*.

Region A region is a relatively large-scale land or ocean area characterized 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 Figure 3.2; AR5, SREX).

Remaining carbon budget Estimated cumulative net global *anthropogenic* CO_2 emissions from the start of 2018 to the time that anthropogenic 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*.

Representative Concentration Pathways (RCPs) See *Pathways*.

Resilience The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for *adaptation*, learning and *transformation*. This definition builds from the definition used by Arctic Council (2013). See also *Hazard*, *Risk* and *Vulnerability*.

Risk The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. In the context of the assessment of climate *impacts*, the term risk is often used to refer to the potential for adverse consequences of a climate-related *hazard*, or of *adaptation* or *mitigation* responses to such a hazard, on lives, *livelihoods*, health and *well-being*, *ecosystems* and species, economic, social and cultural assets, services (including *ecosystem services*), and infrastructure. Risk results from the interaction of *vulnerability* (of the affected system), its *exposure* over time (to the hazard), as well as the (climate-related) hazard and the *likelihood* of its occurrence.

Risk assessment The qualitative and/or quantitative scientific estimation of *risks*. See also *Risk*, *Risk management* and *Risk perception*.

Risk management Plans, actions, strategies or policies to reduce the *likelihood* and/or consequences of risks or to respond to consequences. See also *Risk*, *Risk assessment* and *Risk perception*.

Risk perception The subjective judgment that people make about the characteristics and severity of a *risk*. See also *Risk*, *Risk assessment* and *Risk management*.

Runoff The flow of water over the surface or through the subsurface, which typically originates from the part of liquid precipitation and/or snow/ice melt that does not evaporate or refreeze, and is not transpired. See also *Hydrological cycle*.

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, 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. See also *Baseline scenario*, *Emission scenario*, *Mitigation scenario* and *Pathways*.

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. See also *Narratives*.

SDG-interaction score A seven-point scale (Nilsson et al., 2016) used to rate interactions between *mitigation options* and the *SDGs*. Scores range from +3 (indivisible) to −3 (cancelling), with a zero score indicating 'consistent' but with neither a positive or negative interaction. The scale, as applied in this report, also includes direction (whether the interaction is uni- or bi-directional) and *confidence* as assessed per IPCC guidelines.

Sea ice Ice found at the sea surface that has originated from the freezing of seawater. Sea ice may be discontinuous pieces (ice floes) moved on the ocean surface by wind and currents (pack ice), or a motionless sheet attached to the coast (land-fast ice). Sea ice concentration is the fraction of the ocean covered by ice. Sea ice less than one year old is called first-year ice. Perennial ice is sea ice that survives at least one summer. It may be subdivided into second-year ice and multi-year ice, where multi-year ice has survived at least two summers.

Sea level change (sea level rise/sea level fall) Sea level can change, both globally and locally (relative sea level change) due to (1) a change in ocean volume as a result of a change in the mass of water in the ocean, (2) changes in ocean volume as a result of changes in ocean water density, (3) changes in the shape of the ocean basins and changes

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in the Earth's gravitational and rotational fields, and (4) local subsidence or uplift of the land. Global mean sea level change resulting from change in the mass of the ocean is called barystatic. The amount of barystatic sea level change due to the addition or removal of a mass of water is called its sea level equivalent (SLE). Sea level changes, both globally and locally, resulting from changes in water density are called steric. Density changes induced by temperature changes only are called thermosteric, while density changes induced by salinity changes are called halosteric. Barystatic and steric sea level changes do not include the effect of changes in the shape of ocean basins induced by the change in the ocean mass and its distribution.

Sea surface temperature (SST) The sea surface temperature is the subsurface bulk temperature in the top few meters of the ocean, measured by ships, buoys, and drifters. From ships, measurements of water samples in buckets were mostly switched in the 1940s to samples from engine intake water. Satellite measurements of skin temperature (uppermost layer; a fraction of a millimeter thick) in the infrared or the top centimeter or so in the microwave are also used, but must be adjusted to be compatible with the bulk temperature.

Sendai Framework for Disaster Risk Reduction The Sendai Framework for Disaster Risk Reduction 2015–2030 outlines seven clear targets and four priorities for action to prevent new, and to reduce existing, disaster risks. The voluntary, non-binding agreement recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders, including local government and the private sector. Its aim is to achieve 'substantial reduction of disaster risk and losses in lives, *livelihoods* and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.'

Sequestration See *Uptake*.

Shared Socio-economic Pathways (SSPs) See *Pathways*.

Short-lived climate forcers (SLCF) Short-lived climate forcers refers to a set of compounds that are primarily composed of those with short lifetimes in the *atmosphere* compared to well-mixed *greenhouse gases*, 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 greenhouse gases. These compounds do not accumulate in the atmosphere at decadal to centennial time scales, 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 short-lived climate forcers is referred to as short-lived climate pollutants. See also *Long-lived climate forcers (LLCF)*.

Short-lived climate pollutants (SLCP) See *Short-lived climate forcers (SLCF)*.

Sink A reservoir (natural or human, in soil, ocean, and plants) where a *greenhouse gas*, an *aerosol* or a *precursor* of a greenhouse gas is stored. Note that *UNFCCC* Article 1.8 refers to a sink as any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the *atmosphere*. See also *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).

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-ecological systems 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 system's structure is characterized by reciprocal feedbacks, emphasising that humans must be seen as a part of, not apart from, nature. This definition builds from Arctic Council (2016) and Berkes and Folke (1998).

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 justice See *Justice*.

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

Social value of mitigation activities (SVMA) Social, economic and environmental value of *mitigation* activities that include, in addition to their climate benefits, their *co-benefits* to *adaptation* and *sustainable development* objectives.

Societal (social) transformation See *Transformation*.

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 *Baseline scenario*, *Emission scenario*, *Mitigation scenario* and *Pathways*.

Socio-technical transitions Socio-technical transitions are 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 CO_2 from the *atmosphere*.

Soil moisture Water stored in the soil in liquid or frozen form. Root-zone soil moisture is of most relevance for plant activity.

Solar radiation management See *Solar radiation modification (SRM)*.

Solar radiation modification (SRM) Solar radiation modification refers to the intentional modification of the Earth's shortwave radiative budget with the aim of reducing warming. Artificial injection of stratospheric *aerosols*, marine cloud brightening and land surface *albedo* modification are examples of proposed SRM methods. SRM does not fall within the definitions of *mitigation* and *adaptation* (IPCC, 2012b, p. 2). Note that in the literature SRM is also referred to as solar radiation management or albedo enhancement.

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Stabilization (of GHG or CO_2-equivalent concentration) A state in which the atmospheric concentrations 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.

Stratosphere The highly stratified region of the *atmosphere* above the *troposphere* extending from about 10 km (ranging from 9 km at high latitudes to 16 km in the tropics on average) to about 50 km altitude. See also *Atmosphere*, and *Troposphere*.

Sub-national actor Sub-national actors include state/provincial, regional, metropolitan and local/municipal governments as well as non-party stakeholders, such as civil society, the private sector, cities and other sub-national authorities, local communities and indigenous peoples.

Substantive rights See *Human rights*.

Supply-side measures See *Demand- and supply-side measures*.

Surface temperature See *Global mean surface temperature (GMST)*, *Land surface air temperature*, *Global mean surface air temperature (GSAT)* and *Sea surface temperature (SST)*.

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 *Sustainable Development Goals (SDGs)* and *Development pathways* (under *Pathways*).

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 *well-being*, 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)*.

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.

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 *CO_2* exceeding remaining CO_2 emissions globally. See also *Overshoot pathways* and *Non-overshoot pathways* (both under *Pathways*).

Tipping point A level of change in system properties beyond which a system reorganizes, often abruptly, and does not return to the initial state even if the drivers of the change are abated. For the *climate system*, it refers to a critical threshold when global or regional *climate* changes from one stable state to another stable state. See also *Irreversibility*.

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.

Transformation pathways See *Pathways*.

Transformational adaptation See *Adaptation*.

Transformative change A system-wide change that requires more than technological change through consideration of social and economic factors that, with technology, can bring about rapid change at scale.

Transient climate response See *Climate sensitivity*.

Transient climate response to cumulative CO_2 emissions (TCRE) The transient global average surface temperature change per unit cumulative *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)*. See also *Transient climate response* (under *Climate sensitivity*).

Transit-oriented development (TOD) An approach to urban development that maximizes the amount of residential, business and leisure space within walking distance of efficient public transport, so as to enhance mobility of citizens, the viability of public transport and the value of urban land in mutually supporting ways.

Transition The process of changing from one state or condition to another in a given period of time. Transition can be in individuals, firms, cities, regions and nations, and can be based on incremental or transformative change.

Tropical cyclone The general term for a strong, cyclonic-scale disturbance that originates over tropical oceans. Distinguished from weaker systems (often named tropical disturbances or depressions) by exceeding a threshold wind speed. A tropical storm is a tropical cyclone with one-minute average surface winds between 18 and 32 m s^{-1}. Beyond 32 m s^{-1}, a tropical cyclone is called a hurricane, typhoon, or cyclone, depending on geographic location. See also *Extratropical cyclone*.

Troposphere The lowest part of the *atmosphere*, from the surface to about 10 km in altitude at mid-latitudes (ranging from 9 km at high latitudes to 16 km in the tropics on average), where clouds and weather phenomena occur. In the troposphere, temperatures generally decrease with height. See also *Atmosphere* and *Stratosphere*.

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 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 Convention's ultimate objective is the 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate

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system.' The provisions of the Convention are pursued and implemented by two treaties: the *Kyoto Protocol* and the *Paris Agreement*. See also *Kyoto Protocol* and *Paris Agreement*.

Uptake The addition of a substance of concern to a reservoir. See also *Carbon sequestration* and *Sink*.

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*.

Water cycle See *Hydrological cycle*.

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

Zero emissions commitment See *Climate change commitment*.

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