

Appendix G

Glossary

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A

Adaptation

In human systems, the process of adjusting to an actual or expected environmental change and its effects in a way that seeks to moderate harm or exploit beneficial opportunities. In natural systems, adaptation is the process of adjustment to an actual environmental change and its effects; human intervention may facilitate adjustment to expected changes.

Aerosols

Fine solid particles or liquid droplets suspended in air. They are produced by natural or human activities and can cause cooling by scattering incoming radiation or by affecting cloud cover. Aerosols also can cause warming by absorbing radiation.

Afforestation

The process of establishing trees on land that has lacked forest cover for a very long period of time or land that has never been forested (CCSP 2007).

Related term: Deforestation

Agriculture, Forestry, and Other Land Use (AFOLU)

AFOLU plays a central role for food security and sustainable development and is a key greenhouse gas reporting category for national reports to the United Nations Framework Convention on Climate Change. The main carbon mitigation options within AFOLU involve one or more of three strategies: 1) prevention of emissions to the atmosphere by conserving existing carbon pools in soils or vegetation, or by reducing emissions; 2) sequestration—increasing the size of existing land carbon pools, thereby extracting carbon dioxide from the atmosphere for long-term storage; 3) substitution—substituting biological

products for fossil fuels or energy-intensive products, thereby reducing carbon dioxide emissions. Demand-side measures (e.g., reduction of food loss and waste, changes in human diet, or changes in wood consumption) also may play a role (Mach et al., 2014).

Related terms: Forestry and Other Land Use (FOLU); Land Use, Land-Use Change, and Forestry (LULUCF); Greenhouse gas (GHG)

Albedo

The fraction of solar radiation reflected by a surface or object, often expressed as a percentage. Snow-covered surfaces have a high albedo (highly reflective). Soil albedos range from high to low, and vegetation-covered surfaces and the ocean have a low albedo (low reflectivity). Earth's planetary albedo varies mainly through changes in cloudiness, snow, ice, leaf area, and land cover (Mach et al., 2014).

Algal bloom

A sudden, rapid growth of algae in lakes, estuaries, and ocean waters caused by various factors including warmer surface waters, increased nutrient levels, or increased light levels. Some algal blooms may be toxic or harmful to humans and ecosystems.

Anoxic

A lack of oxygen, usually referring to soils, wetlands, lakes, estuaries, and ocean waters.

Anthropogenic

Caused or influenced by humans; human-induced (CCSP 2007).

Atmospheric column

On average, a column of air with a cross-sectional area of 1 cm², measured from mean (average) sea level to the top of Earth's atmosphere. The

column has a mass of about 1.03 kg and exerts a force or “weight” of about 10.1 newtons (N) or 2.37 pounds, resulting in a pressure at sea level of about 10.1 N/cm² or 101 kilonewtons (kN)/m² (101 kilopascals, kPa).

B

Biodiversity

The variety of life, including the number of plant and animal species, other life forms, genetic types, habitats, and biomes in an ecosystem.

Bioenergy

A form of renewable energy produced from plant and animal biomass.

Bioenergy with Carbon Capture and Storage (BECCS)

A greenhouse gas mitigation technology that reduces carbon dioxide emissions by combining the use of biomass with geological carbon capture and storage (CCS).

Related terms: Carbon capture and storage (CCS), Carbon sequestration

Biofuel

Fuel produced from plant or animal matter.

Biogenic emissions

Gaseous emissions from natural sources (e.g., plants, soils, and water bodies).

Biogeochemical cycles

Fluxes, or flows, of chemical elements between Earth’s different carbon reservoirs, such as from living to non-living, from atmosphere to land or ocean, from plants to dead organic matter in soils, and from decomposition of organic matter into carbon-containing gases.

Related term: Carbon reservoir

Biomass

The mass of living organisms or the material derived from organisms.

Biome

The community of fauna and flora occupying a particular habitat (e.g., Arctic tundra and wetlands).

Biosphere

Parts of the Earth’s surface in which living organisms reside.

Black carbon

Soot produced from incomplete combustion of biomass-based materials, such as coal burning, diesel engines, cooking fires, wildfires, and other combustion sources.

Bottom-up method (for estimating greenhouse gas emissions)

Extrapolation of measurements from a single facility or source to larger scales (e.g., regional, national, and global) to produce a bottom-up estimate. Bottom-up approaches also can involve the use of activity data and emissions factors or process-based models.

C

C₃ plant

A plant that uses the Calvin-Benson pathway for “fixing” carbon dioxide, such as during photosynthesis. C₃ refers to the 3-carbon molecule that is the first product of this type of carbon fixation (i.e., living organisms changing inorganic carbon dioxide to organic compounds).

Related terms: C₄ plant, Carbon fixation

C₄ plant

A plant that uses the Hatch-Slack pathway for “fixing” carbon dioxide during photosynthesis. C₄ refers to the 4-carbon molecule that is the first product of this type of carbon fixation.

Related terms: C₃ plant, Carbon fixation

Carbon allocation

Carbon allocation refers to the partitioning of carbon through different parts of a plant (e.g., stem, roots, and leaves).

Related term: Stomatal conductance

Carbon capture and storage (CCS)

The process of capturing carbon and injecting it (as carbon dioxide) into geological formations underground or in the deep ocean for long-term storage.

Related terms: *Bioenergy with Carbon Capture and Storage (BECCS), Carbon sequestration*

Carbon cycle

The series of processes by which carbon compounds flow among reservoirs in the environment, such as the incorporation of carbon dioxide into living tissue by photosynthesis and its return to the atmosphere through respiration, the decay of dead organisms, and the burning of fossil fuels. In the carbon cycle, carbon flow or output from one reservoir transfers carbon to other reservoir(s).

Carbon dioxide (CO₂)

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

Related terms: *Global warming potential (GWP), carbon dioxide equivalent (CO₂e)*

Carbon dioxide equivalent (CO₂e)

The amount of a gas that would produce the same effect as CO₂ on the radiative balance of Earth's climate system; applicable in this report to greenhouse gases such as methane and nitrous oxide. Outside this report, aerosols and black carbon also influence global warming potential, but translating them to CO₂e values is difficult. The effect on the radiative balance is referred to as the global warming potential, and the time frame over which it is calculated is important because each gas or particle has a different average residence time in the atmosphere. In this report, the time frame over which CO₂e is calculated

is assumed to be 100 years, although other time frames may be specified.

Related terms: *Carbon dioxide (CO₂), Global warming potential (GWP)*

Carbon dioxide (CO₂) fertilization

The enhancement of plant growth resulting from increased atmospheric CO₂ concentration (Mach et al., 2014).

Carbon fixation

In this process, also called carbon assimilation, a living organism converts carbon dioxide into an organic compound, such as in photosynthesis.

Related terms: *C3 plant, C4 plant, Photosynthesis*

Carbon flux

Refers to the direction and rate of transfer, or flows, of carbon between pools.

Related terms: *Carbon cycle, Carbon pool, Carbon reservoir, Carbon sink, Carbon source, Carbon stock*

Carbon pool

A compartment, or reservoir, within the Earth system where carbon can be taken up, stored, and/or released within a carbon budget.

Related terms: *Carbon cycle, Carbon flux, Carbon reservoir, Carbon sink, Carbon source, Carbon stock*

Carbon reservoir

A compartment, or pool, within the Earth system where carbon can be taken up, stored, and/or released within a carbon budget.

Related terms: *Carbon cycle, Carbon flux, Carbon pool, Carbon sink, Carbon source, Carbon stock*

Carbon sequestration

Storage of carbon through natural, deliberate, or technological processes in which carbon dioxide is diverted from emissions sources or removed from the atmosphere and stored biologically in the ocean and

terrestrial environments (e.g., vegetation, soils, and sediment), or in geological formations (USGS.gov).

Carbon sink

A compartment within the Earth system that acquires carbon from the atmosphere and stores it for a specified period of time.

Related term: *Carbon cycle, Carbon flux, Carbon pool, Carbon reservoir, Carbon source, Carbon stock*

Carbon source

A compartment within the Earth system that releases carbon to the atmosphere.

Related terms: *Carbon cycle, Carbon flux, Carbon pool, Carbon reservoir, Carbon sink, Carbon stock*

Carbon stock

The mass of carbon contained within a particular compartment, or pool, within the Earth system.

Related terms: *Carbon cycle, Carbon flux, Carbon pool, Carbon reservoir, Carbon sink, Carbon source*

Climate

Climate, in a narrow sense, is usually defined as the average weather, or, more rigorously, as the statistical description in terms of the mean and variability of defining factors 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 (modified from Mach et al., 2014).

Climate change

Changes in average weather conditions that persist over multiple decades or longer. Climate change encompasses both increases and decreases in temperature, as well as shifts in precipitation, changes in frequency and location of severe weather events, and changes to other features of the climate system.

Related terms: *Global change, Global warming*

Climate feedback

An interaction in which a perturbation in one climate quantity causes a change in a second quantity, with the change in this second quantity ultimately leading 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 (Mach et al., 2014).

Climate model

A numerical representation of the climate system based on the physical, chemical, and biological properties of its components, their interactions, and feedback processes and accounting for some of its known properties. The climate system can be represented by models of varying complexity; that is, for any one component or combination of components, a spectrum or hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions; the extent to which physical, chemical, or biological processes are explicitly represented; or the level at which empirical parameterizations are involved. Coupled atmosphere-ocean general circulation models 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 toward 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 (Mach et al., 2014).

Climate projection

The simulated response of the climate system to a scenario of future emissions or concentrations of greenhouse gases and aerosols, generally derived using climate models. Climate *projections* are distinguished from climate *predictions* by their dependence on the emissions, concentration, or radiative forcing scenario used, which, in turn, is based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized (Mach et al., 2014).

Related terms: *Climate, Climate model*

Climate variability

Natural changes in climate that fall within the observed range of extremes for a particular region, as measured by temperature, precipitation, and frequency of events. Drivers of climate variability include the El Niño–Southern Oscillation and other phenomena.

Related terms: *El Niño–Southern Oscillation (ENSO), La Niña*

Coastal ocean

The portion of the ocean that is influenced by land. Definitions vary considerably. In this report, the coastal ocean is defined as nonestuarine waters within 200 nautical miles (370 km) of the coast.

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 on local circumstances and implementation practices, among other factors. Co-benefits also are referred to as ancillary benefits (Mach et al., 2014).

Continental shelves

The submerged margins of the continental plates, operationally defined in this report as regions with water depths shallower than 200 m.

Coupled Model Intercomparison Project (CMIP)

The Coupled Model Intercomparison Project is a standard experimental protocol for studying the output of coupled atmosphere-ocean general circulation models. Phases three and five (CMIP3 and CMIP5, respectively) coordinated and archived climate model simulations based on shared model inputs by modeling groups from around the world. The CMIP3 multimodel dataset includes projections using the scenarios drawn from the Intergovernmental Panel on Climate Change's Special Report on emissions scenarios. The CMIP5 dataset includes projections using the Representative Concentration Pathways (edited from Mach et al., 2014).

Cryosphere

All regions on and beneath the surface of the Earth and ocean where water is in solid form, including sea ice, lake ice, river ice, snow cover, glaciers, ice sheets, and frozen ground (e.g., permafrost) (Mach et al., 2014).

D

Deforestation

The process of removing or clearing trees from forested land with lasting conversion of that land to nonforest (CCSP 2007).

Related term: *Afforestation*

Denitrification

The microbial reduction of nitrate to dinitrogen gas and nitrous oxide.

Dissolved inorganic carbon (DIC)

The sum of inorganic oxidized carbon species in a solution, including carbon dioxide, carbonic acid, bicarbonate anions, and carbonate anions.

Related term: *Dissolved organic carbon (DOC)*

Dissolved organic carbon (DOC)

Dissolved organic carbon refers to the sum of organic reduced carbon species in a solution (e.g., organic and humic acids). Dissolved organic matter (DOM) refers to the entire chemical compound, while DOC refers only to the carbon fraction. Both DOM and DOC typically are operationally defined as less than 0.45 micrometers and thus may include chemical species that are colloidal and not truly dissolved.

Related terms: *Particulate organic carbon (POC), Dissolved inorganic carbon (DIC)*

Downscaling

A method that derives local- to regional-scale (10 to 100 km) climate information from larger-scale models or data analyses. Two main methods exist. Dynamical downscaling uses the output of regional climate models, global models with variable spatial resolution, or high-resolution global models. Empir-

ical or statistical downscaling methods develop statistical relationships that link the large-scale atmospheric variables with local or regional climate variables. In all cases, the quality of the driving model remains an important limitation on the quality of the downscaled information (Mach et al., 2014).

Drought

A period of abnormally dry weather marked by little or no rain that lasts long enough to cause water shortage for people and natural systems.

E

Earth System Model (ESM)

A coupled atmosphere-ocean general circulation model in which a representation of the carbon cycle is included, allowing for interactive calculation of atmospheric carbon dioxide or compatible emissions. Additional components (e.g., atmospheric chemistry, ice sheets, dynamic vegetation, nitrogen cycle, and urban or crop models) may be included (Mach et al., 2014).

Ecosystem

A functional unit consisting of living organisms, their nonliving 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, ecosystem boundaries are relatively sharp, while in others they are diffuse, and they 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 they are influenced by the effects of human activities in their environment (Mach et al., 2014).

Related term: Ecosystem services

Ecosystem services

The benefits produced by ecosystems on which people depend, including, for example, fisheries,

drinking water, fertile soils for growing crops, climate regulation, and aesthetic and cultural value.

Related term: Ecosystem

Ecotone

A region of transition between two biological communities or biomes.

Edaphic

Produced by or influenced by the soil. Edaphic qualities may refer to characteristics of the soil itself (e.g., texture or chemical properties). Edaphic qualities also may refer to other ecosystem compartments such as microbial or plant communities that are influenced by soil properties.

Efficiency gap

The difference between a predicted rate of an economically attractive purchase of more efficient technology and lower actual realized adoption rates.

El Niño–Southern Oscillation (ENSO)

A natural interaction between surface air pressure and surface water temperature in the tropical Pacific Ocean. ENSO has two phases: the warm oceanic phase, El Niño, accompanies high surface air pressure in the western Pacific, while the cold phase, La Niña, accompanies low surface air pressure in the western Pacific. Each phase generally lasts 6 to 18 months. ENSO events occur irregularly, about every 3 to 7 years. The extremes of this climate oscillation cause extreme weather (such as floods and droughts) in many regions of the world.

Related term: La Niña

Embedded carbon

Carbon fluxes resulting from the production of goods or services typically consumed.

Embeddedness of carbon

The condition that carbon is an integral but often invisible part of how people lead their lives, so they do not think of themselves as using carbon but

instead see the services and products without seeing their embedded carbon.

Embodied carbon

Carbon residing in material typically released to the atmosphere upon decay or disintegration (e.g., cardboard and construction lumber).

Emissions scenarios

Quantitative illustrations of how the release of different amounts of climate-altering gases and particles into the atmosphere from human and natural sources will produce different future climate conditions. The Intergovernmental Panel on Climate Change developed a Special Report on emissions scenarios (IPCC 2000) using a wide range of assumptions about population growth, economic and technological development, and other factors. An A1B emissions scenario is a medium future emissions scenario in which greenhouse gas emissions increase, with reductions in the rate of increase in emissions after 2070. An A2 emissions scenario is a high future emissions scenario assuming continued increases in greenhouse gas emissions. The B1 emissions scenario is a lower future emissions scenario in which emissions are reduced rapidly and substantially. The B2 emissions scenario is a low future emissions scenario in which emissions are reduced substantially, but not as rapidly as B1.

Related term: *Representative Concentration Pathway (RCP)*

Energy end use

Energy used for services such as transportation, cooking, indoor thermal comfort, refrigeration, and illumination.

Energy intensity

The ratio of energy use to economic or physical output (Mach et al., 2014).

Energy supply

The processes for extracting energy resources and converting them into more desirable and suitable

forms of secondary energy, and for delivering energy to places where demand exists (Grubler et al., 2013).

Energy systems

The infrastructure and systems of electricity production, transport, storage, and consumption.

Enteric methane

Methane generated in the gastrointestinal tract; the term is predominantly used to denote methane originating from microbial fermentation in the pregastric compartments of the digestive system of ruminant animals.

Environmental justice

The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Estuary

A body of water in which river water and ocean water mix. The landward boundary of an estuary is defined in this report as the location (also known as the head-of-tide) where tidal fluctuations become very small. The seaward boundary of an estuary is less clearly defined, but it may be determined based on salinity, bathymetry, or coastline position.

Eutrophication

Enrichment of water by nutrients such as nitrate, ammonia, and phosphate, and thus supporting a dense concentration of primary producers, resulting in an increase in primary production. It is one of the leading causes of water quality impairment. The two most acute symptoms of eutrophication are hypoxia (a state of oxygen depletion) and harmful algal blooms (Mach et al., 2014).

Related term: *Hypoxia*

Evapotranspiration

Evaporation of water from soils, plants, and free water surfaces exposed to the atmosphere.

Exclusive Economic Zone (EEZ)

A zone in the ocean typically extending 200 km or less away from the coast of a nation. Oceanic carbon dioxide uptake or loss is not credited to any nation under Intergovernmental Panel on Climate Change carbon dioxide accounting rules.

Extreme event

A weather event that is rare at a particular place and time of year, including, for example, heatwaves, cold waves, heavy rains, periods of drought and flooding, and severe storms. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10% or 90% 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 (Mach et al., 2014).

F

Feedback

The process through which a system is controlled, changed, or modulated in response to its own output. Positive feedback results in amplification of the system output; negative feedback reduces the output of a system.

Related term: Climate feedback

Final energy

Energy transported and distributed to the point of retail for delivery to final users (e.g., firms, individuals, or institutions; Grubler et al., 2013).

First Nations

Indigenous communities in Canada.

Food security

When all people always have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life.

Forcing

A perturbation to a factor that affects Earth’s climate. For example, both volcanoes and humans emit

heat-trapping gases and particles through volcanic emissions and through fossil fuel combustion, respectively, which can perturb Earth’s climate.

Forestry and Other Land Use (FOLU)

The subset of Agriculture, Forestry, and Other Land Use (AFOLU) emissions and removals of greenhouse gases resulting from direct human-induced land use, land-use change, and forestry activities excluding agricultural emissions (Mach et al., 2014).

Related terms: Agriculture, Forestry, and Other Land Use (AFOLU); Land Use, Land-Use Change, and Forestry (LULUCF); Greenhouse gas (GHG)

Fossil fuels

Fuels such as coal, petroleum, and natural gas derived primarily from the chemical and physical transformation (fossilization) of the remains of plants and animals that lived during previous times (CCSP 2007).

Fugitive emissions

Emissions of gases or vapors from pressurized equipment due to leaks and other unintended or irregular releases, typically from industrial, drilling, or mining activities. Fugitive emissions contribute to air pollution and climate change (e.g., methane gas is readily lost during transport through pipelines or during oil drilling activities), as well as the economic cost of lost commodities.

Related term: Leakage

G

Geoengineering

Intentional modifications of the Earth system, usually technological, to reduce future climate change.

Global change

Changes in the global environment. Global change encompasses climate change, but it also includes other critical drivers of environmental change that may interact with climate change, such as land-use

change, alteration of the water cycle, changes in biogeochemical cycles, and biodiversity loss. Global change may alter the capacity of the Earth to sustain life.

Related terms: *Climate change, Global warming*

Global warming

The observed increase in average temperature near Earth's surface and in the lowest layer of the atmosphere. In common usage, global warming often refers to the warming that has occurred because of increased emissions of greenhouse gases from human activities. Global warming is a type of climate change; it also can lead to other changes in climate conditions, such as changes in precipitation patterns.

Global warming potential (GWP)

An index, based on radiative properties of different greenhouse gases, measuring the radiative forcing following a pulse emission of a unit mass of a given greenhouse gas in the present-day atmosphere integrated over a chosen time horizon, relative to the radiative forcing of carbon dioxide. The carbon dioxide GWP is 1. A GWP represents the combined effect of the differing times a given gas remains in the atmosphere and its relative effectiveness in causing radiative forcing over a specified time frame. In this report, the time frame is assumed to be 100 years, but it may be specified according to other time frames (truncated from Mach et al., 2014).

Related term: *Carbon dioxide equivalent (CO₂e)*

Governance

The processes and structures that steer society and the multiplicity of actors who are involved. Institutional arrangements of governance comprise the sets of rules, norms, and shared practices that underlie decision making.

Greenhouse gas (GHG)

Gases that absorb heat in the atmosphere near Earth's surface, preventing it from escaping into space. If the atmospheric concentrations of these gases rise, the average temperature of the lower

atmosphere will gradually increase, a phenomenon known as the greenhouse effect. Greenhouse gases include, for example, carbon dioxide, nitrous oxide, water vapor, and methane.

Gross primary production (GPP)

The gross uptake of carbon dioxide through photosynthesis.

Related term: *Net primary production (NPP)*

H

Halocarbon

A chlorofluorocarbon or other compound in which the hydrogen of a hydrocarbon is replaced by halogens (i.e., group VIIA of the periodic table including fluorine, bromine, and chlorine).

Hydrocarbon

A compound composed of hydrogen and carbon (e.g., petroleum products and fossil fuels).

Hypoxia

Deficiency of oxygen in water bodies defined as oxygen concentrations less than 2 milligrams per liter. Hypoxia can be a symptom of eutrophication (nutrient overloading). Deoxygenation (the process of removing oxygen) leads to hypoxia and the expansion of oxygen minimum zones (modified from Mach et al., 2014).

Related term: *Eutrophication*

I

Ionophore

Ionophores are feed additives used in cattle diets to increase feed efficiency and body weight gain. They are compounds that alter rumen fermentation patterns. Ionophores can be fed to any class of cattle and can be used in any segment of the beef cattle industry (Hershom and Thrift 2012).

Indicator

An observation or calculation that allows scientists, analysts, decision makers, and others to track

environmental trends, understand key factors that influence the environment, and identify effects on ecosystems and society.

Indigenous communities

Those who, having a historical continuity with preinvasion and precolonial 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 nondominant sectors of these societies and are determined to preserve, develop, and transmit to future generations their ancestral territories and ethnic identities, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions, and legal system (Mach et al., 2014).

Indirect fluxes

Fluxes associated with energy used to create or deliver electricity, products, or services consumed in a given area or the carbon flux associated with waste decay or removal of material to the waste stream.

Inland waters

Open-water systems of lakes, reservoirs, nontidal rivers, and streams in noncoastal environments.

Integrated assessment

A method of analysis that combines results and models (e.g., Integrated Assessment Models) from the physical, biological, economic, and social sciences and the interactions among these components in a consistent framework to evaluate the status and consequences of environmental change and the policy responses to it (Mach et al., 2014).

L

La Niña

A natural interaction between surface air pressure and surface water temperature in the tropical Pacific Ocean. El Niño–Southern Oscillation (ENSO) has two phases: the cold phase, La Niña, accompanies low surface air pressure in the western Pacific, while the warm oceanic phase, El Niño, accompanies high

surface air pressure in the western Pacific. Each phase generally lasts 6 to 18 months. ENSO events occur irregularly, about every 3 to 7 years. The extremes of this climate oscillation cause extreme weather (such as floods and droughts) in many regions of the world.

Related term: *El Niño–Southern Oscillation*

Land cover

The physical characteristics of the land surface such as crops, trees, or concrete.

Land use

Activities taking place on land, such as growing food, cutting trees, or building cities.

Leakage

Can refer to leakage of methane or other gases during drilling and storage and during transfers through pipelines. Leakage also can refer to the situation in which a carbon sequestration activity (e.g., tree planting or avoided deforestation) on one piece of land inadvertently, directly or indirectly, triggers an activity, which in whole or in part counteracts the carbon effects of the initial activity (modified from CCSP 2007).

Related term: *Fugitive emissions*

Lock-in

Occurs when a market is stuck with a standard even though participants would be better off with an alternative. In this report, lock-in is used more broadly as path dependence, which is the generic situation where decisions, events, or outcomes at one point in time constrain adaptation, mitigation, or other actions or options at a later point in time (Mach et al., 2014).

Land Use, Land-Use Change, and Forestry (LULUCF)

Land Use, Land-Use Change, and Forestry (LULUCF)—also referred to as FOLU (Forestry and Other Land Use)—is the subset of Agriculture, Forestry, and Other Land Use (AFOLU) emissions

and removals of greenhouse gases resulting from direct, human-induced land use, land-use change, and forestry activities excluding agricultural emissions (Mach et al., 2014).

Related terms: *Agriculture, Forestry, and Other Land Use (AFOLU)*; *Forestry and Other Land Use (FOLU)*; *Greenhouse gas (GHG)*

M

Marine boundary layer

The marine atmospheric boundary layer is the part of the atmosphere that has direct physical and material interaction with the ocean and, hence, is directly influenced by the ocean. Thus, the marine boundary layer is where the ocean and atmosphere exchange large amounts of heat, moisture, and momentum, primarily via turbulent transport (Sikora and Ufermann 2004).

Mesosphere

The layer of Earth's atmosphere directly above the stratosphere. Boundaries vary with season and latitude, beginning approximately 50 to 65 km above Earth's surface and extending to about 85 to 100 km.

Mitigation

Measures to reduce the amount and rate of future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere.

Monomictic lake

A lake that is mixed from top to bottom during one mixing period per year. Monomictic lakes are found in both warm and cold regions.

N

Native American

Member of an Indigenous community in the American continents.

Net ecosystem carbon balance (NECB)

The net rate of carbon accumulation in (or loss from [negative sign]) ecosystems. NECB represents the

overall ecosystem carbon balance from all sources and sinks—physical, biological, and anthropogenic (Chapin et al., 2006).

Net ecosystem exchange (NEE)

The net flux of carbon dioxide to the land from the atmosphere. Positive values refer to carbon released to the atmosphere (i.e., a source), and negative values refer to carbon uptake (i.e., a sink; Hayes and Turner 2012).

Net ecosystem production (NEP)

The net carbon imbalance within an ecosystem between uptake of carbon dioxide from gross primary production and release of carbon dioxide from autotrophic and heterotrophic respiration; by convention, positive NEP values represent net carbon dioxide uptake by the ecosystem, and negative values represent the net release of carbon dioxide (Chapin et al., 2006).

Net primary production (NPP)

The net uptake of carbon dioxide by plants through gross primary production in excess of losses from plant, or autotrophic, respiration (CCSP 2007).

Related term: *Gross primary production (GPP)*

Nutrients

Chemicals such as nitrate, ammonium, and phosphate that plants and animals need to live and grow. At high concentrations, particularly in water, nutrients can become pollutants.

Nutrient-use efficiency

Nutrient-use efficiency usually is measured in terms of yield per concentration of added nutrients. The concept is most applicable to agricultural situations but can refer to any plant.

O

Ocean acidification

The process by which the pH measurement of ocean water has moved toward more acidic levels due to the absorption of human-produced carbon dioxide,

which interacts with ocean water to form carbonic acid, thereby lowering the pH. Increased acidity reduces the ability of plankton and shelled animals to form and maintain carbonate-containing body parts such as shells.

Ozone

A colorless gas consisting of three atoms of oxygen, readily reacting with many other substances. Ozone in the upper atmosphere protects Earth from harmful levels of ultraviolet radiation from the sun. In the lower atmosphere, ozone is an air pollutant with harmful effects on human health.

P

Particulate organic carbon (POC)

Colloidal particles of organic carbon in a solution, typically operationally defined as being greater than 0.45 micrometers. Particulate organic matter (POM) refers to the entire chemical compound, while POC refers only to the elemental carbon fraction.

Related term: *Dissolved organic carbon (DOC)*

Pathogen

Microorganisms, such as a bacteria or viruses, that cause disease.

Peatlands

Areas having a soil organic layer thickness of at least 40 cm (CCSP 2007).

Permafrost

Ground that remains at or below freezing (0°C) for at least two consecutive years.

pH

A dimensionless measure of the acidity of water (or any solution) given by its concentration of hydrogen ions (H^+). pH is measured on a logarithmic scale where $pH = -\log_{10}(H^+)$, where the concentration of hydrogen ions is measured in units of moles per liter. Thus, a pH decrease of 1 unit corresponds to

a 10-fold increase in the concentration of H^+ , or acidity (Mach et al., 2014).

Phenology

The pattern of seasonal life cycle events in plants and animals, such as timing of blooming, hibernation, and migration.

Photosynthesis

The process by which green plants, algae, and other organisms use sunlight to synthesize energy from carbon dioxide and water. Photosynthesis in plants generally involves the green pigment chlorophyll, consumes carbon dioxide and water, and generates oxygen as a by-product.

Phytoplankton

Microscopic plants that live in salt water and freshwater environments.

Planetary boundary layer

The lowest part of the atmosphere. The layer has direct physical and material interaction with a planetary surface.

Related term: *Marine boundary layer*

Primary energy

Energy extracted or captured directly from resources as they exist in nature. Primary energy is typically divided into three distinct groups: nonrenewable energy (e.g., fossil fuels such as coal, crude oil, natural gas, and other fuels such as nuclear); renewable energy (e.g., hydropower, biomass, solar energy, wind, geothermal, and ocean energy); and waste. Primary energy is not used directly but is converted and transformed into secondary energy such as electricity and fuels such as gasoline, jet fuel, or heating oils.

Priming

Priming or the “priming effect” is said to occur when something added to soil or compost affects the rate of microbial decomposition of soil organic matter, either positively or negatively. Organic matter is made up mostly of carbon and nitrogen, so adding a substrate containing certain ratios of these nutrients to soil may

affect the microbes that are mineralizing soil organic matter. Fertilizers, plant litter, detritus, and carbohydrate exudates from living roots potentially can positively or negatively prime SOM decomposition.

Related terms: *Soil organic matter (SOM), Nutrients*

Proven reserves (coal, oil, shale, and natural gas)

Reserves of fossil fuels in the Earth that are economically profitable to recover using current technologies.

Related term: *Unproven reserves*

Proxy

Indirect measurement of climate aspects. Examples of proxy data are biological or physical records from ice cores, tree rings, and soil boreholes.

R

Radiative effects, radiative forcing

The change in the net (downward minus upward) radiative flux (expressed in watts per m² (W/m²) at the tropopause or top of the atmosphere caused by a change in an external driver of climate change, such as a change in the concentration of carbon dioxide or in the output of the sun (truncated from Mach et al., 2014).

Rebound effect

The case in which expected savings from technology adoption may not be realized because of choices, behaviors, and intervening developments not predicted by efficiency intervention planners.

Reforestation

The process of establishing a new forest by planting or seeding trees in an area where trees have previously been removed.

Related terms: *Afforestation, Deforestation*

Representative Concentration Pathway (RCP)

Scenarios that include time series of emissions scenarios and concentrations of the full suite of

greenhouse gases, aerosols, and chemically active gases, as well as land use and land cover. 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 of interest are not only the long-term concentration levels, but also the trajectory taken over time to reach that outcome. RCPs usually refer to the portion of the concentration pathway extending up to the year 2100. Four RCPs produced from Integrated Assessment Models were selected from the published literature for use in the *Intergovernmental Panel on Climate Change Fifth Assessment Report*: RCP2.6, a pathway whereby radiative forcing peaks at approximately 3 watts per m² (W/m²) before 2100 and then declines; RCP4.5 and RCP6.0, two intermediate stabilization pathways in which radiative forcing is stabilized at approximately 4.5 W/m² and 6.0 W/m², respectively, after 2100; and RCP8.5, a high emissions pathway for which radiative forcing reaches greater than 8.5 W/m² by 2100 and continues to rise for some amount of time (truncated and adapted from Mach et al., 2014).

Related terms: *Emissions scenarios; Integrated assessment; Radiative effects, radiative forcing*

Resilience

The capacity of social, economic, and environmental systems to cope with a hazardous event, trend, or disturbance. It is measured in ways that systems respond or reorganize to maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation (truncated and adapted from Mach et al., 2014).

Respiration

Metabolic pathways that break down complex molecules to release chemically stored energy for maintenance, growth, and reproduction, resulting in the release of waste products such as carbon dioxide, nitrous oxide, or methane.

Rhizosphere

The environment in soils near the root zone of plants.

Risk

Threats to life, health, and safety; the environment; economic well-being; and other things of value. Risks are evaluated in terms of how likely they are to occur (probability) and the damages that would result if they did happen (consequences).

Rumen

The largest segment of ruminant animals' complex stomach, in which methanogenic archaea generate methane (predominantly) from hydrogen and carbon dioxide.

S

Scenario

Set of assumptions used to help understand plausible future conditions such as population growth, land use, and sea level rise. Scenarios are neither predictions nor forecasts, and they are commonly used for planning purposes.

Related term: *Emissions scenarios*

Sink

A physical location where carbon is removed from the atmosphere and stored, either through natural or technological processes. Entire ecosystems, specific ecosystem components (e.g., forest and soil), or political boundaries may be characterized as a sink.

Related terms: *Carbon sink, Carbon source*

Snowpack

Snow that accumulates over winter and slowly melts to release water in spring and summer.

Social network analysis

A method that maps the connections among people who have links to one another in a common area of concern.

Social practice theory

A perspective that focuses on activities engaged in by people to accomplish goals as a principal way of understanding behavior in a social context.

Socioecological systems

Nested, multilevel systems that provide essential services to society such as supply of food, fiber, energy, and drinking water (Berkes and Folke 1998).

Sociotechnical transitions analysis

A method that includes both social and technical aspects for understanding why technological change occurs and whether change can be steered and accelerated.

Soil organic carbon (SOC)

The organic carbon content of soil organic matter (SOM). SOM and SOC in soil result from an imbalance between the supply of raw materials, such as plant, microbial, and animal parts, and the decay of those materials by the soil microbial community.

Related term: *Soil organic matter (SOM)*

Soil organic matter (SOM)

Organic material (e.g., carbon and other elements such as nitrogen in soils). SOM results from an imbalance between the supply of raw materials such as plant, microbial, and animal parts and the decay of those materials by the soil microbial community. SOM forms the basis of life on Earth, enabling persistence and growth of the entire biosphere and can be considered in terms of its carbon content (e.g., soil organic carbon).

Related term: *Soil organic carbon (SOC)*

Source

A physical location from which carbon is released to the atmosphere, either through natural or technological processes. Entire ecosystems, specific ecosystem components (e.g., forest or soil), or political boundaries may be characterized as a source.

Related terms: *Carbon sink, Carbon source, Sink*

Stakeholder

An individual or group that is directly or indirectly affected by or interested in the outcomes of decisions.

Stomatal conductance

The rate of passage of carbon dioxide entering, or water vapor exiting, through the stomata (pores) of a leaf.

Related term: *Transpiration*

Storm surge

The temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (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 (Mach et al., 2014).

Stratification

The layering of water by temperature and salinity, which affect the density of water. Layering can occur in ocean waters, estuaries, lakes, and other water bodies, and it may be long term or undergo seasonal changes.

Stratosphere

The second major layer of Earth's atmosphere, residing above the troposphere and below the mesosphere. Near the equator, the stratosphere starts at 18 km; at midlatitudes, it starts at 10 to 13 km and ends at 50 km; at the poles, it starts at about 8 km.

Related terms: *Mesosphere, Troposphere*

Stressor

A factor that affects people and natural, managed, and socioeconomic systems. Multiple stressors can have compounded effects, such as when economic or market stress combines with drought to negatively impact farmers.

Related term: *Drought*

Surface energy balance

A statement of the conservation of energy applied to a given surface. For Earth's surface, the main terms are the vertical fluxes into or out of the surface due to net radiation, sensible heat, and

latent heat, as well as the net horizontal fluxes of energy that may take place below the surface (e.g., due to ocean currents). Any nonzero residual flux typically is applied as a storage term, increasing or decreasing the internal energy below the surface and usually resulting in an associated change of surface temperature (AMS 2018).

T**Thermohaline circulation**

A part of the large-scale ocean circulation that is driven by global density gradients created by surface heat and freshwater fluxes.

Thermokarst

The process by which characteristic landforms result from the thawing of ice-rich permafrost or the melting of massive ground ice (Mach et al., 2014).

Threshold

The value of a parameter summarizing a system, or a process affecting a system, at which a qualitatively different system behavior emerges. Beyond this value, the system may not conform to statistical relationships that described it previously. For example, beyond a threshold level of ocean acidification, wide-scale collapse of coral ecosystems may occur (USGCRP 2017).

Tipping point

The point at which a change in the climate triggers a significant environmental event, which may be permanent, such as widespread bleaching of corals or the melting of very large ice sheets.

Related terms: *Threshold, Forcing*

Top-down method (for estimating greenhouse gas emissions)

Approaches based on atmospheric measurements that are directed toward estimating emissions from regions that could include multiple facilities (Heath et al., 2015).

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 generally is transmitted orally from generation to generation and often is used as a synonym for Indigenous or local knowledge (Mach et al., 2014).

Transpiration

The evaporation of water through plant leaves.

Related term: Stomatal conductance

Trend

A systematic change over time (CCSP 2007).

Troposphere

The lowest region of the atmosphere, extending from Earth's surface to a height of about 6 to 18 km, which is the lower boundary of the stratosphere. The troposphere is the lowest layer of Earth's atmosphere where nearly every weather condition takes place. It contains approximately 75% of the atmosphere's mass and 99% of the total mass of water vapor and aerosols.

Related terms: Mesosphere, Stratosphere

Tundra

A type of biome common to extreme northern latitudes where tree growth is inhibited by low temperatures and short growing seasons.

U

Uncertainty

An expression of the degree to which a quantity or process is unknown. In statistics, a term used to describe the range of possible values around a best estimate, sometimes expressed in terms of probability or likelihood. Uncertainty about the future climate arises from the complexity of the climate system and the ability of models to represent it, as well as the inability to predict the decisions that

society will make. There also is uncertainty about how climate change, in combination with other stressors, will affect people and natural systems.

United Nations Framework Convention on Climate Change (UNFCC)

An international environmental treaty adopted on May 9, 1992, and ratified on March 21, 1994. The objective of the UNFCC is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

Unproven reserves

Reserves of fossil fuels in the Earth that are economically unprofitable to recover using current technologies.

Related term: Proven reserves

Urban heat island effect

The tendency for higher air temperatures to persist in urban areas because of heat absorbed and emitted by buildings and asphalt, tending to make cities warmer than the surrounding countryside.

Urban infrastructure

Materials and organization structures and facilities needed for the operation of urban living (e.g., roads, buildings, public transit, and pipelines).

V

Validate

To establish or verify accuracy. For example, using measurements of temperature or precipitation to determine the accuracy of climate model results.

Value

Belief or ideal held by individuals or society about what is important or desirable.

Value (economic)

The benefit, usually expressed in monetary terms, gained from use or enjoyment from a good or service.

Vector (disease)

An organism, such as an insect, that transmits disease-causing microorganisms such as viruses or bacteria. Vector-borne diseases include, for example, malaria, dengue fever, and lyme disease.

Vulnerability

The degree to which physical, biological, and socioeconomic systems are susceptible to and unable to cope with adverse impacts of climate change.

Vulnerability assessment

An analysis of the degree to which a system is susceptible to or unable to cope with the adverse effects of climate change.

W**Water-use efficiency**

Refers to the ratio of carbon uptake through plant productivity to water lost by the plant through evapotranspiration.

Related terms: *Evapotranspiration, Transpiration*

Water stress

Water stress occurs when demand for water by people and ecosystems exceeds available supply.

Wetlands

Soils that are inundated or saturated by water at a frequency and duration sufficient to support, and that do support under normal circumstances, a prevalence of vegetation typically adapted for life in saturated conditions (U.S. EPA 2015). Tidal wetlands are influenced by ocean tides and may be saturated with salt water or freshwater. Terrestrial wetlands are nontidal and are saturated with freshwater.

Woody encroachment

Refers to woody plants colonizing grasslands or other nonforested ecosystems.

Y**Yedoma**

An organic-rich (about 2% carbon by mass) Pleistocene-age permafrost sediment with ice content of 50% to 90% by volume.

REFERENCES

- AMS, 2018: Glossary of the American Meteorological Society. [<http://glossary.ametsoc.org>]
- Berkes, F., and C. Folke, 1998: *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge University Press, Cambridge, UK.
- CCSP, 2007: *First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [A. W. King, L. Dilling, G. P. Zimmerman, D. M. Fairman, R. A. Houghton, G. Marland, A. Z. Rose, and T. J. Wilbanks (eds.)]. National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC, USA, 242 pp.
- Chapin, F.S., G. M. Woodwell, J. T. Randerson, E. B. Rastetter, G. M. Lovett, D. D. Baldocchi, D. A. Clark, M. E. Harmon, D. S. Schimel, R. Valentini, and C. Wirth, 2006: Reconciling carbon-cycle concepts, terminology, and methods. *Ecosystems*, **9**(7), 1041-1050.
- Grubler, A., T. B. Johansson, L. Mundaca, N. Nakicenovic, S. Pachauri, K. Riahi, H.-H. Rogner, and L. Strupeit, 2013: Energy primer. In: *Global Energy Assessment*. Cambridge University Press, Cambridge, UK, pp. 99-150.
- Hayes, D., and D. Turner, 2012: The need for “apples-to-apples” comparisons of carbon dioxide source and sink estimates. *Eos Transactions*, **93**(41), 404-405. doi: 10.1029/2012EO410007.
- Heath, G., E. Warner, D. Steinberg, and A. Brandt. 2015. *Estimating U.S. Methane Emissions from the Natural Gas Supply Chain: Approaches, Uncertainties, Current Estimates, and Future Studies*. Joint Institute for Strategic Energy Analysis, National Renewable Energy Laboratory, Golden, CO. [<https://nrel.gov/docs/fy16osti/62820.pdf>]
- Hershorn, M., and T. Thrift, 2012: *Application of Ionophores in Cattle Diets*. University of Florida Animal Science Extension, publication AN285. [<http://edis.ifas.ufl.edu/pdffiles/AN/AN28500.pdf>]
- IPCC, 2000: *Emissions Scenarios: A Special Report of Working Group III of the Intergovernmental Panel on Climate Change*. Intergovernmental Panel on Climate Change. [<http://ipcc.ch/pdf/special-reports/spm/sres-en.pdf>]
- Mach, K.J., S. Planton, and C. von Stechow, 2014: Annex II: Glossary. In: *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. [Core Writing Team, R. K. Pachauri and L. A. Meyer (eds.)]. Intergovernmental Panel on Climate Change, Geneva, Switzerland, pp.117-130.
- Sikora, T. D., and S. Ufermann, 2004: Marine atmospheric boundary layer cellular convection and longitudinal roll vortices. In: *Synthetic Aperture Radar Marine User's Manual*. [C. R. Jackson and J. R. Apel (eds.)]. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. [http://www.sarusersmanual.com/ManualPDF/NOAASARManual_CH14_pg321-330.pdf]
- U.S. EPA, 2015: Section 404 and swampbuster: Wetlands on agricultural lands. U.S. Environmental Protection Agency. [<https://www.epa.gov/cwa-404/section-404-and-swampbuster-wetlands-agricultural-lands>]
- USGCRP, 2017: *Climate Science Special Report: Fourth National Climate Assessment, Volume I*. [D. J. Wuebbles, D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, and T. K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, 666 pp. [<https://science2017.globalchange.gov>]