FAQ: Ecosystem Integrity in the Post-2020 Global Biodiversity Framework
Wildlife Conservation Society (WCS)
Updated: 15 December 2019

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Section I. Defining ecosystem integrity

Q1: What does ecosystem integrity refer to?

A: Ecosystem 'integrity" is generally used to refer to the completeness and functionality of an ecosystem.

When we use the term[s] ecosystem integrity [or intactness,] we refer to the completeness and functionality of an ecosystem and its ecological processes, particularly in relation to its natural state. Ecosystem intactness, integrity and degradation are all terms that are closely related and used somewhat interchangeably. Declines in integrity reduce habitat quality for native biota, disrupt ecological processes and functions, and diminish ecosystem resilience and capacity to sustain species and many ecosystem services. More intact ecosystems support higher biodiversity and reduce extinction risk; conversely, more degraded ecosystems support lower biodiversity and have higher extinction risk. Ecosystem integrity can be evaluated different ways, including through the presence of ecologically functional populations of native species within sufficient quality *and* extent of habitat. In the absence of robust species assessments and other ecological data, which are not always available, analyses of anthropogenic pressures and ecosystem degradation, fragmentation and loss can also serve as a proxy to measure ecosystem integrity (more on this below). Due to the complex nature of its constituent elements, ecosystem integrity or intactness exists at a scale along a gradient of anthropogenic or other disturbance.

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."* This definition encompasses both the conservation of large, intact ecosystems as critical reservoirs of biodiversity and ecosystem services such as carbon sequestration and storage, but also reflects the need to connect those large intact ecosystems through management of all ecosystems, including managed or productive lands and/or seas for ecological processes including connectivity.

Q2: What is the relationship between the terms "integrity" and "intactness" with respect to ecosystems?

A: These terms are sometimes used interchangeably; however, there is a distinction.

The terms "integrity" and "intactness" are sometimes used interchangeably with regards to ecosystem quality, although the terms have different histories and therefore connotations for different stakeholders. Ecological or ecosystem integrity is a broad concept that describes the completeness, functionality or health of an ecosystem, whereas intactness can sometimes refer to the extent to which an ecosystem is subject to measurable anthropogenic disturbance or is missing some component or functionality. Given the challenges of measuring ecosystem integrity across different ecosystem types, some attempt to measure their integrity using their level of intactness or freedom from anthropogenic degradation is useful. Intactness can therefore be thought of as a way to measure ecosystem integrity. Intactness has therefore been the term of choice in evaluating ecosystem integrity based on anthropogenic disturbance in many peer-reviewed studies, while the term "ecological integrity" has a longer history of usage in international policy arenas because it reflects a broader concept.

Note: From here forward, this FAQ will use the term "ecosystem integrity," because this FAQ focuses on the use of the concept in international policy and intergovernmental fora.

Q3: Ecosystem integrity is often used in the context of forest or coral reef ecosystems (e.g. Aichi Target 10) -- is this term relevant for all ecosystem types/biomes?

A: Yes, the concept of ecosystem integrity is applicable to all ecosystem types

Although frequently used to refer to the structure of highly biodiverse or high biomass ecosystems such as tropical forests or coral reefs, the concept of ecosystem integrity is broadly defined and universally applicable across all biomes; it is relevant to all terrestrial, freshwater, and marine ecosystems, as they all depend on the interactions between species and the biotic and abiotic aspects of their habitat. The concept is equally applicable in temperate forests, grasslands, shallow coastal habitat and coastal upwelling zones. To this point, ecosystem integrity is addressed explicitly in reference to both coral reefs and other climate-vulnerable ecosystems in CBD Aichi Target 10.

Section II. Assessing or measuring ecosystem integrity

Q4: How can ecosystem integrity be assessed or measured?

A: Ecosystem integrity is a broad concept, and there are different ways to measure it based on the available data.

As described above, ecosystem integrity refers to the broad idea of ecosystem completeness and functionality. The integrity of an ecosystem can be evaluated using the presence of ecologically functional populations of native species within sufficient quality and extent of habitat. Given the complex nature of its constituent elements, ecosystem integrity exists at a scale along a gradient of anthropogenic or other disturbance, meaning that definitions of an "intact" ecosystem are relative and are defined by identifying biodiversity/ecosystem values and interpreting available data. In the absence of robust species population assessments or other ecological data, which are not universally available, global or regional datasets on anthropogenic pressures can help evaluate ecosystem degradation, fragmentation and loss, and can therefore serve as a proxy for measuring ecosystem integrity.

Q5: Can ecosystem integrity be measured for all habitat types, including both terrestrial and marine habitats?

A: Yes, ecosystem integrity can be measured for all ecosystem types, although the tools or indicators can vary.

Baselines and data exist for measuring ecosystem integrity for many ecosystem types; however, measurement will sometimes need to be context-specific, based on the type of ecosystem and its location. In the terrestrial realm and at broad scales, there are numerous papers in the peer-reviewed literature that assess ecosystem integrity at global scales (e.g. Watson et al. 2016; Venter et al. 2016). Building on this, WCS scientists and partners have recently co-authored a paper that examines the trends in ecosystem integrity at the ecoregional level (terrestrial only), using spatial analyses of human pressure (Beyer et al. 2019). Other efforts focus on developing new tools to measure integrity in a holistic manner for specific ecosystem types (Potapov et al. 2017; Jones et al. 2018). WCS and our conservation partners are also working with ongoing efforts to develop other metrics, such as the IUCN Red List of Ecosystems and a global Forest Health Index to measure forest ecosystem health or for the marine realm. For some ecosystems lacking in standardized global datasets (e.g. some indicators for coral reefs), key metrics of ecosystem health will need to be standardized and evaluated to assess global status and progress.

Q6: What is the Forest Health Index? What can it be used for?

A: WCS and our partners in a scientific consortium are developing a global framework metric for forest ecosystem integrity.

A scientific consortium (WCS, University of Queensland, University of Oxford, University of Maryland, World Resources Institute and WWF) has been working to develop a global tool for measuring the health of all forest ecosystems (tropical, boreal, etc.) based on spatial and structural integrity, as well as

measures of faunal integrity. This Forest Health Index (FHI) will be a direct measure of the condition of a forest ecosystem, relative to the natural, undisturbed state in a given locality, and will present a holistic indicator of the degree to which a forest ecosystem has or has not been degraded by human action. This will be one way to demonstrate the way in which existing data can be used and organized to evaluate ecosystem integrity for some ecosystems/biomes. The underlying principles behind the metric can be re-applied to other ecosystem types, making this a powerful demonstration of how innovative science can drive effective monitoring of habitat degradation, fragmentation and loss in a post-2020 framework. [Note: WCS and partners will submit the FHI for peer review in early 2020.]

Q7: Some of the maps based on the concept of wilderness or intact ecosystems do not include my country or region. Is this concept relevant to all?

A: Thresholds for ecosystem integrity can be set in different ways; the use of this concept may change slightly depending on context. However, it is relevant for everyone.

There have been many recent studies relating to the concept of ecosystem integrity, some of which focus on identifying the areas with the highest levels of ecosystem integrity, or the most intact ecosystems (Watson et al. 2016; Venter et al. 2016; Jones et al. 2018). When these studies are conducted at a global scale, it is critical to set a threshold that is based on the level at which ecosystem processes, and therefore the integrity of an ecosystem, begins to degrade. For many of these global assessments, including the *Three Conditions* framework for terrestrial ecosystems, this is roughly the threshold of agricultural land conversion (Locke et al. 2019). This means that high integrity or intact ecosystems tend to be concentrated in areas with low human presence. These studies help to identify where the Earth's last intact ecosystems are located, and helps structure global efforts to retain these ecosystems in their current state. However, small countries or those with more extensive land conversion in their past may also be able to adjust this threshold to determine which ecosystems within their territory have *relatively* high integrity, and could be protected or actively restored to more closely approach intact ecosystems. Additionally, they may contribute to broader goals on ecosystem integrity by functioning as a key connectivity pathway for migratory species. In this way, the concept can be used by all countries and at multiple scales.

Q8: Can ecosystem integrity be evaluated or measured in marine habitats?

A: Yes, however there are key differences and further research efforts are currently being conducted to apply terrestrial methodologies to marine ecosystems.

Due to the differences between marine and terrestrial ecosystems, including measurements for the different anthropogenic pressures on marine ecosystems and the unique ecologies of pelagic and benthic habitats, there are special considerations on how to evaluate marine ecosystem integrity. The tools already exist to measure ecosystem integrity, described above, and we are working with partners to lead the research into applying the same human pressure proxies to locate marine wilderness areas (Jones et al. 2018). However, there are important caveats, and existing tools will need to be refined for the marine realm. Further research is being undertaken in this regard, including application of KBA Criterion C on Ecological Integrity in marine environments across the globe. For some ecosystems lacking in standardized global datasets (e.g. some indicators for coral reefs), key metrics of ecosystem health will need to be standardized and evaluated to assess global status and progress.

Section III. Ecological integrity in international policy

Q9: Does ecosystem integrity appear in national and international policy?

A: Ecosystem integrity is reflected in both international agreements (hard and soft law) and national policies.

Ecosystem integrity stems from language in Principle 7 of the 1992 Rio Declaration on the Environment and Development, which states that "*States shall cooperate in a spirit of global partnership to conserve,*

protect and restore the health and integrity of the Earth's ecosystem." The concept of ecosystem integrity has been used in intergovernmental agreements and policy fora subsequently, including the UNESCO-World Heritage Convention and the Paris Agreement (which notes "*the importance of ensuring the integrity of all ecosystems, including oceans*"). Parties to the CBD have agreed on the value of ecosystem integrity to ecosystem-based solutions to climate change adaptation and disaster risk reduction, including the adoption of relevant guidance on climate change adaptation and disaster risk reduction at CBD CoP14. Furthermore, ecosystem integrity is mentioned in Aichi Target 10 on climate-vulnerable ecosystems. The Guidelines for Identification of Key Biodiversity Areas (the KBA Standard), adopted by the IUCN Congress in 2016 and increasingly in use at the national level in countries such as Mozambique, Australia, Uganda, Canada, and others, has a special criterion for sites that meet a standard for ecosystem integrity. Some countries have used ecosystem integrity as a guiding principle in national legislation or regulation, such as Canada's legislation on national parks.

Q10: Is ecosystem integrity explicitly defined in these national or international policies?

A: The underlying concept is shared by all of these policy frameworks, although specific definitions and/or thresholds vary.

The Operational Guidelines of the UNESCO World Heritage Convention define integrity as "*a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes*." Canada's legislation for national parks defines ecosystem integrity as, "*…a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes*." The KBA Standard has a special criterion for sites that meet a standard for ecological integrity, defined as those "*...Essentially undisturbed by significant industrial human influence," and that "maintain their full complements of species in their natural abundances or biomass, support the ability of species to engage in natural movements, and allow for the unimpeded functioning of ecological processes*." However, specific indicators or measurements or thresholds used to assess ecological integrity vary across ecosystem types, and have evolved over time. This suggests that this concept can be interpreted by different audiences, and would benefit from further clarification in policy frameworks.

Q11: How is ecosystem integrity reflected in current Strategic Plan for Biodiversity and Aichi Targets, as adopted by Parties to CBD in 2010?

A: Ecosystem integrity appears both explicitly and implicitly within the Aichi Targets (Targets 5 and 10), but challenges with definition and organization have hindered implementation efforts.

Ecosystem integrity is mentioned explicitly in Aichi Target 10: "*By 2015 the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning*." Aichi Target 5 addresses ecosystem degradation (which includes a wide range of pressures such as fragmentation, logging, overgrazing, over-hunting, overfishing and changes to fire and hydrological regimes), which can be seen as the inverse of, or primary threat to, ecosystem integrity. Unfortunately, both Aichi Targets 5 and 10 (and some others) suffer from ambiguity that has led to confusion and relatively poor implementation (Butchart et al. 2016, SBSTTA 2018). Numerous studies have demonstrated that the planet is losing natural habitat and high integrity ecosystems at an alarming rate (Watson et al. 2016) and the CBD SBSTTA has concluded that Aichi Targets 5 and 10 have not been achieved by Parties (SBSTTA 2018). The problem can be addressed not only through implementation or funding to deliver on these targets, but also by increasing the clarity and measurability in the targets themselves.

Q12: Parties to CBD have approved the "Biodiversity Intactness Index" as an indicator for the Aichi Targets. Does this evaluate ecosystem integrity or intactness?

A: The current formulation of a Biodiversity Intactness Index is species-focused, not ecosystem-focused, and is difficult to apply at multiple scales.

The Biodiversity Intactness Index (BII) has been approved by CBD's Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), but it provides an incomplete measure of the aspects addressed by the term ecosystem integrity and is challenging to use in practice. BII is a species-focused metric that requires sparse population data, and often relies on expert consultation or modelling. This is also true of the Biodiversity Habitat Index or BHI, another SBSTTA-approved indicator. These may be valuable indicators and tools for some contexts, but the type of assessments proposed here to evaluate ecosystem integrity, namely using pressure data to determine where ecosystems remain intact, is more reliable and flexible (with respect to scale, geography, etc.). By evaluating the pressure on biodiversity and ecosystems, governments can proactively address ecosystem degradation and loss (using BII or BHI to assess the response of biodiversity will be too reactive and less effective), and allows for evaluation of progress at different scales.

Section IV. Ecosystem integrity in the post-2020 global biodiversity framework

Q13: Why is ecosystem integrity a critical part of the post-2020 global biodiversity framework?

A: Ecosystem integrity is essential for biodiversity conservation, and also delivers critical ecosystem services that contribute to other international goals, including the SDGs.

High integrity ecosystems are critical for biodiversity conservation, as species need sufficient habitat and intact species assemblages to survive an increasing number of local and global threats (including climate change). Existing and forthcoming research highlights the critical contribution of wilderness or intact ecosystems to biodiversity conservation (DiMarco et al. 2019). This makes the concept critically important to achieve the biodiversity conservation objectives of the CBD. However, high levels of ecosystem integrity also contribute to other environmental values and provide ecosystem services, including carbon storage and sequestration, fisheries replenishment, disaster risk reduction, and economic and food security (Watson et al. 2018; Martin and Watson 2016). In this way, maintaining high levels of ecosystem integrity will also deliver on other aspects of the CBD, including sustainable use of biodiversity, and will also directly contribute to other international commitments on climate change, fisheries, etc., as well as the Sustainable Development Goals. This provides a critical link between the agenda of the CBD and other international agreements, which has been specifically requested by Parties.

Q14: How would prioritizing ecosystem integrity affect existing and planned obligations under the CBD and other international treaties?

A: A goal on ecosystem integrity in the post-2020 biodiversity framework will provide an overarching objective that can inspire appropriate interventions at different scales.

As noted above, existing Aichi Targets such as 5 and 10 already set critical goals with respect to ecosystem integrity, but they also suffer from ambiguity and weak organization that has led to confusion and relatively poor implementation (Butchart et al. 2016, SBSTTA 2018). Without a clear, actionable global or target for ecosystem integrity, the implementation of existing targets will all too often default to managing fragmentation in a piecemeal manner. Thus, the articulation of targets addressing ecosystem integrity must be improved significantly in a post-2020 framework, as must the indicators used to report on progress towards this goal.

Q15: Where in the framework should ecosystem integrity appear?

A: We propose that ecosystem integrity and function serve as a/the key overarching objective for the 2030 and 2050 goal on ecosystems within the proposed framework for the zero draft.

Defining and elevating ecosystem integrity would help prioritize quality and function alongside extent, which would in turn help us avoid potential issues associated with reporting on habitat condition and trends. The IUCN Commission on Ecosystem Management (CEM) has proposed a 2030 goal for ecosystem

integrity that could provide element to build on: *"By 2030, for all ecosystems, halt net declines in area, integrity and function, and prevent increases in risk of collapse, towards net gains by 2050, through recovery, restoration, and retention of intact areas"*. Furthermore, the International Coral Reef Initiative (ICRI) is developing recommendations on a target that will seek, as its objective, maintaining the integrity and function of coral reef ecosystems [note: An ICRI submission to Co-Chairs is forthcoming following its 34th General Meeting in December 2019].

We recommend that the relationship between this overarching concept, and more specific, quantitative targets to, for example, halt conversion of natural habitat/ecosystems, create protected areas, or expand restoration efforts, be addressed while drafting the framework for review by Parties. For example, within the targets designed to combat drivers, the land use change target could specifically refer to the need to halt conversion of intact ecosystems as a critical step towards maintaining overall ecosystem integrity.

Q16: How would Parties identify indicators to measure progress towards such an overarching goal or objective?

A: Indicators are already available, but existing and emerging indicators will need to be identified that measure all aspects of ecosystem integrity and function.

Even if 2030 and 2050 goals on ecosystem outcomes are general, the indicators used to measure progress towards this goal will necessarily be more specific. Scientists have shown that ecosystem integrity can be measured across terrestrial biomes using anthropogenic disturbance (Beyer et al. 2019), and tools such as the Forest Health Index are coming online now that will allow for a more thorough, standardized evaluation of ecosystem integrity for forest ecosystems. For other ecosystem types, such as marine environments for which remote sensing tools are not as advanced, available tools for evaluating essential ocean variables will need to be used (for corals, this could include live coral cover, reef fish biomass and structural complexity), and combine them with global datasets on pressure that are increasingly available (for corals, this could include datasets on coastal development, thermal conditions, etc.).

Q17: How would you deal with the differences in ecosystem dynamics and availability of data for different ecosystems?

A: We see two options for dealing with discrepancies among ecosystem types: biome-specific sub-targets or improved indicators.

One option would be to develop biome-specific sub-targets underneath the 2030 and 2050 goals for ecosystems that would allow CBD Parties to set quantitative, SMART thresholds or targets by ecosystem type or biome for 2030. Alternatively, a second option is to develop an overarching goal that is SMART and applicable to all ecosystems, and develop indicators that address each biome. These indicators would then be used to reflect on efforts to maintain or increase the integrity of various ecosystem types at the national level or otherwise.