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**Abrupt climate change**

A large-scale change in the climate system that takes place over a few decades or less, persists (or is anticipated to persist) for at least a few decades, and has the potential to cause substantial disruptions in human and/or natural systems.

**Access to food**

One of the three components underpinning food security, the other two being availability and utilization. Access to food is dependent on (i) the affordability of food (i.e., people have income or other resources to exchange for food); (ii) satisfactory allocation within the household or society (i.e., it is not withheld for political or cultural reasons); and (iii) preference (i.e., it is what people want to eat, influenced by socio-cultural norms). See also Food security.

**Acclimatization**

A change in functional (biochemical, behavioral) or morphological traits (phenotype) occurring once or repeatedly (e.g., seasonally) during the lifetime of an individual. Through acclimatization the individual maintains performance across a range of environmental conditions. For a clear differentiation between findings in laboratory and field studies, the term acclimation is used in ecophysiology for the respective phenomena when observed in well-defined experimental settings. The term (adaptive) plasticity characterizes the (limited) scope of changes in phenotype that an individual can reach through the process of acclimatization.

**Adaptability**

See Adaptive capacity.

**Adaptation**

In human systems, the process of adjustment to actual or expected climate and its effects, which seeks 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.

*Incremental adaptation* – Adaptation actions where the central aim is to maintain the essence and integrity of an incumbent system or process at a given scale (Park et al., 2012).

*Transformational adaptation* – Adaptation that changes the fundamental attributes of a system in response to actual or expected climate and its effects. See also Transformation.

**Adaptation assessment**

The practice of identifying options to adapt to climate change and evaluating them in terms of criteria such as availability, benefits, costs, effectiveness, efficiency, and feasibility.

**Adaptation constraint**

Factors that make it harder to plan and implement adaptation actions.

**Adaptation deficit**

The gap between the current state of a system and a state that minimizes adverse impacts from existing climate conditions and variability.

**Adaptation limit**

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 that avoid intolerable risks.

*Soft adaptation limit* – Options are currently not available to avoid intolerable risks through adaptive action.

**Adaptation opportunity**

Factors that make it easier to plan and implement adaptation actions.

**Adaptive capacity**

The ability of systems, institutions, and individuals to adjust to potential damage, to take advantage of opportunities, or to respond to consequences (Millennium Ecosystem Assessment, 2005).

**Adaptive management**

A process of iteratively planning, implementing, and modifying strategies for managing resources in the face of uncertainty and change. Adaptive management involves adjusting approaches in response to observations of their effect and changes in the system brought on by resulting feedback effects and other variables. Adaptive management is thus strongly reflexive.

**Aggregate impacts**

Total impacts integrated across sectors and/or regions. The aggregation of impacts requires knowledge of (or assumptions about) the relative importance of different impacts. Measures of aggregate impacts include, for example, the total number of people affected, or the total economic costs, and are usually bound by time, place, and /or sector.

**Agrobiodiversity (Agricultural biodiversity)**

The outcome of the interactions among genetic resources, the environment, and the management systems and practices used by farmers. It results from both natural selection and human interventions over millennia.

**Anomaly**

The deviation of a climate variable from its value averaged over a reference period for a particular location or a region. Anomalies are typically presented as time series or as maps, and sometimes as maps of the departure of the variable from its spatially-resolved values during a reference period.

**Anthropogenic**

Resulting from or produced by human activities.

**Anthropogenic emissions**

Emissions of greenhouse gases, greenhouse gas precursors, and aerosols caused by human activities. These activities include the burning of fossil fuels, deforestation, land use changes, livestock production, fertilization, waste management, and industrial processes.

**Arid zone**

A zone characterized by pastoralism and no farming except with irrigation. For the most part, the native vegetation of arid zones is sparse, being comprised of annual and perennial grasses and other herbaceous vegetation, and shrubs and small trees. There is high rainfall variability, with annual amounts ranging between 100 and 300 millimeters (FAO Forest Resources Division, 1989).

**Atmosphere-Ocean General Circulation Model (AOGCM)**

See Climate model.

**Atlantic Multi-decadal Oscillation/Variability (AMO/AMV)**

A multi-decadal (65 to 75 year) fluctuation in the North Atlantic, in which sea surface temperatures showed warm phases during roughly 1860 to 1880 and 1930 to 1960 and cool phases during 1905 to 1925 and 1970 to 1990 with a range of order 0.4°C.

**Attribution**

See Detection and attribution.

**Baseline/reference**

The baseline (or reference) is the state against which change is measured. It might be a current baseline, in which case it represents observable, present-day conditions. It might also be a future baseline, which is a projected future set of conditions that would be obtained by excluding the driving factor of interest. Alternative interpretations of the reference conditions can give rise to multiple baselines.

**Biodiversity**

The variability among living organisms from terrestrial, marine, and other ecosystems. Biodiversity includes variability at the genetic, species, and ecosystem levels (Global Biodiversity Assessment, 1995).

**Bioenergy**

Energy derived from any form of biomass such as recently living organisms or their metabolic by-products.

**Biofuel**

A fuel, generally in liquid form, produced from organic matter or combustible oils produced by living or recently living plants. Examples of biofuel include alcohol, black liquor from the paper-manufacturing process, and soybean oil.

**Biomass**

The total mass of living or dead organisms, or both, in a given area or volume. Biomass burning is the burning of living and dead vegetation.

**Biome**

A biome is a major and distinct regional element of the biosphere, typically consisting of several ecosystems (e.g., forests, rivers, ponds, swamps within a region). Biomes are characterised by typical communities of plants and animals.

**Biosphere (terrestrial and marine)**

The part of the Earth system comprising all ecosystems and living organisms, in the atmosphere, on land (terrestrial biosphere), or in the oceans (marine biosphere), including derived dead organic matter, such as litter, soil organic matter, and oceanic detritus.

**Boundary organization**

A bridging institution that acts as an intermediary between science and policy, whose goal is to shape perceptions of salience, credibility, and legitimacy of available information, and effectively balance any trade-offs among them. This organization carries out information functions, including communication with decision makers, translation of science, and mediation between different views of how to interpret new information.

**Business as usual (BAU)**

An assumption that operating practices and policies remain as they are at present. Although baseline scenarios could incorporate some specific features of BAU scenarios (e.g., a ban on a specific technology), BAU scenarios imply that no practices or policies other than the current ones are in place. See also Baseline/reference and Scenario.

**Capacity building**

The practice of enhancing strengths and attributes of, and resources available to, an individual, community, society, or organization to respond to change.

**Carbon cycle**

The flow of carbon (in various forms, e.g., as carbon dioxide) through the atmosphere, ocean, terrestrial biosphere, and lithosphere. In this report, the reference unit for the global carbon cycle is GtC or equivalently PgC ( $10^{15}$  g).

**Carbon dioxide (CO<sub>2</sub>)**

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

**Carbon dioxide (CO<sub>2</sub>) fertilization**

The enhancement of the growth of plants as a result of increased atmospheric carbon dioxide (CO<sub>2</sub>) concentration.

**Carbon sequestration**

See Uptake.

**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 emission reduction or removal projects in developing (Non-Annex B) countries, and receive Certified Emission Reduction Units for doing so which can be credited towards the commitments of the respective developed countries. The CDM is intended to facilitate the two objectives of promoting sustainable development in developing countries and of helping industrialized 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 of the state of the atmosphere 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-altering pollutants (CAPs)**

Gases and particles released from human activities that affect the climate either directly, through mechanisms such as radiative forcing from changes in greenhouse gas concentrations, or indirectly, by, for example, affecting cloud formation or the lifetime of greenhouse gases in the atmosphere. CAPs include both those pollutants that have a warming effect on the atmosphere, such as CO<sub>2</sub>, and those with cooling effects, such as sulfates.

**Climate change**

A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulation of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. 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 that alter the atmospheric composition, and climate variability attributable to natural causes. See also Climate change commitment, Climate variability, and Detection and attribution.

**Climate change commitment**

Due to the thermal inertia of the ocean and slow processes in the cryosphere and land surfaces, the climate would continue to change even if the atmospheric composition were held fixed at today's values. Past change in atmospheric composition leads, directly or indirectly, to a committed climate change, which continues for as long as a radiative imbalance persists and until all components of the climate system have adjusted to a new state. The further change in temperature after the composition of the atmosphere becomes constant is referred to as the constant-composition temperature commitment or simply committed warming or warming commitment. Climate change commitment includes other future changes, for example in the hydrological cycle, in extreme weather and climate events, and in sea-level change. The constant-emission commitment is the committed climate change that would result from keeping anthropogenic emissions constant and the zero-emission commitment is the climate change commitment when emissions are set to zero. See also Climate change.

**Climate extreme (extreme weather or climate event)**

See 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. In this Assessment Report, a somewhat narrower definition is often used in which the climate quantity that is perturbed is the global mean surface temperature, which in turn causes changes in the global radiation budget. In either case, the initial perturbation can either be externally forced or arise as part of internal variability.

**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).

**Climate model (spectrum or hierarchy)**

A numerical representation of the climate system that is based on the physical, chemical, and biological properties of its components, their interactions, and feedback processes, and that accounts 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 extent to which processes are parameterized as opposed to being modeled explicitly. Coupled Atmosphere–Ocean General Circulation Models (AOGCMs) provide a representation of the climate system that is near or at the most comprehensive end of the spectrum currently available. 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.

**Climate prediction**

A climate prediction or climate forecast is an estimate, starting from a particular state of the climate system, of the actual evolution of the climate over a period that may range from a season to some decades. Since the future evolution of the climate system may be highly sensitive to initial conditions, such predictions are usually probabilistic in nature. See also Climate projection, Climate scenario, and Predictability.

**Climate projection**

A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases and aerosols, generally based upon numerical simulations by 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. See also Climate scenario.

**Climate-resilient pathways**

Evolutionary processes for managing change within complex systems in order to reduce disruptions and enhance opportunities. They are rooted in iterative processes of identifying vulnerabilities to climate change impacts; taking appropriate steps to reduce vulnerabilities in the context of development needs and resources and to increase the options available for vulnerability reduction and coping with unexpected threats; monitoring emerging climate parameters and their implications, along with monitoring the effectiveness of vulnerability reduction efforts; and revising risk reduction responses on the basis of continuing learning. This process may involve a combination of incremental changes and, as necessary, significant transformations.

**Climate sensitivity**

The change in the globally- and annually-averaged surface temperature following a specified change in some forcing factor.

*Equilibrium climate sensitivity*

In IPCC reports, equilibrium climate sensitivity is the equilibrium change in the annual mean global surface temperature following a doubling of the atmospheric equivalent carbon dioxide concentration. Due to computational constraints, the equilibrium climate sensitivity in a climate model is usually estimated by running an atmospheric general circulation model coupled to a mixed-layer ocean model, because equilibrium climate sensitivity is largely determined by atmospheric processes. Efficient models can be run to equilibrium with a dynamic ocean.

*Climate sensitivity parameter* (units: °C (W m<sup>-2</sup>)<sup>-1</sup>)

The equilibrium change in the annual mean global surface temperature following a unit change in radiative forcing.

*Effective climate sensitivity*

A measure of the strengths of climate feedbacks at a particular time. The effective climate sensitivity, evaluated from model output, circumvents the requirement of equilibrium. It may vary with forcing history and climate state.

*Transient climate response*

The change in the global surface temperature, averaged over a 20-year period, centered at the time of atmospheric carbon dioxide doubling, for example at year 70 in a climate-model experiment in which the CO<sub>2</sub> concentration increases at 1% yr<sup>-1</sup>. It is a measure of the strength and rapidity of the surface temperature response to greenhouse gas forcing.

**Climate scenario**

A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models. Climate projections often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as the observed current climate. A climate change scenario is the difference between a climate scenario and the current climate. See also Emissions scenario, Scenario.

**Climate system**

A highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the lithosphere, and the biosphere, and the interactions among them. The climate system evolves 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 threshold**

A limit within the climate system that, when crossed, induces a non-linear response to a given forcing. See Abrupt climate change.

**Climate variability**

Variations in the mean and other statistics (such as standard deviations, the frequency or intensity of extremes, etc.) of attributes of the climate on all spatial and temporal scales between those of individual weather events and those (typically multi-decadal) on which the climate is considered to change. 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.

**Climatic driver** (climate driver)

A changing aspect of the climate system that influences a component of a human or natural system.

**CMIP3 and CMIP5**

Phases three and five of the Coupled Model Intercomparison Project (CMIP3 and CMIP5), coordinating and archiving climate model simulations based on shared model inputs by modeling groups from around the world. The CMIP3 multi-model dataset includes projections using SRES scenarios. The CMIP5 dataset includes projections using the Representative Concentration Pathways.

**Coastal squeeze**

The squeeze of coastal ecosystems and amenities (e.g., beaches, salt marshes, mangroves, and mud and sand flats) between landward-retreating shorelines (from sea level rise and/or erosion), and naturally or artificially fixed shorelines, including engineering defenses (e.g., seawalls), potentially making the ecosystems or amenities vanish.

**Co-benefits**

The positive effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the net effect on overall social welfare. Co-benefits are often subject to uncertainty and depend among others on local circumstances and implementation practices.

**Community-based adaptation**

Community-based adaptation focuses attention on empowering and promoting the adaptive capacity of communities. It is a proactive problem-solving and forward-looking approach that takes contexts, culture, knowledge, agency, preferences, and particularities of communities and their members as strengths.

**Community-based disaster risk management**

See Local disaster risk management.

**Confidence**

The validity 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. In this report, confidence is expressed qualitatively (Mastrandrea et al., 2010). See also Likelihood and Uncertainty.

**Contextual vulnerability (Starting-point vulnerability)**

The starting point approach considers vulnerability as a present inability to cope with external pressures or changes, such as changing climate conditions. Here, vulnerability is considered a characteristic of social and ecological systems that is generated by multiple factors and processes. (O'Brien et al., 2007)

**Control run**

A model run carried out to provide a baseline for comparison with climate change experiments. The control run uses constant values, appropriate to a time before the Industrial Revolution, for the radiative forcing due to greenhouse gases and anthropogenic aerosols.

**Convection**

Vertical motion driven by buoyancy, usually caused by near-surface cooling or increases in salinity in the ocean and near-surface warming or cloud-top radiative cooling in the atmosphere. In the atmosphere, convection is the leading mechanism for the transfer of heat and vapor from the surface into the atmosphere. It is also effective at both

scavenging and vertically transporting chemical species. In the ocean, convection can carry surface waters to deep within the ocean.

**Coping**

The use of available skills, resources, and opportunities to address, manage, and overcome adverse conditions, with the aim of achieving basic functioning of people, institutions, organizations, and systems in the short to medium term.

**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.

**Coral bleaching**

The paling in color which results if a coral loses its energy-providing symbiotic organisms.

**Cryosphere**

All regions occupied seasonally or perennially by snow, ice, and frozen ground (including permafrost) on and beneath the surface of the Earth. See also Ice sheet.

**Cultural impacts**

Climate change impacts on material and ecological aspects of culture and the lived experience of culture, including dimensions such as identity, community cohesion and belonging, worldview, values, perceptions, and tradition. Cultural impacts are strongly related to ecological impacts of climate change, especially for iconic and representational dimensions of species and landscapes. Culture and cultural practices frame the importance and value of the impacts of change; shape the feasibility and acceptability of adaptation options; and provide the skills and practices that enable adaptation.

**Decarbonization**

The process by which countries or other entities aim to achieve a low-carbon economy, or by which individuals aim to reduce their consumption of carbon.

**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 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).

**Desertification**

Land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities. The United Nations Convention to Combat Desertification defines land degradation as a reduction or loss of biological or economic productivity in arid, semi-arid, and dry sub-humid areas. This could include losses of function or productivity from land types key to human livelihoods, such as rain-fed cropland, irrigated cropland, range or pasture, forest, and woodlands. Desertification can be caused by both changes in climate and unsustainable human activities; examples of common causes of land degradation include: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical, or biological properties of soil; and (iii) long-term loss of natural vegetation.

**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 an assignment of statistical confidence (Hegerl et al., 2010).



**Disadvantaged populations**

Sectors of a society that are marginalized, often because of low socio-economic status, low income, or lack of access to basic services such as health or education; lack of power; race, gender, or religion; or poor access to communication technologies.

**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.

**Disaster management**

Social processes for designing, implementing, and evaluating strategies, policies, and measures that promote and improve disaster preparedness, response, and recovery practices at different organizational and societal levels.

**Disaster risk**

The likelihood over a specified time period of 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.

**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.

**Disaster risk reduction (DRR)**

Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience.

**Discounting**

A mathematical operation making monetary (or other) amounts received or expended at different times (years) comparable. The discounter uses a fixed or possibly time-varying discount rate ( $>0$ ) from year to year that makes future value worth less today.

**Disturbance regime**

Frequency, intensity, and types of disturbances of ecological systems, such as fires, insect or pest outbreaks, floods, and droughts.

**Diurnal temperature range**

The difference between the maximum and minimum temperature during a 24-hour period.

**Downscaling**

A method that derives local- to regional-scale (10 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 develop relationships that link the large-scale atmospheric variables statistically with local/regional climate variables. In all cases, the quality of the driving model limits the quality of the downscaled information.

**Drought**

A 'prolonged absence or marked deficiency of precipitation,' a 'deficiency that results in water shortage for some activity or for some group,' or a 'period of abnormally dry weather sufficiently prolonged for the lack of

precipitation to cause a serious hydrological imbalance' (Heim, 2002). Drought has been defined in a number of ways. A megadrought is a long-drawn out and pervasive drought, lasting much longer than normal, usually a decade or more.

*Agricultural drought*

Moisture deficits in the topmost 1 meter or so of soil (the root zone) that affect crops.

*Meteorological drought*

A prolonged deficit of precipitation.

*Hydrologic drought*

Below-normal streamflow and lake and groundwater levels.

**Dynamic global vegetation model (DGVM)**

A model that simulates vegetation development and dynamics through space and time, as driven by climate and other environmental changes.

**Early warning system**

The set of 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.

**Earth system model (ESM)**

A coupled atmosphere-ocean general circulation model in which representations of climatically important biogeochemical cycles are included. As a minimum the carbon cycle is included, allowing for interactive calculation of atmospheric CO<sub>2</sub> 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 Climate model.

**Ecological community**

A community of plants and animals characterized by a typical assemblage of species and their abundances. See Ecosystem.

**Ecological infrastructure**

Functioning ecosystems that deliver valuable services to people, such as fresh water, climate regulation, soil formation, and disaster risk reduction. Refers to the nature-based equivalent of built or engineered infrastructure and includes, for example, healthy mountain catchments, rivers, wetlands, coastal dune systems, and nodes or corridors of natural habitat that together form a network of interconnected structural elements in the landscape. Ecological infrastructure provides ecosystem services.

**Ecophysiological process**

Processes in which individual organisms respond continuously to environmental variability, such as climate change, generally at a microscopic or sub-organ scale. Ecophysiological mechanisms underpin individual organisms' tolerance to environmental stress, and comprise a broad range of responses defining the absolute tolerances by individuals of environmental conditions. Ecophysiological responses may scale up to control species' geographic ranges.

**Ecosystem**

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

**Ecosystem approach**

A strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. An ecosystem approach is based on the application of scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions, and interactions of organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems. The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete knowledge or understanding of their functioning. Priority targets are conservation of biodiversity and of the ecosystem structure and functioning, in order to maintain ecosystem services.

**Ecosystem based adaptation**

The use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. (IUCN glossary, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn__glossary_definitions.pdf))

**Ecosystem services**

Ecological processes or functions having monetary or non-monetary value to individuals or society at large. These are frequently classified as (i) supporting services such as productivity or biodiversity maintenance, (ii) provisioning services such as food, fiber, or fish, (iii) regulating services such as climate regulation or carbon sequestration, and (iv) cultural services such as tourism or spiritual and aesthetic appreciation.

**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 Perú, disrupting the local fishery. It has since become identified with a basin-wide warming of the equatorial 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 typical intervals between events of two to seven years, is known as the El Niño-Southern Oscillation (ENSO). It is often measured by the surface pressure difference between Darwin and Tahiti and 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 warms, further weakening the trade winds. This event 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.

**Emergent risk**

A risk that arises from the interaction of phenomena in a complex system, for example the risk caused when geographic shifts in human population in response to climate change lead to increased vulnerability in the receiving region.

**Emerging risk**

A risk that has emerged only recently in the scientific literature in sufficient detail to permit assessment. For example, the initial consequences associated with these risks may have only recently been detected above the natural variability of the climate system, as is the case for certain effects of ocean acidification on calcareous organisms.

**Emissions scenario**

A plausible representation of the future development of emissions of substances that are potentially radiatively active (e.g., greenhouse gases, aerosols), based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socioeconomic development, technological change) and their key relationships. Concentration scenarios, derived from emission scenarios, are used as input to a climate model to compute climate projections. In IPCC (1992) a set of emission scenarios was presented which were used as a basis for the climate projections in IPCC (1996). These emission scenarios are referred to as the IS92 scenarios. In the IPCC Special Report on Emission Scenarios (Nakićenović and Swart, 2000) emission scenarios, the so-called SRES scenarios, were published, some of which were used, among others, as a basis for the climate projections presented in Chapters 9 to 11 of IPCC (2001) and Chapters 10 and 11 of IPCC (2007). New emission scenarios for climate

change, the four Representative Concentration Pathways, were developed for, but independently of, the present IPCC assessment. See Climate scenario and Scenario.

**Ensemble**

The results of a collection of model experiments characterizing a climate prediction or projection. Differences in initial conditions and model formulation result in different evolutions of the modeled system and may give information on uncertainty associated with model error and error in initial conditions in the case of climate predictions and on uncertainty associated with model error and with internally generated climate variability in the case of climate projections.

**Environmental migration**

Human migration involves movement over a significant distance and duration. Environmental migration refers to human migration where environmental risks or environmental change plays a dominant role in influencing the migration decision and destination. Migration may involve distinct categories such as direct, involuntary, and temporary displacement due to weather-related disasters; voluntary relocation as settlements and economies become less viable; or planned resettlement encouraged by government actions or incentives. All migration decisions are multi-causal, and hence it is not meaningful to describe any migrant flow as being solely for environmental reasons.

**Eustatic sea-level rise**

See Sea-level change.

**Evolutionary adaptation**

The change in characteristics of a population as a result of selection acting on inheritable traits. The rate of evolutionary adaptation depends on the individual lifespan of organisms, generation turnover time, and degree of outcrossing (as opposed to inbreeding).

**Exposure**

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

**Extension agent**

An individual practitioner or organization engaged in communication and learning activities, organized by professionals from different disciplines, to promote the application of scientific research and new knowledge to a field of practice. For example, in agriculture, health, business, or other discipline, extension would be offered as an out-of-school adult education program, or other professional communication, to promote transfer of skills and induce change in voluntary behaviour, to help to resolve problems and make better decisions.

**External forcing**

Forcing by an agent outside the climate system causing a change in the climate system. Volcanic eruptions, solar variations, and anthropogenic changes in the composition of the atmosphere and land use change are external forcings. Orbital forcing is also an external forcing as the insolation changes with the orbital parameters eccentricity, tilt, and precession of the equinox.

**Externalities**

Externalities arise from a human activity, when agents responsible for the activity do not take full account of the activity's impact on others' production and consumption possibilities, and no compensation exists for such impacts. When the impact is negative, they are external costs. When the impact is positive they are external benefits.

**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.

**Extreme climate event**

See Extreme weather event.

**Extreme weather event**

A weather 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. At present, single extreme events cannot generally be directly attributed to anthropogenic influence. 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).

**Extreme coastal high water**

Extremely high sea level on a coast, commonly defined in terms of the higher percentiles (e.g., 90th to 99.9th) of a distribution of hourly values of observed sea level at a station for a given reference period. Extreme coastal high water depends on average sea level, tides, regional weather systems, and coastal bathymetry and topography (e.g., in controlling storm surge elevations). Extreme water levels on coasts open to wave activity can also be increased by wave setup (the increase in still water level due to the presence of breaking waves) and wave runup (the elevation to which breakers flow up the beach face or foreshore).

**Famine**

Scarcity of food over an extended period and over a large geographical area, such as a country, or lack of access to food for socio-economic, political, or cultural reasons. Famines may be triggered by extreme climate events such as drought or floods, but can also be caused by disease, war, or other factors.

**Feedback**

See Climate feedback.

**Fire weather**

Weather conditions conducive to triggering and sustaining wild fires; usually based on a set of indicators and combinations of indicators including temperature, soil moisture, humidity, and wind. Fire weather does not include the presence or absence of fuel load.

**Fitness (Darwinian)**

Fitness is the relative capacity of an individual or genotype to both survive and reproduce, quantified as the average contribution of the genotype to the gene pool of the next generations. During evolution, natural selection favors functions providing greater fitness such that the functions become more common over generations.

**Flood**

The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas 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 state that prevails when people have secure access to sufficient amounts of safe and nutritious food for normal growth, development, and an active and healthy life. See also Access to food.

**Food system**

A food system includes the suite of activities and actors in the food chain (i.e., producing, processing and packaging, storing and transporting, trading and retailing, and preparing and consuming food); and the outcome of these activities relating to the three components underpinning food security (i.e., access to food, utilisation of food, and food availability), all of which need to be stable over time. Food security is therefore underpinned by food systems, and is an emergent property of the behavior of the whole food system. Food insecurity arises when any aspect of the food system is stressed.

**Forecast**

See Climate prediction and Climate projection.

**General Circulation Model (GCM)**

See Climate model.

**Geoengineering**

A set of proposed methods and technologies that aim to alter the climate system in order to alleviate the impacts of climate change. Most methods, but not all, seek to either a) reduce the amount of solar energy absorbed by the climate system (solar radiation management) or b) remove carbon dioxide from the atmosphere on a scale sufficient to mitigate climate change. In this report geoengineering does not include carbon capture and storage at the point of combustion, but does include free-air capture of CO<sub>2</sub>.

**Glacial lake outburst flood (GLOF)**

A flood due to the failure of a dam impounding a lake. Glacial lake outburst floods are typically a result of cumulative developments and occur (i) only once (e.g., full-breach failure of moraine-dammed lakes), (ii) for the first time (e.g., new formation and outburst of glacial lakes), and/or (iii) repeatedly (e.g., ice-dammed lakes with drainage cycles, or ice fall).

**Global change**

A generic term to describe global scale changes in systems, including the climate system, ecosystems, and social-ecological systems.

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

See Climate model.

**Global surface temperature**

An estimate of the global mean surface air temperature, often presented as an anomaly and often computed as the area-weighted global average of the sea surface temperature anomaly and land surface air temperature anomaly.

**Greenhouse effect**

The infrared radiative effect of all infrared-absorbing constituents in the atmosphere. Greenhouse gases, clouds, and (to a small extent) aerosols absorb infrared radiation emitted from the Earth's surface and elsewhere in the atmosphere. These substances emit infrared radiation in all directions, but, everything else being equal, the net amount emitted to space is normally less than would have been emitted in the absence of these absorbers because of the decrease of temperature with altitude in the troposphere and the consequent weakening of emission. An increase in the concentration of greenhouse gases increases the magnitude of the greenhouse effect; the difference is sometimes called the enhanced greenhouse effect. The change in a greenhouse gas concentration because of anthropogenic emissions contributes to an instantaneous radiative forcing. The surface and the troposphere warm in response to this forcing, gradually restoring the radiative balance at the top of the atmosphere and increasing the heat content of the climate system.

**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 vapor (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 greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases 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 greenhouse gases sulfur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

**Ground-level ozone**

Atmospheric ozone formed naturally or from human-emitted precursors near Earth's surface, thus affecting human health, agriculture, and ecosystems. Ozone is a greenhouse gas, but ground-level ozone, unlike stratospheric ozone, also affects organisms at the surface directly. Ground-level ozone is sometimes referred to as tropospheric ozone, although much of the troposphere is well above the surface and thus does not expose organisms at the surface directly. See Ozone.

**Groundwater recharge**

The process by which external water is added to the zone of saturation of an aquifer, either directly into a geologic formation that traps the water or indirectly by way of another formation.

**Hazard**

The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources.

**Heat wave**

A period of abnormally and uncomfortably hot weather.

**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. There is robust evidence that poverty, discrimination of many kinds, and extreme natural and technological disasters undermine human security and that it can be enhanced by actions to reduce vulnerability to climate change.

**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, political systems, technological systems, and economic systems are all human systems in the sense applied in the AR5.

**Hydrological cycle**

The cycle in which the atmosphere and the hydrosphere exchange water. Water evaporates from the oceans and the land surface, is carried over the Earth by the atmospheric circulation as water vapor, condenses to form clouds, and precipitates over ocean and land as rain or snow. Precipitation on land can be intercepted by trees and vegetation, run off over the land surface, infiltrate into soils, recharge groundwater, discharge into streams, and ultimately, flow into the oceans or into enclosed water bodies, from which it will eventually evaporate again. The various parts of the hydrological cycle are usually referred to as hydrological systems.

**Hypoxic events**

Events that lead to deficiencies of oxygen in water bodies.

**Ice cap**

A dome-shaped ice mass that is considerably smaller in extent than an ice sheet.

**Ice sheet**

A mass of land ice of continental size that is sufficiently thick to cover most of the underlying bedrock, 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.

**Ice shelf**

A floating slab of ice of considerable thickness extending from the coast (usually of great horizontal extent with a very gently sloping surface), often filling embayments in the coastline of the ice sheets. Nearly all ice shelves are in Antarctica, where most of the ice discharged into the ocean flows via ice shelves.

**(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**

Effects on natural and human systems. In this report, the term ‘impacts’ is used to refer to the effects on natural and human systems of physical events, of disasters, and of climate change.

**Indian Ocean Dipole (IOD)**

Large-scale interannual variability of sea surface temperature in the Indian Ocean. This pattern appears as a zonal gradient of tropical sea surface temperature, which in one extreme phase in boreal autumn shows cooling off Sumatra and warming off Somalia in the west, combined with anomalous easterlies along the equator.

**Indigenous peoples**

Indigenous communities, peoples, and nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form at present non-dominant sectors of society and are determined to preserve, develop, and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions, and legal system.

**Industrial Revolution**

A period of rapid industrial growth with far-reaching social and economic consequences, beginning in Britain during the second half of the eighteenth 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 and emission of, in particular, fossil carbon dioxide. In this report the terms pre-industrial and industrial refer, somewhat arbitrarily, to the periods before and after 1750, respectively.

**Industrialized countries/developing countries**

There is no established or agreed convention, methodology, or consensus for the definition of industrialized, developed, or developing countries. Categorizing countries on the basis of their level of development would require a clearly articulated and agreed view and an agreed definition of what constitutes development and this does not exist. The origins of the terms date back to the 1960s where it became common practice to refer to countries in the context of policy discussions and the dynamics of the relationship between richer and poorer countries. What exists now are new common practices and uses by institutions where such definition is critical for establishing rights, benefits, and/or obligations. The United Nations Statistics divides countries into developed regions, developing regions, least developed countries, land-locked developing countries, small-island developing states, transition economies. Many countries in each of these lists appear in more than one category. In the case of the World Bank, the main criterion for classifying countries is by income – low, middle, and high income. These categories are relevant for their lending and operational categories such as IDA eligibility, civil works and infrastructure preferences, etc. In the case of the UNDP Human Development Index, the categories are not developed/industrialized nor developing but four categories as follows: very high human development, high human development, medium human development, and low human development based on an index that compares factors such as life expectancy, literacy, education and standards of living, and measures of well-being.

**Informal sector**

Commercial enterprises (mostly small) that are not registered or that otherwise fall outside official rules and regulations. Among the businesses that make up the informal sector, there is great diversity in the value of the goods



or services produced, the numbers employed, the extent of illegality, and the connection to the formal sector. Many informal enterprises have some characteristics of formal-sector enterprises, and some people are in informal employment in the formal sector as they lack legal protection or employment benefits.

**Informal settlement**

A term given to settlements or residential areas that by at least one criterion fall outside official rules and regulations. Most informal settlements have poor housing (with widespread use of temporary materials) and are developed on land that is occupied illegally with high levels of overcrowding. In most such settlements, provision for safe water, sanitation, drainage, paved roads, and basic services are inadequate or lacking. The term “slum” is often used for informal settlements, although it is misleading as many informal settlements develop into good quality residential areas, especially where governments support such development.

**Institutions**

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.

**Insurance/reinsurance**

A family of financial instruments for sharing and transferring risk among a pool of at-risk households, businesses, and/or governments. See Risk transfer.

**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.

**Integrated coastal zone management (ICZM)**

A process for the management of the coast based on an integrated approach to all aspects of the coastal zone to achieve sustainability.

**Invasive species / invasive alien species (IAS)**

A species aggressively expanding its range and population density into a region in which it is not native, often through out-competing native species.

**Key vulnerability, key risk, key impact**

A vulnerability, risk, or impact relevant to the definition and elaboration of “dangerous anthropogenic interference (DAI) with the climate system,” in the terminology of United Nations Framework Convention on Climate Change (UNFCCC) Article 2, meriting particular attention by policy makers in that context.

Key risks are potential adverse consequences for humans and social-ecological systems due to the interaction of climate-related physical hazards with vulnerabilities of societies and systems exposed. Risks are considered “key” due to high physical hazard or high vulnerability of societies and systems exposed, or both.

Vulnerabilities are considered “key” if they have the potential to combine with hazardous events to result in severe consequences for society or social-ecological systems. Vulnerabilities that have little influence on risk would not be considered key.

**Land grabbing**

Large acquisitions of land or water rights for industrial agriculture, mitigation projects, or biofuels that have negative consequences on local and marginalized communities.

**Land surface air temperature**

The surface air temperature as measured in shaded and well-ventilated screens over land at 1.5 m above the ground.

**Land use and land use change**

Land use refers to the total of arrangements, activities, and inputs undertaken by humans in a certain land cover type. 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, and conservation). Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land use change may have an impact on the surface albedo, evapotranspiration, sources and sinks of greenhouse gases, or other properties of the climate system and may thus give rise to radiative forcing and/or other impacts on climate, locally or globally. See also the IPCC Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000).

**La Niña**

See El Niño-Southern Oscillation.

**Last Glacial Maximum (LGM)**

The maximum extent of the glaciers and ice sheets during the last glaciation, approximately 21 ka ago. This period has been widely studied because the radiative forcings and boundary conditions are relatively well known and because the global cooling during that period is comparable with the projected warming over the 21st century.

**Likelihood**

The chance of a specific outcome occurring, where this might be estimated probabilistically. This is expressed in this report using a standard terminology, defined in Box 1-1. See also 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 categorized as human, social, natural, physical, or financial. Entitlements are held in tension between the behavior of actors and the controlling function of institutions.

**Local disaster risk management (LDRM)**

The process in which local actors (citizens, communities, government, non-profit organizations, institutions, and businesses) engage in and have ownership of the identification, analysis, evaluation, monitoring, and treatment of disaster risk and disasters, through measures that reduce or anticipate hazard, exposure, or vulnerability; transfer risk; improve disaster response and recovery; and promote an overall increase in capacities. LDRM normally requires coordination with and support from external actors at the regional, national, or international levels. Community-based disaster risk management is a subset of LDRM where community members and organizations are in the center of decisionmaking.

**Low regrets policy**

A policy that would generate net social and/or economic benefits irrespective of whether or not anthropogenic climate change occurs.

**Maladaptive actions**

Actions that may lead to increased risk of adverse climate-related outcomes or increased vulnerability to climate change, now or in the future.

**Mean sea level**

The surface of the ocean at a particular point averaged over an extended period of time such as a month or year. Mean sea level is often used as a national datum to which heights on land are referred.

**Meridional overturning circulation (MOC)**

Meridional (north-south) overturning circulation in the ocean quantified by zonal (east-west) summation of mass transports in depth or density layers. In the North Atlantic, away from the sub-polar regions, the MOC (which is in principle an observable quantity) is often identified with the thermohaline circulation (THC), which is a conceptual and incomplete interpretation. It must be borne in mind that the MOC is also driven by wind, and can also include

shallower overturning cells such as occur in the upper ocean in the tropics and subtropics, in which warm (light) waters moving poleward are transformed to slightly denser waters and subducted equatorward at deeper levels.

**Microclimate**

Local climate at or near the Earth's surface. See also Climate.

**Mitigation (of climate change)**

A human intervention to reduce the sources or enhance the sinks of greenhouse gases.

**Mitigation (of disaster risk and disaster)**

The lessening of the potential adverse impacts of physical hazards (including those that are human-induced) through actions that reduce hazard, exposure, and vulnerability.

**Mode of climate variability**

Underlying space-time structure with preferred spatial pattern and temporal variation that helps account for the gross features in variance and for teleconnections. A mode of variability is often considered to be the product of a spatial climate pattern and an associated climate index time series.

**Monsoon**

A tropical and subtropical seasonal reversal in surface winds and precipitation, caused by differential heating between a continental-scale land mass and the adjacent ocean. Monsoon rains occur mainly over land in summer.

**Net ecosystem production (NEP)**

Net primary production (NPP) minus heterotrophic respiration (including decomposition of dead organic matter).

**Non-climatic driver (non-climate driver)**

An agent or process outside the climate system that influences a human or natural system.

**Nonlinearity**

A process is called nonlinear when there is no simple proportional relation between cause and effect. The climate system contains many such nonlinear processes, resulting in a system with potentially very complex behavior. Such complexity may lead to abrupt climate change. See also Predictability and Threshold.

**North Atlantic Oscillation (NAO)**

Sea-level pressure near Iceland minus sea-level pressure near the Azores. The North Atlantic Oscillation describes large-scale multi-annual fluctuations in the strength of the westerly winds blowing across the Atlantic into Europe, and thus also fluctuations in the embedded cyclones with their associated frontal systems.

**Northern Annular Mode (NAM)**

A wintertime fluctuation in the strength of a pattern characterized by low surface pressure in the Arctic and strong mid-latitude westerlies. The NAM has links with the northern polar vortex into the stratosphere. It is best developed in the North Atlantic and is strongly correlated with the North Atlantic Oscillation.

**Ocean acidification**

Ocean acidification refers to a change in ocean chemistry (including rising CO<sub>2</sub> and decreasing pH and carbonate levels) over an extended period (decades or longer), which is caused primarily by the uptake of carbon dioxide from the atmosphere, but can also be caused by other processes. Anthropogenic ocean acidification refers to the component that is caused by human activity.

**Opportunity costs**

The benefits of an activity forgone through the choice of another activity.

**Outcome vulnerability (End-point vulnerability)**

The end-point approach considers vulnerability as the end point of a sequence of analyses beginning with projections of future emission trends, moving on to the development of climate scenarios, and thence to biophysical impact studies and the identification of adaptive options. Any residual consequences that remain after adaptation has taken place define the levels of vulnerability. (O'Brien et al., 2007)

**Oxygen minimum zone**

Midwater layer (200-1000 m) in the open ocean in which oxygen saturation in the ocean is at its lowest. The degree of oxygen depletion depends on the largely bacterial consumption of organic matter, and the distribution of the OMZs is influenced by the large-scale ocean circulation.

**Ozone**

The triatomic form of oxygen (O<sub>3</sub>). Ozone is a highly reactive trace constituent of the atmosphere and is a greenhouse gas. In the troposphere, it is created both naturally and by photochemical reactions involving gases resulting from human activities (photochemical 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<sub>2</sub>). By absorbing ultraviolet radiation and acting as a greenhouse gas, stratospheric ozone plays a dominant role in the stratospheric radiative balance and reduces incoming harmful UV-B radiation. Its concentration is highest in the ozone layer of the stratosphere.

**Pacific Decadal Oscillation (PDO)**

A multi-annual fluctuation of sea surface temperature over the North Pacific north of 20°N. The PDO, when broadened to cover the whole Pacific Ocean, is called the Inter-decadal Pacific Oscillation. The PDO and IPO exhibit similar temporal evolution.

**Parameterization**

The representation in models of processes that cannot be explicitly resolved at the spatial or temporal resolution of the model (sub-grid scale processes) by relationships, often statistical, between model-resolved larger-scale flow and the area- or time-averaged effect of such sub-grid scale processes.

**Particulates**

Very small solid particles emitted during the combustion of fossil and biomass fuels. Particulates may consist of a wide variety of substances. Of greatest concern for health are particulates of diameter less than or equal to 10 nm, usually designated as PM<sub>10</sub>.

**Pastoralism**

A livelihood strategy based on moving livestock to seasonal pastures primarily in order to convert grasses, forbs, tree-leaves, or crop residues into human food. The search for feed is however not the only reason for mobility; people and livestock may move to avoid various natural and/or social hazards, to avoid competition with others, or to seek more favorable conditions. Pastoralism can also be thought of as a strategy that is shaped by both social and ecological factors concerning uncertainty and variability of precipitation, and low and unpredictable productivity of terrestrial ecosystems.

**Path dependence**

The generic situation where decisions, events, or outcomes at one point in time constrain adaptation, mitigation, or other options at a later point in time.

**Permafrost**

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

**Persistent organic pollutants (POPs)**

Toxic organic chemical substances that persist in the environment for long periods of time, are transported and deposited in locations distant from their sources of release, bioaccumulate in fatty tissues, and can have adverse effects on human health and ecosystems.

**Phenology**

The study of natural phenomena that recur periodically (e.g., development stages, migration) and their relation to climate and seasonal changes.

**Photochemical smog**

A mix of oxidizing air pollutants produced by the reaction of sunlight with primary air pollutants, especially hydrocarbons.

**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).

**Poverty trap**

Poverty trap is understood differently across disciplines. In the social sciences, the concept, primarily employed at the individual, household, or community level, describes a situation in which escaping poverty becomes impossible due to unproductive or inflexible resources. A poverty trap can also be seen as a critical minimum asset threshold, below which families are unable to successfully educate their children, build up their productive assets, and get out of poverty. Extreme poverty is itself a poverty trap, since poor persons lack the means to participate meaningfully in society. In economics, the term poverty trap is often used at national scales, referring to a self-perpetuating condition where an economy, caught in a vicious cycle, suffers from persistent underdevelopment. Many proposed models of poverty traps are found in the literature.

**Predictability**

The extent to which future states of a system may be predicted based on knowledge of current and past states of the system. Since knowledge of the climate system's past and current states is generally imperfect, as are the models that utilize this knowledge to produce a climate prediction, and since the climate system is inherently nonlinear and chaotic, predictability of the climate system is inherently limited. Even with arbitrarily accurate models and observations, there may still be limits to the predictability of such a nonlinear system (AMS, 2000).

**Pre-industrial**

See Industrial Revolution.

**Probability density function (PDF)**

A function that specifies the relative chances of occurrence of different instances of a variable. The function integrates to unity (or equivalently to 100%) over the domain for which it is defined, and has the property that the integral over a sub-domain equals the probability that the instance of the variable lies within that part. For example, the probability that a temperature anomaly defined in a particular way is greater than zero is obtained from its PDF by integrating the PDF over all possible temperature anomalies greater than zero. Probability density functions that describe two or more variables simultaneously are similarly defined.

**Projection**

An estimate of the 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 socioeconomic and technological developments that may or may not be realized. See Climate prediction and Climate projection.

**Proxy**

A record of an indicator variable that is interpreted, using physical and biophysical principles, to represent some combination of climate-related variations. Climate-related data derived in this way are referred to as proxy data, and are indispensable for reconstructing climatic changes before the era of widespread measurement of climate variables. Examples of proxies include pollen abundances, various attributes of tree rings and corals, and various data, particularly hydrogen and oxygen isotope ratios, derived from ice cores. Proxy data can be calibrated to provide quantitative climate information.

**Radiative forcing**

The change in the net, downward minus upward, irradiance (rate of flow of radiative energy through a unit area, expressed in  $\text{W m}^{-2}$ ) at the tropopause due to a change in an external driver of climate change, such as, for example, a change in the concentration of carbon dioxide or the output of the Sun. Sometimes internal drivers are still treated as forcings even though they result from the alteration in climate, for example aerosol or greenhouse gas changes in paleoclimates. The traditional radiative forcing is computed with all tropospheric properties held fixed at their unperturbed values, and after allowing for stratospheric temperatures, if perturbed, to readjust to radiative-dynamical equilibrium. Radiative forcing is called instantaneous if no change in stratospheric temperature is accounted for. The radiative forcing once rapid adjustments are accounted for is termed the adjusted forcing. For the purposes of this report, radiative forcing is further defined as the change relative to the year 1750 and, unless otherwise noted, refers to a global and annual average value. Radiative forcing is not to be confused with cloud radiative forcing, a similar term describing an unrelated measure of the impact of clouds on the irradiance at the top of the atmosphere.

**Reanalysis**

Estimates of historical atmospheric and oceanic temperature, wind, current, and other meteorological and oceanographic quantities, created by processing past meteorological and oceanographic data using fixed state-of-the-art weather forecasting models and data assimilation techniques. Using fixed data assimilation avoids effects due to changes in the analysis system over the history of operational weather forecasting. Although continuity is improving, reanalyses still suffer from changing coverage and biases in the observing systems.

**Reasons for concern**

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 impacts, risks, and vulnerabilities.

**Reference scenario**

See Baseline/reference.

**Reflexivity**

A system attribute where cause and effect form a feedback loop, where the effect changes the system itself. Self-adapting systems like societies are inherently reflexive, as are planned changes in complex systems. Reflexive decision-making in a social system has the potential to change the underpinning values that led to those decisions. Reflexivity is also an important aspect of adaptive management.

**Reforestation**

Planting of forests on lands that have previously sustained 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 Report on Land Use, Land-Use Change and Forestry (IPCC, 2000). See also 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).

**Relative sea level**

Sea level measured by a tide gauge with respect to the land upon which it is situated. See also Mean sea level and Sea level change.

**Representative concentration pathways (RCPs)**

Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases 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 that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome. (Moss et al., 2010).

RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which Integrated Assessment Models produced corresponding emission scenarios. ECPs describe the RCPs extension beyond 2100 (up to 2500) that were calculated using simple rules generated by stakeholder consultations, and do not represent fully consistent scenarios.

Four RCPs produced from Integrated Assessment Models were selected from the published literature and are used in the present IPCC Assessment as a basis for the climate predictions and projections presented in WGI AR5 Chapters 11 to 14:

- RCP8.5: One high pathway for which radiative forcing reaches  $>8.5 \text{ W m}^{-2}$  by 2100 and continues to rise for some amount of time (the corresponding ECP assuming constant emissions after 2100 and constant concentrations after 2250)
- RCP6.0 and RCP4.5: Two intermediate “stabilization pathways” in which radiative forcing is stabilized at approximately  $6 \text{ W m}^{-2}$  and  $4.5 \text{ W m}^{-2}$  after 2100 (the corresponding ECPs assuming constant concentrations after 2150)
- RCP2.6: One pathway where radiative forcing peaks at approximately  $3 \text{ W m}^{-2}$  before 2100 and then declines (the corresponding ECP assuming constant emissions after 2100).

**Resilience**

The ability of a social, ecological, or socio-ecological system and its components to anticipate, reduce, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner.

**Return value/period**

The return value of any variable in a stationary climate is defined in the context of a return period, T, as that value expected to be reached or exceeded on average once every T years over a long period of time. Equivalently, the return value is expected to be reached or exceeded with a 1/T chance in any given year.

**Risk**

The potential for consequences where something of human value (including humans themselves) is at stake and where the outcome is uncertain. Risk is often represented as probability of occurrence of a hazardous event(s) multiplied by the consequences if the event(s) occurs. This report assesses climate-related risks.

**Risk assessment**

The qualitative and/or quantitative scientific identification, analysis, and evaluation of risks posed by climate change.

**Risk management**

The plans, actions, or policies implemented to reduce risks of or respond to climate change impacts or extreme weather events.

**Risk perception**

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

**Risk transfer**

The practice of sharing with other parties the risk of loss. Risk transfer includes formally or informally shifting the risk of financial consequences for particular negative events from one party to another whereby a household, community, enterprise, or state authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party.

**Salt-water intrusion / encroachment**

Displacement of fresh surface water or groundwater by the advance of salt water due to its greater density. This usually occurs in coastal and estuarine areas due to decreasing land-based influence (e.g., from reduced runoff or groundwater recharge, or from excessive water withdrawals from aquifers) or increasing marine influence (e.g., relative sea-level rise).

**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 useful to provide a view of the implications of developments and actions. See also Climate scenario, Emission scenario, Representative Concentration Pathways, and SRES scenarios.

**Sea level change**

Sea level can change, both globally and locally, due to (i) changes in the shape of the ocean basins, (ii) changes in the total mass of water, and (iii) changes in ocean volume as a result of changes in ocean-water density. Sea level changes induced by changes in water density are called steric. Density changes due to temperature changes are called thermosteric, while density changes due to salinity changes are called halosteric. See also Relative Sea Level and Thermal expansion.

**Sea surface temperature (SST)**

The 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 (the uppermost layer; a fraction of a millimeter thick at infrared wavelengths or a centimeter or so thick at microwave wavelengths) are also used, but must be adjusted if they are to be compatible with measurements of the bulk temperature.

**Semi-arid zone**

A zone that can support rain-fed agriculture with more or less sustained levels of production. Sedentary livestock production also occurs. Native vegetation is represented by a variety of species, such as grasses and grass-like plants, forbs and half-shrubs, and shrubs and trees. Annual precipitation varies from 300–600 to 700–800 millimeters, with summer rains, and from 200–250 to 450–500 millimeters with winter rains (FAO Forest Resources Division, 1989).

**Sensitivity**

The degree to which a system is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea-level rise).

**Significant wave height**

The average trough-to-crest height of the highest one third of the wave heights (sea and swell) occurring in a particular time period.

**Sink**

In the context of anthropogenic climate change, any process, activity, or mechanism that removes a greenhouse gas, an aerosol, or a precursor of a greenhouse gas or aerosol from the atmosphere. The term is widely used in studies of mass and energy balances to denote losses from a defined study volume; its opposite, denoting gains, is “source.”

**Snow water equivalent**

The depth of liquid water that would result if a mass of snow melted completely.



**Social cost of carbon**

Two definitions of social cost of carbon are found in the literature: (1) The net present value of climate damages from one more tonne of carbon in the form of CO<sub>2</sub>. (2) The net welfare effects of one more tonne of carbon (including avoided mitigation costs and damages). Which definition is used depends on the application to which the concept is intended.

**Social protection**

In the context of development aid and climate policy, social protection usually describes all public and private initiatives that provide income or consumption transfers to the poor, protect the vulnerable against livelihood risks, and enhance the social status and rights of the marginalized; with the overall objective of reducing the economic and social vulnerability of poor, vulnerable, and marginalized groups. In other contexts, social protection may be used synonymously with social policy and can be described as all public and private initiatives that provide access to services, such as health, education, or housing, or income and consumption transfers to people. Social protection policies protect the poor and vulnerable against livelihood risks and enhance the social status and rights of the marginalized, as well as prevent vulnerable people from falling into poverty.

**Socio-economic scenario**

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

**Southern Annular Mode (SAM)**

The leading mode of variability of Southern Hemisphere geopotential height, which is associated with shifts in the latitude of the midlatitude jet.

**Species distribution modeling**

Simulation of ecological effects of climate change. It uses statistically or theoretically derived response surfaces to relate observations of species occurrence or known tolerance limits to environmental predictor variables, thereby predicting a species' range as the manifestation of habitat characteristics that limit or support its presence at a particular location. Species distribution models are also referred to as environmental niche models. Bioclimate envelope models can be considered as a subset of species distribution models that predict species occurrence or habitat suitability based on climatic variables only.

**SRES scenarios**

Emission scenarios developed by Nakićenović and Swart (2000) and used, among others, as a basis for some of the climate projections shown in Chapters 9 to 11 of IPCC (2001) and Chapters 10 and 11 of IPCC (2007). The following terms are relevant for a better understanding of the structure and use of the set of SRES scenarios:

*Scenario family* Scenarios that have a similar storyline of demographic, societal, economic, and technical change. Four scenario families comprise the SRES scenario set: A1, A2, B1, and B2.

*Illustrative scenario* A scenario that is illustrative for each of the six scenario groups reflected in the Summary for Policymakers of Nakićenović and Swart (2000). They include four revised scenario markers for the scenario groups A1B, A2, B1, B2, and two additional scenarios for the A1FI and A1T groups. All scenario groups are deemed to be equally sound.

*Marker scenario* A scenario that was originally posted in draft form on the SRES website to represent a given scenario family. The choice of markers was based on which of the initial quantifications best reflected the storyline, and the features of specific models. Markers are no more likely than other scenarios, but are considered by the SRES writing team as illustrative of a particular storyline. They are included in revised form in Nakićenović and Swart (2000). These scenarios were scrutinized more closely, by the entire writing team and via the SRES open process, than others. Scenarios were also selected to illustrate the other two scenario groups.

*Storyline* A narrative description of a scenario or scenario family, highlighting the main scenario characteristics, relationships between key driving forces, and the dynamics of their evolution.

**Storm surge**

The temporary increase, at a particular locality, of the height of the sea due to extreme weather (low atmospheric pressure and/or strong winds). The storm surge is defined as being the excess above the level expected from the tidal variation alone at that time and place.

**Storm tracks**

Originally, a term referring to the tracks of individual cyclones, but now often generalized to refer to the main regions where the tracks of extratropical disturbances occur as sequences of low (cyclonic) and high (anticyclonic) pressure systems.

**Stratosphere**

The layer 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. Because temperature increases with height in the stratosphere, it is dynamically stable (and therefore strongly “stratified”).

**Subsidiarity**

The principle that decisions of government (other things being equal) are best made and implemented, if possible, at the lowest, most decentralized level, that is, closest to the citizen. Subsidiarity is designed to strengthen accountability and reduce the dangers of making decisions in places remote from their point of application. The principle does not necessarily limit or constrain the action of higher orders of government, but merely counsels against the unnecessary assumption of responsibilities at a higher level.

**Subsistence agriculture**

Farming and associated activities which together form a livelihood strategy in which most output is consumed directly but some may be sold at market. Subsistence agriculture can be part of a basket of livelihood activities.

**Surface runoff**

The water that travels over the land surface to the nearest surface stream; runoff of a drainage basin that has not passed beneath the surface since precipitation. Sometimes called overland flow.

**Surface temperature**

See Global surface temperature, Land surface air temperature, and Sea surface temperature.

**Sustainability**

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

**Sustainable development**

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987).

**Thermal expansion**

In connection with sea level, the increase in volume (and decrease in density) that results from an increase in water temperature. The increased volume entails an increase in sea level. See also Sea level change.

**Thermocline**

The layer of maximum vertical temperature gradient in the ocean, lying between the surface ocean and the abyssal ocean. In subtropical regions, its source waters are typically surface waters from higher latitudes that have subducted and moved equatorward. At high latitudes, it is sometimes absent, replaced by a halocline, which is a layer of maximum vertical salinity gradient.

**Thermohaline circulation (THC)**

Large-scale circulation in the ocean that transforms low-density upper ocean waters to higher-density intermediate and deep waters and returns those waters back to the upper ocean. The circulation is asymmetric, with conversion to

dense waters in restricted regions at high latitudes and the return to the surface involving slow upwelling and diffusive processes over much larger geographic regions. The THC is driven by high densities at or near the surface, caused by cold temperatures and/or high salinities, but despite its suggestive though common name, is also driven by mechanical forces such as wind and tides. Frequently, the term THC has been used synonymously with Meridional Overturning Circulation.

**Tipping point**

A level of change in system properties beyond which a system reorganizes, often abruptly, and persists in its new state even if the drivers of the change are abated.

**Traditional knowledge**

The knowledge, innovations, and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is generally transmitted orally from generation to generation. Often used as a synonym for indigenous knowledge or local knowledge. (Convention on Biological Diversity, <http://www.cbd.int/traditional/intro.shtml>)

**Transformation**

A change in the fundamental attributes of a system, often based on altered paradigms, goals, or values. Transformations can occur in technological or biological systems, financial structures, and regulatory, legislative, or administrative regimes.

**Tree line**

The upper limit of tree growth in mountains or at high latitudes. It is more elevated or more poleward than the forest line.

**Tropical cyclone**

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<sup>-1</sup>. Beyond 32 m s<sup>-1</sup>, a tropical cyclone is called a hurricane, typhoon, or cyclone, depending on geographic location.

**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 Stratosphere.

**Tsunami**

A wave, or train of waves, produced by a disturbance such as a submarine earthquake displacing the sea floor, a landslide, a volcanic eruption, or an asteroid impact.

**Tundra**

A treeless biome characteristic of polar and alpine regions.

**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, 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; Manning et al., 2004). See also Confidence and Likelihood.

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

The Convention was adopted on 9 May 1992 in New York and signed at the 1992 Earth Summit in Rio de Janeiro by more than 150 countries and the European Community. Its ultimate objective is the 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the

climate system'. It contains commitments for all Parties. Under the Convention, Parties included in Annex I (all OECD countries and countries with economies in transition) aim to return greenhouse gas emissions not controlled by the Montreal Protocol to 1990 levels by the year 2000. The convention entered in force in March 1994.

**Uptake**

The addition of a substance of concern to a reservoir. The uptake of carbon containing substances, in particular carbon dioxide, is often called (carbon) sequestration.

**Upwelling region**

A region of an ocean where cold, typically nutrient-rich waters well up from the deep ocean.

**Urban heat island**

The relative warmth of a city compared with surrounding areas.

**Volatile organic compounds (VOCs)**

Organic air pollutants that are reactive at ambient air conditions. Other terms used to represent VOCs are hydrocarbons (HCs), reactive organic gases (ROGs), and non-methane volatile organic compounds (NMVOCs). NMVOCs are major contributors (together with NO<sub>x</sub> and CO) to the photochemical formation of oxidants like ozone.

**Vulnerability**

The propensity or predisposition to be adversely affected.

**Vulnerability index**

A metric characterizing the vulnerability of a system to a change in climate. A vulnerability index is typically derived by combining, with or without weighting, several indicators assumed to represent hazards or physical impacts, exposure, sensitivity, resilience, or adaptive capacity.

**Water cycle**

See Hydrological cycle.

**Water-use efficiency**

Carbon gain by photosynthesis per unit of water lost by evapotranspiration. It can be expressed on a short-term basis as the ratio of photosynthetic carbon gain per unit transpirational water loss, or on a seasonal basis as the ratio of net primary production or agricultural yield to the amount of water used.

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