Earth Commission Glossary

Press kit supplementary material, May 2023

New Earth Commission terms

Safe boundaries: Guardrails on Earth system states for "maintain[ing] and enhanc[ing] the stability and resilience of the Earth system over time, thereby safeguarding its functions and ability to support humans and all other living organisms." (Rockström et al. 2021) Set at global and subglobal scales.

Harm: Negative impacts on humans, communities and countries from Earth system change, additional to background rates.

Significant harm: Widespread severe existential or irreversible negative impacts on countries, communities and people from Earth system change, such as loss of lives, livelihoods or incomes, displacement, loss of food, water or nutritional security, chronic disease, injury or malnutrition.

Just (NSH, no significant harm) boundary: Guardrails on Earth system states for minimizing human exposure (present and future generations, countries, communities, and individuals) to significant harm (no significant harm, NSH) from Earth system change.

Just access: Minimum access to necessary resources and services to lead a dignified life (level 1) and escape from poverty (level 2).

Just access level: Earth system states that would result from just minimum access to electricity, water,
food, and infrastructure needs.

Corridor:

- Rockström et al. 2021: "A corridor for people and the planet is where (a) biophysical stability of the Earth system is maintained and enhanced over time, thereby safeguarding its functions and ability to support humans and all other living organisms, and (b) nature's benefits, risks and related responsibilities are equitably shared among all human beings in the world. Safe in the sense that the Earth's life support systems remain sufficiently stable and able to support all life; just in the sense that human needs are equitably met, particularly for the most vulnerable; and a corridor in the sense of setting clear bounds on which pathways of future human development are both safe and just over time. Safe and just also implies that the Earth's natural resources, such as budgets for carbon, nutrients, water and land, are finite and have to be shared between people and with nature. This corridor bounds pathways of future human development that are both safe and just over time. This safe and just corridor will provide high-level "outcome" goals and the context for companies, cities, governments, and other actors who want to take action by operationalizing scientifically guided sustainability in their ventures (Andersen et al., 2020). Safe and just also implies that the Earth's natural resources, such as budgets for carbon, nutrients, water, and land, are finite (defined by safety) and have to be shared between people and with nature." For the corridor to be just, the space within it also has to be shared in a just manner, which requires just allocation.
- Quantitative operationalisation: Earth system states over time that are bounded by a foundation that enables minimum access to water, food, energy and infrastructure for all humans and by a safe and just (NSH) ESB ceiling of maximum allowed human pressure on biophysical domains.

Biodiversity

The EC uses two synthetic measures of biodiversity, area of natural ecosystems and functional integrity to globally characterize the safe and just biosphere space for humanity. The two indicators complement, but do not replace the multiple facets of biodiversity, nor the local, regional and global dimensions of biosphere function.

- **Area of natural ecosystems (*written as 'natural ecosystems' in our popular communications*)**; representing the area of natural ecosystems with only small human influence (but not excluding low density population subsistence use, eg indigenous communities) with (near to) full functioning of the ecosystem processes, functions and species composition characteristic for the ecosystem.

- **Functional integrity [NCP] (*written as 'working landscapes' in our popular communications*);** representing the quality of ecosystems in terms of providing ecological

functions and their contributions to people, incorporating structural, functional integrity and connectivity that enable this, though independently of degree of modification or species composition. Functional integrity is expressed as the overall capacity of ecosystems in providing their functions and contributions .

Other key biodiversity terms are:

Ecosystem Intactness: the state of an ecosystem being largely unimpaired by post-industrial human alteration. Ecosystem intactness represents the most direct measure of biodiversity intactness and refers to the relative abundance and diversity of originally present species, or the Biodiversity Intactness Index, which has previously been used to define a planetary boundary for biodiversity (DeClerck et al.under review, Scholes and Biggs, 2005, Steffen et al., 2015).:

Ecosystem integrity
Ecosystems have integrity when their core ecological characteristics – such as the diversity, composition, and abundance of species and the structure, functions, and ecological processes these species support – are within their natural range of variation and resilient to perturbations (CBD definition)

A simple definition for ecosystem integrity could be: "The intactness of ecosystems and associated
ecological processes, as measured by indicators that capture a) the extent, quality and function of ecosystem components (including biotic and abiotic factors), and/or b) anthropogenic pressures as a proxy for ecosystem degradation and loss."(Post-2020 GBF).

Ecological integrity:

- Carter et al. 2019, define ecological integrity as the extent to which the composition, structure, and function of an ecosystem fall within their natural range of variation.
- Parrish et al. 2003: Adapting the definition from Karr and Dudley (1981), defines ecological integrity as the ability of an ecological system to support and maintain a community of organisms that has species composition, diversity, and functional organization comparable to those of natural habitats within a region. An ecological system or species has integrity or is viable when its dominant ecological characteristics (e.g., elements of composition, structure, function, and ecological processes) occur within their natural ranges of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human disruptions.

Earth system

Earth system: "The energetically open but nearly materially closed system of all living and non-living (abiotic) interacting things at the surface of the Earth, bounded by outer space on the outside, and by the inner Earth (with its own heat source) on the inside." Its inner boundary extends somewhat (downwards) with the timescale of consideration (cf NASA 1986) but for EC (short timescale) purposes we can exclude most of the lithosphere from the system. [definition written by Tim Lenton for use by EC.]

- "forcings and feedbacks within the system, including biological processes, are as important to it functioning as external drivers" also "human activities are an integral part of system functioning." (Steffen et al., 2020)
- Today's Earth system is a **social-ecological system,** that is, "a coupled system of humans and nature" (Berkes et al. 1998; Liu et al. 2007)

Earth system governance: "as the interrelated and increasingly integrated system of formal and informal rules, rule-making systems, and actor-networks at all levels of human society (from local to global) that are set up to steer societies towards preventing, mitigating, and adapting to global and local environmental change and, in particular, earth system transformation, within the normative context of sustainable development". (Biermann et al., 2009: 4).

Global commons: the biophysical systems and processes that regulate the planet's life-support systems and thereby human wellbeing on Earth (Nature paper).

Goals, targets, etc.

Goal: "Overarching objectives, such as reducing poverty or climate risks" (WG4 ToR)

- In practice, *target* and *goal* are often used interchangeably.

Target: Measurable objectives that guide policy action on a specific time frame (e.g. a carbon emissions target, or a target for a certain % of a population to have access to clean water)

- Generally, "a level or situation that you intend to achieve" (Cambridge Dictionary); a desirable "end state"
- In management, the appropriateness of targets are often evaluated using the SMART criteria: Specific, Measureable, Assignable, Realistic and Time-bound (Doran, 1981)
- Targets may be a point (e.g. economic inflation target of 2% over the coming year) or a range (e.g. global warming target of at most 2°C by 2100)
- Key differences between *targets* and *boundaries*:
    - Well-designed targets are time-limited. / Boundaries are (in prior uses) not time-limited, that is, a time by which the boundary is to be achieved is not specified.
    - Targets are negotiated and adopted by decision-making actors such as governments, industries, sectors, non-governmental organizations or individuals. /

Boundaries (in the sense of planetary boundaries) are a product of scientific assessment, but can include the use of expert judgement.
    - Scientific assessment could, however, propose targets to be then adopted by decision-makers.

Science-based target: A target based on evidence from natural and/or social sciences.

- In the context of the Science-Based Targets Network (SBTN), science-based targets are defined at the actor level as: "Voluntary, measurable, and actionable targets that are aligned with societal sustainability goals".
    - They are "science-based" by virtue of being "aligned with higher-level sustainability goals / targets [/thresholds?] defined by a combination of environmental science and societal risk tolerance, at the relevant level of governance".
    - SBTs are adopted by businesses or cities, according to methodologies designed by SBTN, in consideration of their materiality assessments, their capacities, impacts and users in the social-ecological systems relevant, the relevant science, etc.
- According to Andersen et al., a target is science-based if:
    - "analytical evidence suggests that the achievement of the target is a biophysical possibility within its specified time-frame";
    - it is "quantified, such that progress towards it is measurable"; and
    - it is "supported by a clear, analytical rationale for why it is set at [a] particular level.".

Transformation: Transformation entails "a fundamental qualitative change… that often involves a change in paradigm and may include shifts in perception and meaning, changes in underlying norms and values, reconfiguration of social networks and patterns of interaction, changes in power structures, and the introduction of new institutional arrangements and regulatory frameworks" (IPCC SREX 2012: 436).

Likelihood: in the context of this report, likelihood is defined within a risk assessment framework. The likelihood levels can be described as frequency values or the chance of occurrence of an impact. Both likelihood and probability express odds of occurrences but there is a clear difference. Likelihood refers to the possibility of a risk potential occurring measured in qualitative values that represent levels of significance, such as "low" or "high".

Confidence: The "degree of certainty in" or "confidence in the validity of" a specific ESB quantification. We use the same scheme for assessing and communicating confidence as the IPCC, which sets out two components: (1) robustness of the evidence base, judged as limited, medium, or robust, considering its type, amount, quality, and consistency; (2) degree of scientific agreement across the peer-reviewed literature and among the members of each Earth

Commission Working Group, judged as low, medium, or high. Based on these two dimensions, five qualifiers can be used to express the level of confidence in a particular ESB quantification: very low, low, medium, high, and very high. This self-assessment is an expert judgement based on our understanding of the available literature.

Scenarios, trajectories, pathways, etc.

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." (IPCC AR5)

Trajectory: The sequence of values that a quantity takes over time. Could correspond to a projection, prediction, scenario, or pathway.

Pathway: Has a variety of uses, including:

- In Earth system science, as building blocks of scenarios. "Pathways are plausible trajectories of development in certain fields (eg. policy and governance, socio-economical, technical, energy-industrial). They evolve over time and can be combined with other assumptions or conditions to create scenarios." (weADAPT)
- In target setting or solutions science, a plan or sequence of actions for achieving a goal. "Alternative possible trajectories for knowledge, intervention and change, which prioritise different goals, values and functions" (Leach, Scoones & Stirling 2010); "patterns of changes in sociotechnical systems unfolding over time that lead to new ways of achieving specific societal functions" (Turnheim et al. 2015)

Prediction: In climate science, "a climate **prediction** or climate forecast is the result of an attempt to produce (starting from a particular state of the climate system) an estimate of the actual evolution of the climate in the future, for example, at seasonal, interannual or decadal time scales. Because the future evolution of the climate system may be highly sensitive to initial conditions, such predictions are usually probabilistic in nature." (IPCC AR5)

Projection: "A **projection** is a potential future evolution of a quantity or set of quantities, often computed with the aid of a model. Unlike predictions, projections are conditional on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized." (IPCC AR5)