

## Glossary (selected)

**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 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*.

**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+)*.

**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.

**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*.

**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<sub>2</sub>)* can be removed from the *atmosphere*. See also *Bioenergy* and *Carbon dioxide capture and storage (CCS)*.

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

**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<sub>2</sub>* sinks, and the resulting atmospheric *CO<sub>2</sub>* growth rate. This is referred to as the global carbon budget; (2) the estimated cumulative amount of global carbon dioxide emissions 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 dioxide removal (CDR)** *Anthropogenic* activities removing *CO<sub>2</sub>* 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<sub>2</sub>* *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<sub>2</sub>)* released per unit of another variable such as *gross domestic product (GDP)*, output energy use or transport.

**Carbon neutrality** See *Net zero CO<sub>2</sub> emissions*.

**Carbon price** The price for avoided or released *carbon dioxide (CO<sub>2</sub>)* or *CO<sub>2</sub>-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*.

**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 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 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<sub>2</sub> emissions*.

**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)*.

**CO<sub>2</sub> equivalent (CO<sub>2</sub>-eq) emission** The amount of *carbon dioxide (CO<sub>2</sub>)* 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<sub>2</sub>-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<sub>2</sub>-equivalent emissions of each gas. CO<sub>2</sub>-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<sub>2</sub>-equivalent emissions and resulting CO<sub>2</sub>-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.

**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 \(REDD+\)](#).

**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).

**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.

**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](#)).

**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](#).

**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).

**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 Striiple, 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).

**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<sub>2</sub>O), *carbon dioxide* (CO<sub>2</sub>), *nitrous oxide* (N<sub>2</sub>O), *methane* (CH<sub>4</sub>) and *ozone* (O<sub>3</sub>) 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<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>, the *Kyoto Protocol* deals with the GHGs sulphur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). See also *Carbon dioxide (CO<sub>2</sub>)*, *Methane (CH<sub>4</sub>)*, *Nitrous oxide (N<sub>2</sub>O)* and *Ozone (O<sub>3</sub>)*.

**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).

**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 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*.

**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<sub>2</sub>)*, *methane (CH<sub>4</sub>)*, *nitrous oxide (N<sub>2</sub>O)*, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF<sub>6</sub>)) 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*.

**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.

**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.

**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 \(of GHG or CO<sub>2</sub>-equivalent concentration\)](#).

**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](#).

**Net zero CO<sub>2</sub> emissions** Net zero [carbon dioxide \(CO<sub>2</sub>\)](#) emissions are achieved when [anthropogenic](#) CO<sub>2</sub> emissions are balanced globally by anthropogenic CO<sub>2</sub> removals over a specified period. Net zero CO<sub>2</sub> 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<sub>2</sub> emissions](#), [Negative emissions](#) and [Net negative emissions](#).

**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<sub>2</sub>)* 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<sub>2</sub>)* 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.

**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.

#### *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  $3 \text{ W m}^{-2}$  and then declines to be limited at  $2.6 \text{ W m}^{-2}$  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  $4.5 \text{ W m}^{-2}$  and  $6.0 \text{ W m}^{-2}$  in 2100 (the corresponding ECPs have constant concentrations after 2150).
- RCP8.5: One high pathway which leads to  $>8.5 \text{ W m}^{-2}$  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<sub>2</sub>-equivalent concentration)* and *Narratives*.

**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*.

**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).

**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*.

**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.

**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*.

**Soil carbon sequestration (SCS)** Land management changes which increase the soil organic carbon content, resulting in a net removal of *CO<sub>2</sub>* from the *atmosphere*.

**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.

















