Last updated: 13 February 2018  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.8: By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species   
  
Indicator 15.8.1: Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
International Union for Conservation of Nature (IUCN)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
This indicator aims to quantify trends in:   
  
  
  
Part A: Commitment by countries to relevant multinational agreements, specifically:  
  
(1) National adoption of invasive alien species-relevant international policy.   
  
(2) Percentage of countries with   
  
(a) national strategies for preventing and controlling invasive alien species; and   
  
(b) national legislation and policy relevant to invasive alien species.  
  
  
  
Part B: The translation of policy arrangements into action by countries to implement policy and actively prevent and control invasive alien species IAS and the resourcing of this action, specifically:  
  
(3) National allocation of resources towards the prevention or control of invasive alien species.  
  
  
  
Rationale and interpretation:  
  
Aichi Biodiversity Target 9 states “By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment”.  
  
  
  
Under Part A, sub-indicator (1), the larger the number of invasive alien species -relevant international policies, the greater the level of global commitment to controlling invasive alien species. The more international agreements a country is party to, the more strongly committed the country is to control invasive alien species.   
  
  
  
Under Part A, sub-indicator (2)(a), effective national policy and legislation underpins effective national strategies and action for preventing and controlling invasive alien species.   
  
  
  
Measurement of Part A, sub-indicators (1) and (2)(a) was first undertaken in 2010, and published in Butchart et al. (2010), CBD (2014), McGeoch et al. (2010), and Tittensor et al. (2014). Sub-indicator (2) indicators have now also been added to include (b) national commitment (mandate and legal authority) to key invasive alien species related themes.   
  
  
  
Under Part B, the indicator now also addresses (3) resourcing by national governments for the prevention and control of invasive alien species, as identified by the Sustainable Development Goals indicator 15.8.1 (“Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species”). Adequate resourcing is vital to ensure implementation and effective delivery of targets set.  
  
  
  
Concepts:  
  
An “Alien” species is described as one which has been introduced outside its natural distribution range because of intentional or accidental dispersion by human activity. An alien species which has become established in a natural or semi-natural ecosystem or habitat, is an agent of change, and threatens native biological diversity is known as an “Invasive alien species” (Convention on Biological Diversity 2016).  
  
  
  
The introduction of an alien species can be intentional or unintentional /accidental. Alien species have been introduced intentionally for forestry, ornamental purposes, for aquaculture/mariculture, hunting, fisheries etc. Examples of unintentional or accidental introductions include: alien species that have escaped from gardens, aquaculture containment facilities, forestry, horticulture; pets and aquarium species that are released in the wild; transport contaminants and stowaways including in ballast water or as hull fouling organisms, and seeds carried in soil, equipment, vehicles etc.  
  
  
  
Mechanisms of impact of invasive species include competition, predation, hybridisation, and disease transmission, parasitism, herbivory and trampling and rooting. The outcomes of these impacts lead to biodiversity loss, habitat degradation, and loss of ecosystem services.  
  
  
  
Comments and limitations:  
  
The adoption of legislation does not necessarily indicate the existence of regulations or policy to implement the legislation or how successful such implementation has been on the ground. There remains a need for further indicator development to make this link clearer. Legislation does not necessarily capture all efforts against invasive alien species that are happening at the national level.  
  
  
  
Allocation of resources to facilitate the implementation of IAS management action is difficult to measure, particularly in a way that is comparable across countries. Proxies used to measure allocation of resources included- allocation of a budget line to invasive species management activities (including prevention, rapid response and active management); appointed staff to carry out any IAS related activities; active programmes/ projects etc.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
This indicator is calculated from data derived from four annually updated datasets.  
  
  
  
Part A (1) Countries’ commitments to global conventions/ international agreements relevant to invasive alien species.   
  
  
  
Ten Multinational Environmental Agreements (MEAs) were used to quantify the trend of countries commitment to global conventions that were relevant to invasive alien species issues. The year of Accession and Ratification were noted. The ten MEAs are:  
  
Convention on Biological Diversity (CBD)  
  
OIE- World Organization for Animal Health  
  
The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)   
  
International Plant Protection Convention (IPPC)  
  
The Ramsar Convention on Wetlands of International Importance  
  
The Convention on Migratory Species of Wild Animals  
  
The Cartagena Protocol on Biosafety  
  
The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)   
  
WTO Sanitary and Phytosanitary or SPS measure  
  
World Heritage Convention (WHC)  
  
  
  
Part A (2)(a) National Legislation considered relevant to the prevention of introduction of invasive alien species and control.   
  
  
  
Any National Legislation, Act or regulation that had any relevance to alien and invasive alien species was recorded including annotations of relevant text of the Legislation, key words, and date of enactment. 196 countries were included. Legislation was considered relevant if it applied to alien and invasive alien species rather than solely on weeds, pests and diseases of agriculture. If more than one relevant piece of Legislation was enacted the date of the most recent one was recorded.  
  
  
  
Part A (2)(b) National Biodiversity Strategy and Action Plan (NBSAP) targets alignment to Aichi Biodiversity target 9 set out in the Strategic Plan for Biodiversity 2011-2020.  
  
  
  
Aichi Biodiversity Target 9 is focused on invasive alien species, it states that “By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment”. The Aichi Targets are timebound and measurable. The CBD encourages all its member states to revise their NBSAPS and integrate the Aichi Targets into their strategies. The NBSAP of all CBD member were studied and numbers of countries that had integrated the Aichi Biodiversity Target 9 into their NBSAP targets was noted   
  
  
  
Part B (3) Results of online survey on Policy responses, mandate, legal authority and resourcing to manage the threat of invasive alien species.  
  
  
  
An online survey was developed and submitted to all CBD nodes and focal points to obtain an insight into the allocation of resources to the management of invasive alien species. Experts from 79 of the 196 countries completed the survey. Considering the difficulty in obtaining information on the level of national investment on invasive alien species issues, proxy indicators were used to measure the allocation of resources by individual countries, such as “does the country have a dedicated and staffed program for invasive alien species management”, “has the country applied for and obtained any funding from global funding mechanisms such as the GEF for projects related to alien and invasive alien species”, etc.   
  
  
  
Part A and Part B Indicators were calculated as follows:  
  
  
  
Part A Indicator: Commitment by countries to relevant multinational agreements, and National strategies for preventing and controlling invasive alien species, underpinned by national policy and legislation for effective management of biological invasions.   
  
  
  
The components of this sub-indicator are calculated as, (1) the number of countries demonstrating adoption of invasive alien species-relevant international policy divided by the total number of countries (196 to date) for which data are available; (2) the number of countries with (a) national legislation and policy relevant to Invasive alien species concerns; and (b) national strategies for preventing and controlling invasive alien species, each divided by the total number of countries (196 to date) for which data are available. The first data point for components (1) and (2)(a) of this sub-indicator is 2010; the first data point for component (2)(b) is 2017.  
  
  
  
Part B Indicator: (3) The translation of policy arrangements into action by countries to implement policy and actively prevent and control invasive alien species and the resourcing of this action.  
  
  
  
This sub-indicator is calculated as the number of national respondents to the annual survey on invasive alien species response financing reporting availability of sufficient resources, divided by the total number of countries (79 to date) for which data are available. The first data point for this sub-indicator is 2017.  
  
  
  
Disaggregation:  
  
All datasets developed for the measurement of this indicator used the country name as the qualifier. Datasets can be aggregated regionally if desired.  
  
  
  
Treatment of missing values:  
  
  
  
At country level  
  
Countries for which no data are available are omitted from the indicator.  
  
  
  
At regional and global levels  
  
NA.  
  
  
  
Regional aggregates:  
  
The indicator is calculated as the simple proportion of countries (for which data are available) that have a given invasive alien species response (treaties, strategy, legislation, financing) in place.  
  
  
  
Sources of discrepancies:  
  
All data sources are national, and so there are no differences between global and national figures.  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
NA.  
  
  
  
Quality assurance  
  
NA.  
  
  
  
  
  
Data Sources  
  
  
  
Data sources and data collection:  
  
Four datasets were updated/developed for the measurement of this indicator.  
  
  
  
Part A (1) Countries’ commitments to global conventions/ international agreements relevant to invasive alien species (used for “National adoption of invasive alien species-relevant international policy”).  
  
Information sources comprised membership information from the Conventions and the United Nations Information Portal on Multilateral Environmental Agreements (InforMEA; https://www.informea.org/en). 196 countries were included. The data format is a spreadsheet of countries vs MEAs, with year of membership in each cell.  
  
  
  
Part A (2)(a) National Biodiversity Strategy and Action Plan (NBSAP) targets alignment to Aichi Biodiversity target 9 set out in the Strategic Plan of Biodiversity Conservation 2011-2020 and status of implementation of targets as described in the 5th National reports (used for “National strategies for preventing and controlling invasive alien species”).  
  
  
  
The information source was the CBD website, which features country profiles (https://www.cbd.int/countries/ ). 196 countries were included. The data format is a spreadsheet of countries vs inclusion of IAS in NBSAP, and Aichi Target 9 alignment.  
  
  
  
Part A (2)(b) National Legislation considered relevant to the prevention of introduction of invasive alien species and control (used for “National strategies for preventing and controlling invasive alien species”). The data format is a spreadsheet of countries vs inclusion of invasive alien species in legislation, with year of legislation in each cell. Key information sources included ECOLEX (https://www.ecolex.org/), FAOLEX (http://www.fao.org/faolex/en/) and national government websites with information on Legislation. Country experts were also contacted for clarifications.  
  
  
  
Part B (3) Results of online survey, disseminated to all CBD national focal points, on Policy responses, mandate, legal authority and resourcing to manage the threat of invasive alien species (used for “National legislation and policy relevant to invasive alien species” and “National allocation of resources towards the prevention or control of invasive alien species”). 79 countries were included. The data format is a spreadsheet of countries vs each of nine IAS management related themes, for both mandate and legal authority; and with an additional dataset indicating funding received from global funding mechanisms for invasive alien species related projects.  
  
  
  
Data Availability  
  
  
  
Description:  
  
On an average data is available for over 90% of the 196 parties to the CBD that are considered for the distinct aspects considered in the development and measurement of this indicator.  
  
  
  
Calendar  
  
  
  
Data collection:  
  
 National agencies producing relevant data include government, non-governmental organizations (NGOs), and academic institutions working jointly and separately. Data are gathered from published and unpublished sources, species experts, scientists, and conservationists through correspondence, workshops, and electronic fora. This indicator was first calculated in 2010 and includes the current 2017 update. Plans include an annual update and make it available for global, regional and national use.  
  
   
  
Data release:  
  
The next release is planned during May- June 2018.  
  
  
  
Data providers  
  
Data were collected through survey of relevant national agencies, specifically National Focal Points to the Convention on Biological Diversity (https://www.cbd.int/information/nfp.shtml). These are primarily national Ministries of Environment or similar agencies.  
  
  
  
Data compilers  
  
International Union for Conservation of Nature (IUCN) Species Survival Commission (SSC) Invasive Species Specialist Group (ISSG)  
  
  
  
References  
  
These metadata are based on http://www.bipindicators.net/iaslegislationadoption, supplemented by the references listed below.  
  
  
  
BUTCHART, S. H. M. et al. (2010). Global biodiversity: indicators of recent declines. Science 328: 1164–1168. Available from http://www.sciencemag.org/content/328/5982/1164.short.   
  
  
  
CBD (2014). Global Biodiversity Outlook 4. Convention on Biological Diversity, Montréal, Canada. Available from https://www.cbd.int/gbo4/.   
  
  
  
CBD (2016). Glossary of Terms. Convention on Biological Diversity, Montréal, Canada. Available from https://www.cbd.int/invasive/terms.shtml.   
  
  
  
MCGEOCH, M.A., et al. (2010). Global indicators of alien species invasion: threats, biodiversity impacts and responses. Diversity and Distributions 16: 95-108.  
  
  
  
TITTENSOR, D. et al. (2014). A mid-term analysis of progress towards international biodiversity targets. Science 346: 241–244. Available from http://www.sciencemag.org/content/346/6206/241.short.  
  
Related indicators as of February 2020  
  
NA.

Last update: March 2020  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.1: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements  
  
Indicator 15.1.1: Forest area as a proportion of total land area  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
Food and Agriculture Organization of the United Nations (FAO)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
  
  
Forest area as a proportion of total land area  
  
  
  
Rationale:  
  
  
  
Forests fulfil a number of functions that are vital for humanity, including the provision of goods (wood and non-wood forest products) and services such as habitats for biodiversity, carbon sequestration, coastal protection and soil and water conservation.   
  
  
  
The indicator provides a measure of the relative extent of forest in a country. The availability of accurate data on a country's forest area is a key element for forest policy and planning within the context of sustainable development.  
  
  
  
Changes in forest area reflect the demand for land for other uses and may help identify unsustainable practices in the forestry and agricultural sector.  
  
  
  
Forest area as percentage of total land area may be used as a rough proxy for the extent to which the forests in a country are being conserved or restored, but it is only partly a measure for the extent to which they are sustainably managed.  
  
  
  
The indicator was included among the indicators for the Millennium Development Goals (MDG) (indicator  
  
7.1 “Proportion of land covered by forest”).  
  
  
  
Concepts:  
  
  
  
In order to provide a precise definition of the indicator, it is crucial to provide a definition of   
  
“Forest” and “Total Land Area”.   
  
  
  
According to the FAO definitions, Forest is defined as: “land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use”. More specifically:  
  
Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters.  
  
It includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of at least 10 percent and tree height of 5 meters or more. It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used.  
  
It includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest.  
  
It includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters.  
  
It includes abandoned shifting cultivation land with a regeneration of trees that have, or are expected to reach, a canopy cover of at least 10 percent and tree height of at least 5 meters.  
  
It includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.  
  
It includes rubberwood, cork oak and Christmas tree plantations.  
  
It includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met.  
  
It excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations, olive orchards and agroforestry systems when crops are grown under tree cover. Note: Some agroforestry systems such as the “Taungya” system where crops are grown only during the first years of the forest rotation should be classified as forest.  
  
  
  
Total land area is the total surface area of a country less the area covered by inland waters, like major rivers and lakes.   
  
  
  
The indicator is expressed as percent.  
  
  
  
Comments and limitations:  
  
  
  
Assessment of forest area is carried out at infrequent intervals in many countries. Although the improved access to remote sensing data can help some countries to update their forest area estimates more frequently, estimation of forest area using remote sensing techniques for has certain challenges. In particular they relate to the assessment of land use (remote sensing primarily assesses land cover), and gradual changes, such as forest regrowth, that can require several years to become detectable. In addition, forest area with low canopy cover density (e.g. 10-30%) are still difficult to detect at large scale with affordable remote sensing techniques.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
Forest area (reference year) / Land area (2015) \* 100  
  
  
  
This indicator can be aggregated to global or regional level by adding all country values globally or in a specific region  
  
  
  
Disaggregation:  
  
  
  
No further disaggregation of this indicator  
  
  
  
Treatment of missing values:  
  
  
  
At country level  
  
  
  
For countries and territories where no information was provided to FAO for FRA 2020 (47 countries and territories representing 0.5 percent of the global forest area), FAO made estimates of forest area based on existing information from previous assessments, literature search, remote sensing or a combination of these data sources.   
  
  
  
At regional and global levels  
  
  
  
See above  
  
  
  
Regional aggregates:  
  
  
  
Since information is available for all countries and territories, regional and global estimates are produced by aggregating country-level data.  
  
  
  
Sources of discrepancies:  
  
  
  
The national figures in the database are reported by the countries themselves following standardized format, definitions and reporting years, thus eliminating any discrepancies between global and national figures. The reporting template requests that countries provide the full reference for original data sources as well as national definitions and terminology. Separate sections in the template country reports deal with the analysis of data (including any assumptions made and the methods used for estimates and projections to the common reporting years); calibration of data to the official land area as held by FAO; and reclassification of data to the classes used in FAO’s Global Forest Resources Assessments.  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
  
  
  
  
Detailed methodology and guidance on how to prepare the country reports through an online web platform and to convert national data according to national categories and definitions to FAO’s global categories and definitions is found in the documents “Guidelines and Specifications” (www.fao.org/3/I8699EN/i8699en.pdf)   
  
  
  
Quality assurance:  
  
  
  
Once received, the country reports undergo a rigorous review process to ensure correct use of definitions and methodology as well as internal consistency. A comparison is made with past assessments and other existing data sources. Regular contacts between national correspondents and FAO staff by e-mail and regional/sub-regional review workshops form part of this review process.  
  
  
  
All country reports (including those prepared by FAO) are sent to the respective Head of Forestry for validation before finalization and publishing of data. The data are then aggregated at sub-regional, regional and global levels by the FRA team at FAO.  
  
  
  
Data Sources  
  
  
  
Description:  
  
  
  
FAO has been monitoring the world's forests at 5 to 10 year intervals since 1946. The Global Forest Resources Assessments (FRA) are now produced every five year. The latest of these assessments, FRA 2020, contains information for 236 countries and territories on about 60 variables related to the extent of forests, their conditions, uses and values for several points in time.   
  
  
  
  
  
Collection process:  
  
  
  
Officially nominated national correspondents and their teams prepare the country reports for the assessment. Some prepare more than one report as they also report on dependent territories. For the remaining countries and territories where no information is provided, a report is prepared by FAO using existing information, literature search, remote sensing or a combination of two or more of them.  
  
  
  
All data are provided to FAO by countries in the form of a country report through an on-line platform following a standard format, which includes the original data and reference sources and descriptions of how these have been used to estimate the forest area for different points in time. The on-line platform was used for all data entry, review and quality control.  
  
  
  
  
  
  
  
Data Availability  
  
  
  
Description:  
  
  
  
Forest area data are available for all 236 countries and territories included in FRA 2020.  
  
  
  
Time series:  
  
  
  
1990, 2000, 2010, 2015, 2016, 2017, 2018, 2019, 2020  
  
  
  
Calendar  
  
  
  
Data collection:  
  
  
  
Data collection process for FRA 2020 was launched in 2018 and data collection took place in 2018-2019   
  
  
  
Data release:  
  
Data with updated time series and including year 2020 will be released June 2020. The possibilities of a more frequent reporting on forest area and other key indicators are currently being evaluated.  
  
  
  
Data providers  
  
  
  
The data are provided by the countries through a global network of officially nominated national correspondents. For the countries and territories which do not have a national correspondent, a report is prepared by FAO using previously reported information, literature search, remote sensing or their combination.  
  
  
  
Data compilers  
  
  
  
FAO  
  
  
  
References  
  
  
  
URL:  
  
  
  
http://www.fao.org/forest-resources-assessment/en/  
  
  
  
References:  
  
  
  
http://www.fao.org/forest-resources-assessment/current-assessment/en/  
  
  
  
Related indicators as of February 2020  
  
  
  
15.2.1:  
  
Progress towards sustainable forest management

Last updated: 12 February 2020  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.4: By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development  
  
Indicator 15.4.1: Coverage by protected areas of important sites for mountain biodiversity  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
UN Environment World Conservation Monitoring Centre (UNEP-WCMC)  
  
BirdLife International (BLI)  
  
International Union for Conservation of Nature (IUCN)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
This indicator Coverage by protected areas of important sites for mountain biodiversity shows temporal trends in the mean percentage of each important site for mountain biodiversity (i.e., those that contribute significantly to the global persistence of biodiversity) that is covered by designated protected areas.  
  
  
  
Rationale:  
  
The safeguard of important sites is vital for stemming the decline in biodiversity and ensuring long term and sustainable use of mountain natural resources. The establishment of protected areas is an important mechanism for achieving this aim, and this indicator serves as a means of measuring progress toward the conservation, restoration and sustainable use of mountain ecosystems and their services, in line with obligations under international agreements. Importantly, while it can be disaggregated to report on any given single ecosystem of interest, it is not restricted to any single ecosystem type, and so faithfully reflects the intent of SDG target 15.1.  
  
  
  
Levels of access to protected areas vary among the protected area management categories. Some areas, such as scientific reserves, are maintained in their natural state and closed to any other use. Others are used for recreation or tourism, or even open for the sustainable extraction of natural resources. In addition to protecting biodiversity, protected areas have high social and economic value: supporting local livelihoods; protecting watersheds from erosion; harbouring an untold wealth of genetic resources; supporting thriving recreation and tourism industries; providing for science, research and education; and forming a basis for cultural and other non-material values.  
  
  
  
This indicator adds meaningful information to, complements and builds from traditionally reported simple statistics of mountain area covered by protected areas, computed by dividing the total protected area within a country by the total territorial area of the country and multiplying by 100 (e.g., Chape et al.   
  
2005). Such percentage area coverage statistics do not recognise the extreme variation of biodiversity importance over space (Rodrigues et al. 2004), and so risk generating perverse outcomes through the protection of areas which are large at the expense of those which require protection.  
  
  
  
The indicator is used to track progress towards the 2011–2020 Strategic Plan for Biodiversity (CBD 2014, Tittensor et al. 2014), and was used as an indicator towards the Convention on Biological Diversity’s 2010   
  
Target (Butchart et al. 2010).  
  
  
  
Concepts:  
  
Protected areas, as defined by the International Union for Conservation of Nature (IUCN; Dudley 2008), are clearly defined geographical spaces, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. Importantly, a variety of specific management objectives are recognised within this definition, spanning conservation, restoration, and sustainable use:  
  
  
  
Category Ia: Strict nature reserve  
  
Category Ib: Wilderness area  
  
Category II: National park  
  
Category III: Natural monument or feature  
  
Category IV: Habitat/species management area  
  
Category V: Protected landscape/seascape  
  
Category VI: Protected area with sustainable use of natural resources  
  
  
  
The status "designated" is attributed to a protected area when the corresponding authority, according to national legislation or common practice (e.g., by means of an executive decree or the like), officially endorses a document of designation. The designation must be made for the purpose of biodiversity conservation, not de facto protection arising because of some other activity (e.g., military).  
  
  
  
Sites contributing significantly to the global persistence of biodiversity are identified following globally criteria set out in A Global Standard for the Identification of Key Biodiversity Areas (IUCN 2016) applied at national levels. Key Biodiversity Areas encompass (a) Important Bird & Biodiversity Areas, that is, sites contributing significantly to the global persistence of biodiversity, identified using data on birds, of which >13,000 sites in total have been identified from all of the world’s countries (BirdLife International 2014, Donald et al. 2018); (b) Alliance for Zero Extinction sites (Ricketts et al. 2005), that is, sites holding effectively the entire population of at least one species assessed as Critically Endangered or Endangered on The IUCN Red List of Threatened Species, of which 853 sites have been identified for 1,483 species of mammals, birds, amphibians, reptiles, freshwater crustaceans, reef-building corals, conifers, cycads and other taxa; (c) Key Biodiversity Areas identified under an earlier version of the Key Biodiversity Area criteria (Langhammer et al. 2007), including those identified in Ecosystem Hotspot Profiles developed with support of the Critical Ecosystem Partnership Fund. These three subsets are being reassessed using the Global Standard, which unifies these approaches along with other mechanisms for identification of important sites for other species and ecosystems (IUCN 2016)  
  
  
  
Comments and limitations:  
  
Quality control criteria are applied to ensure consistency and comparability of the data in the World Database on Protected Areas. New data are validated at UNEP-WCMC through a number of tools and translated into the standard data structure of the World Database on Protected Areas. Discrepancies between the data in the World Database on Protected Areas and new data are minimised by provision of a manual (UNEP-WCMC 2019) and resolved in communication with data providers. Similar processes apply for the incorporation of data into the World Database of Key Biodiversity Areas (BirdLife International 2019).  
  
  
  
The indicator does not measure the effectiveness of protected areas in reducing biodiversity loss, which ultimately depends on a range of management and enforcement factors not covered by the indicator. A number of initiatives are underway to address this limitation. Most notably, numerous mechanisms have been developed for assessment of protected area management, which can be synthesised into an indicator (Leverington et al. 2010). This is used by the Biodiversity Indicators Partnership as a complementary indicator of progress towards Aichi Biodiversity Target 11   
  
(http://www.bipindicators.net/pamanagement). However, there may be little relationship between these measures and protected area outcomes (Nolte & Agrawal 2013). More recently, approaches to “green listing” have started to be developed, to incorporate both management effectiveness and the outcomes of protected areas, and these are likely to become progressively important as they are tested and applied more broadly.  
  
  
  
Data and knowledge gaps can arise due to difficulties in determining whether a site conforms to the IUCN definition of a protected area, and some protected areas are not assigned management categories. Moreover, “other effective area-based conservation measures”, as specified by Aichi Biodiversity Target   
  
11 of the Strategic Plan for Biodiversity 2011–2020, recognise that some sites beyond the formal protected area network, while not managed primarily for nature conservation, may nevertheless be managed in ways which are consistent with the persistence of the biodiversity for which they are important (Jonas et al. 2014). However, the formally agreed definition of an OECM (“A geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity, with associated ecosystem functions and services and, where applicable, cultural, spiritual, socioeconomic, and other locally relevant values”) were only agreed in November 2018 and measures are only recently in place for countries to submit OECM data to UNEP-WCMC. OECMs are now collated by UNEP-WCMC in a separate database, the WD-OECM.  
  
  
  
Regarding important sites, the biggest limitation is that site identification to date has focused mainly on specific subsets of biodiversity, for example birds (for Important Bird and Biodiversity Areas) and highly threatened species (for Alliance for Zero Extinction sites). While Important Bird and Biodiversity Areas have been documented to be good surrogates for biodiversity more generally (Brooks et al. 2001, Pain et al. 2005), the application of the unified standard for identification of Key Biodiversity Areas (IUCN 2016) sites across different levels of biodiversity (genes, species, ecosystems) and different taxonomic groups remains a high priority, building from efforts to date (Eken et al. 2004, Knight et al. 2007, Langhammer et al. 2007, Foster et al. 2012). Birds now comprise <50% of the species for which Key Biodiversity Areas have been identified, and as Key Biodiversity Area identification for other taxa and elements of biodiversity proceeds, such bias will become a less important consideration in the future.  
  
  
  
Key Biodiversity Area identification has been validated for a number of countries and regions where comprehensive biodiversity data allow formal calculation of the site importance (or “irreplaceability”) using systematic conservation planning techniques (Di Marco et al. 2016, Montesino Pouzols et al. 2014).  
  
  
  
Future developments of the indicator will include: a) expansion of the taxonomic coverage of mountain Key Biodiversity Areas through application of the Key Biodiversity Areas standard (IUCN 2016) to a wide variety of mountain vertebrates, invertebrates, plants and ecosystem type; b) improvements in the data on protected areas by continuing to increase the proportion of sites with documented dates of designation and with digitised boundary polygons (rather than coordinates).  
  
  
  
  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
This indicator is calculated from data derived from a spatial overlap between digital polygons for protected areas from the World Database on Protected Areas (UNEP-WCMC & IUCN 2020) and digital polygons for mountain Key Biodiversity Areas (from the World Database of Key Biodiversity Areas, including Important Bird and   
  
Biodiversity Areas, Alliance for Zero Extinction sites, and other Key Biodiversity Areas). Sites were classified as mountain Key Biodiversity Areas by undertaking a spatial overlap between the Key Biodiversity Area polygons and a mountain raster layer (UNEP-WCMC 2002), classifying any Key Biodiversity Area as a mountain Key Biodiversity Area where it had ≥5% overlap with the mountain layer. The value of the indicator at a given point in time, based on data on the year of protected area establishment recorded in the World Database on Protected Areas, is computed as the mean percentage of each Key Biodiversity Area currently recognised that is covered by protected areas.  
  
  
  
Year of protected area establishment is unknown for ~12% of protected areas in the World Database on Protected Areas, generating uncertainty around changing protected area coverage over time. To reflect this uncertainty, a year was randomly assigned from another protected area within the same country, and then this procedure repeated 1000 times, with the median plotted.   
  
  
  
Prior to 2017, the indicator was presented as the percentage of Key Biodiversity Areas completely covered by protected areas. However, it is now presented as the mean % of each Key Biodiversity Area that is covered by protected areas in order to better reflect trends in protected area coverage for countries or regions with few or no Key Biodiversity Areas that are completely covered.  
  
  
  
Disaggregation:  
  
Given that data for the global indicator are compiled at national levels, it is straightforward to disaggregate to national and regional levels (e.g., Han et al. 2014), or conversely to aggregate to the global level. Key Biodiversity Areas span all ecosystem types, including mountains (Rodríguez-Rodríguez et al. 2011). The indicator can therefore be reported in combination across terrestrial and freshwater systems, or disaggregated among them. However, individual Key Biodiversity Areas can encompass terrestrial and freshwater (and indeed marine) systems simultaneously, and so determining the results is not simply additive. Finally, the indicator can be disaggregated according to different protected area management categories (categories I–VI) to reflect differing specific management objectives of protected areas.  
  
  
  
In addition to the aggregation of the coverage of protected areas across important sites for mountain biodiversity as an indicator towards SDG 15.4, other disaggregations of coverage of protected areas of particular relevance as indicators towards SDG targets (Brooks et al. 2016) include:  
  
  
  
SDG 14.5.1 Coverage of protected areas in relation to marine areas.  
  
SDG 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type.  
  
  
  
Protected area coverage data can be combined with other data sources to yield further, complementary, indicators. For example, protected area overlay with ecoregional maps can be used to provide information on protected area coverage of different broad biogeographical regions. Protected area coverage of the distributions of different groups of species (e.g., mammals, birds, amphibians) can similarly provide indicators of trends in coverage of biodiversity at the species level. Protected area coverage can be combined with the Red List Index to generate indicators of the impacts of protected areas in reducing biodiversity loss (Butchart et al. 2012). Finally, indicators derived from protected area overlay can also inform sustainable urban development; for example, the overlay of protected areas onto urban maps could provide an indicator of public space as a proportion of overall city space.  
  
  
  
Treatment of missing values:  
  
 At country level  
  
Data are available for protected areas and Key Biodiversity Areas in all of the world’s countries, and so no imputation or estimation of national level data is necessary.  
  
  
  
 At regional and global levels  
  
Global indicators of protected area coverage of important sites for biodiversity are calculated as the mean percentage of each Key Biodiversity Area that is covered by protected areas. The data are generated from all countries, and so while there is uncertainty around the data, there are no missing values as such and so no need for imputation or estimation.  
  
  
  
Regional aggregates:  
  
UNEP-WCMC is the agency in charge of calculating and reporting global and regional figures for this indicator, working with BirdLife International and IUCN to combine data on protected areas with those for sites of importance for biodiversity. UNEP-WCMC aggregates the global and regional figures on protected areas from the national figures that are calculated from the World Database on Protected Areas and disseminated through Protected Planet. The World Database on Protected Areas and Protected Planet are jointly managed by UNEP-WCMC and IUCN and its World Commission on Protected Areas. The World Database on Protected Areas is held within a Geographic Information System that stores information about protected areas such as their name, size, type, date of establishment, geographic location (point) and/or boundary (polygon). Protected area coverage is calculated using all the protected areas recorded in World Database on Protected Areas whose location and extent is known apart from protected areas without digital boundaries and those sites who have a status of ‘proposed’ or ‘not reported’.  
  
  
  
  
  
Sources of discrepancies:  
  
National processes provide the great bulk of the data that are subsequently aggregated into both the World Database on Protected Areas and the World Database of Key Biodiversity Areas, and so there are very few differences between national indicators and the global one. One minor source of difference is that the World Database on Protected Areas incorporates internationally-designated protected areas (e.g., World Heritage sites, Ramsar sites, etc), a few of which are not considered by their sovereign nations to be protected areas.   
  
  
  
Note that because countries do not submit comprehensive data on degazetted protected areas to the WDPA, earlier values of the indictor may marginally underestimate coverage. Furthermore, there is also a lag between the point at which a protected area is designated on the ground and the point at which it is reported to the WDPA. As such, current or recent coverage may also be underestimated.  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
The WDPA has its origins in a 1959 UN mandate when the United Nations Economic and Social Council called for a list of national parks and equivalent reserves Resolution 713 (XXVIII). More details are available here: https://www.protectedplanet.net/c/world-database-on-protected-areas. The UN List of Protected Areas has been published in 1961/62, 1966/71, 1972 (addendum to the 1966/71 edition), 1973, 1974, 1975, 1980, 1982, 1985, 1990, 1993, 1997, 2003, 2014 and 2018 which have resulted in a global network of national data providers for the WDPA. For example, in 2014 all Convention on Biological Diversity (CBD) National Focal points and all National Focal points for the CBD Protected Areas Programme of Work (PoWPA) to request data for the 2014 Un List of Protected Areas (https://www.protectedplanet.net/c/united-nations-list-of-protected-areas/united-nations-list-of-protected-areas-2014). Protected areas data is therefore compiled directly from government agencies, regional hubs and other authoritative sources in the absence of a government source. All records have a unique metadata identifier (MetadataID) which links the spatial database to the Source table where all sources are described. The data is collated and standardised following the WDPA Data Standards and validated with the source. The process of collation, validation and publication of data as well as protocols and the WDPA data standards are regularly updated in the WDPA User Manual (https://www.protectedplanet.net/c/wdpa-manual) made available through www.protectedplanet.net where all spatial data and the Source table are also published every month and can be downloaded.   
  
  
  
The process for compilation of data on sites contributing significantly to the global persistence of biodiversity (Key Biodiversity Areas) is documented online (http://www.keybiodiversityareas.org/home). Specifically, (http://www.keybiodiversityareas.org/what-are-kbas), the Key Biodiversity Area identification process is a highly inclusive, consultative and bottom-up exercise. Although anyone with appropriate scientific data may propose a site to qualify as a Key Biodiversity Area, wide consultation with stakeholders at the national level (both non-governmental and governmental organizations) is required during the proposal process. Key Biodiversity Area identification builds off the existing network of Key Biodiversity Areas, including those identified as Important Bird & Biodiversity Areas through the BirdLife Partnership of 120 national organisations (http://www.birdlife.org/worldwide/partnership/birdlife-partners), for the Alliance for Zero Extinction by 93 national and international organisations (http://www.zeroextinction.org/partners.html), and as other Key Biodiversity Areas by civil society organisations supported by the Critical Ecosystem Partnership Fund in developing ecosystem profiles, named in each of the profiles listed here (http://www.cepf.net/resources/publications/Pages/ecosystem\_profiles.aspx), with new data strengthening and expanding expand the network of these sites. Any site proposal undergoes independent scientific review. This is followed by the official site nomination with full documentation meeting the Documentation Standards for Key Biodiversity Areas. Sites confirmed by the Key Biodiversity Areas Secretariat to qualify as Key Biodiversity Areas then appear on the Key Biodiversity Areas website (http://www.keybiodiversityareas.org/home).  
  
  
  
The WDPA User Manual (https://www.protectedplanet.net/c/wdpa-manual) published in English, Spanish, and French provides guidance to countries on how to submit protected areas data to the WDPA, what are the benefits of providing such data, which are the data standards and which quality checks are performed. We also provide a summary of our methods to calculate protected areas coverage to all WDPA users: https://www.protectedplanet.net/c/calculating-protected-area-coverage. The “Global Standard for the Identification of Key Biodiversity Areas” (https://portals.iucn.org/library/node/46259) comprises the standard recommendations available to countries in the identification of Key Biodiversity Areas, with further guidelines available on the Key Biodiversity Areas website (http://www.keybiodiversityareas.org/home). Specifically, (http://www.keybiodiversityareas.org/get-involved), the main steps of the Key Biodiversity Area identification process are the following:   
  
submission of Expressions of Intent to identify a Key Biodiversity Area to Regional Focal Points;   
  
proposal Development process, in which proposers compile relevant data and documentation and consult national experts, including organizations that have already identified Key Biodiversity Areas in the country, either through national Key Biodiversity Area Coordination Groups or independently;   
  
review of proposed Key Biodiversity Areas by Independent Expert Reviewers, verifying the accuracy of information within their area of expertise; and   
  
a Site Nomination phase comprising the submission of all the relevant documentation for verification by the Key Biodiversity Areas Secretariat (see section 3.3 below).   
  
Once a Key Biodiversity Area is identified, monitoring of its qualifying features and its conservation status is important. Proposers, reviewers and those undertaking monitoring can join the Key Biodiversity Areas Community to exchange their experiences, case studies and best practice examples.  
  
  
  
Quality assurance  
  
The process on how the data is collected, standardised and published is available in the WDPA User Manual at: https://www.protectedplanet.net/c/wdpa-manual which is available in English, French and Spanish. Specific guidance is provided at https://www.protectedplanet.net/c/world-database-on-protected-areas on, for example, predefined fields or look up tables in the WDPA: https://www.protectedplanet.net/c/wdpa-lookup-tables, how WDPA records are coded how international designations and regional designations data is collected, how regularly is the database updated, and how to perform protected areas coverage statistics.   
  
  
  
The process of identification of Key Biodiversity Areas is supported by the Key Biodiversity Areas Partnership (http://www.keybiodiversityareas.org/kba-partners). Among the roles of the partnership is establishment of the Key Biodiversity Areas Secretariat, which checks information submitted in the Site Nomination phase for the correct application of the Key Biodiversity Areas Standard ((https://portals.iucn.org/library/node/46259), and the adequacy of site documentation and then verifies the site, which is then published on the Key Biodiversity Areas Website (http://www.keybiodiversityareas.org/get-involved). In addition, the Chairs of the IUCN Species Survival Commission and World Commission on Protected Areas (both of whom are elected by the IUCN Membership of governments and non-governmental organisations), appoint the Chair of an independent Key Biodiversity Areas Standards and Appeals Committee, which ensures the correct application of the Global Standard for the identification of Key Biodiversity Areas. The R code for calculating protected area coverage of Key Biodiversity Areas is documented as Dias, M. (2017) “R code for calculating protected area coverage of KBAs” (http://www.keybiodiversityareas.org/userfiles/files/R\_code\_for\_calculating\_protected\_area\_coverage\_of\_KBAs\_March\_2017.pdf).  
  
  
  
In addition to dissemination via the Protected Planet website (https://www.protectedplanet.net/), the UN List process described in 3.1 the fact that protected areas data is collected from national agencies acknowledged in the WDPA metadata, and Key Biodiversity Areas website (http://www.keybiodiversityareas.org/home), Protected Planet and Key Biodiversity Areas data are disseminated through the Integrated Biodiversity Assessment Tool, available for research and conservation online (https://www.ibat-alliance.org/ibat-conservation/). This incorporates Country Profile documents for all of the world’s countries, which includes documentation of the indicator of protected area coverage of Key Biodiversity Areas. Each annual update to these Country Profiles are sent for consultation to National Focal Points of the Convention on Biological Diversity (https://www.cbd.int/information/nfp.shtml), National Statistics Offices SDG Representatives and UN Permanent Missions (Geneva) representatives.  
  
  
  
Data Sources  
  
  
  
Description:  
  
Protected area data are compiled by ministries of environment and other ministries responsible for the designation and maintenance of protected areas. Protected Areas data for sites designated under the Ramsar Convention and the UNESCO World Heritage Convention are collected through the relevant convention international secretariats. Protected area data are aggregated globally into the World Database on Protected Areas by the UN Environment World Conservation Monitoring Centre, according to the mandate for production of the United Nations List of Protected Areas (Deguignet et al. 2014). They are disseminated through Protected Planet, which is jointly managed by UNEP-WCMC and IUCN and its World Commission on Protected Areas (UNEP-WCMC 2016).  
  
  
  
Key Biodiversity Areas are identified at national scales through multi-stakeholder processes, following standard criteria and thresholds. Key Biodiversity Areas data are aggregated into the World Database on Key Biodiversity Areas, managed by BirdLife International. Specifically, data on Important Bird and Biodiversity Areas are available online at http://datazone.birdlife.org/site/search and data on Alliance for Zero Extinction sites are available online at https://zeroextinction.org. Both datasets, along with Key Biodiversity Areas identified through other processes, are available through the World Database on Key Biodiversity Areas, and, along with the World Database on Protected Areas, are also disseminated through the Integrated Biodiversity Assessment Tool for Research and Conservation Planning.  
  
  
  
Collection process:  
  
See information under other sections.  
  
  
  
Data Availability  
  
  
  
Description:  
  
This indicator has been classified by the IAEG-SDGs as Tier 1. Current data are available for all countries in the world, and these are updated on an ongoing basis.  
  
  
  
Time series:  
  
~150 years   
  
  
  
Calendar  
  
  
  
Data collection:  
  
UNEP-WCMC produces the UN List of Protected Areas every 5–10 years, based on information provided by national ministries/agencies. In the intervening period between compilations of UN Lists, UNEP-WCMC works closely with national ministries/agencies and NGOs responsible for the designation and maintenance of protected areas, continually updating the  
  
WDPA as new data become available. The World Database of Key Biodiversity Areas is also updated on an ongoing basis, as new national data are submitted.   
  
  
  
Data release:  
  
The indicator of protected area coverage of important sites for biodiversity is anticipated to be released annually.   
  
  
  
Data providers  
  
  
  
Protected area data are compiled by ministries of environment and other ministries responsible for the designation and maintenance of protected areas. Key Biodiversity Areas are identified at national scales through multi-stakeholder processes, following standard criteria and thresholds.  
  
  
  
Data compilers  
  
  
  
Name:  
  
UNEP-WCMC and IUCN  
  
  
  
Description:  
  
Protected area data are aggregated globally into the World Database on Protected Areas by the UN Environment World Conservation Monitoring Centre, according to the mandate for production of the United Nations List of Protected Areas (Deguignet et al. 2014). They are disseminated through Protected Planet, which is jointly managed by UNEP-WCMC and IUCN and its World Commission on Protected Areas (UNEP-WCMC 2016). Key Biodiversity Areas data are aggregated into the World Database on Key Biodiversity Areas, managed by BirdLife International (2019). Specifically, data on Important Bird and Biodiversity Areas are available online at http://datazone.birdlife.org/site/search and data on Alliance for Zero Extinction sites are available online at http://www.zeroextinction.org/search.cfm. Both datasets, along with the World Database on Protected Areas, are also disseminated through the Integrated Biodiversity Assessment Tool for Research and Conservation Planning.  
  
  
  
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URL:  
  
http://www.unep-wcmc.org/; http://www.birdlife.org/; http://www.iucn.org/  
  
  
  
References:  
  
These metadata are based on http://mdgs.un.org/unsd/mi/wiki/7-6-Proportion-  
  
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Last updated: 11 July 2017  
  
  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.5: Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species  
  
Indicator 15.5.1: Red List Index  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
International Union for Conservation of Nature (IUCN)  
  
BirdLife International (BLI)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
The Red List Index measures change in aggregate extinction risk across groups of species. It is based on genuine changes in the number of species in each category of extinction risk on The IUCN Red List of Threatened Species (IUCN 2015) is expressed as changes in an index ranging from 0 to 1.  
  
  
  
Rationale:  
  
The world’s species are impacted by a number of threatening processes, including habitat destruction and degradation, overexploitation, invasive alien species, human disturbance, pollution and climate change. This indicator can be used to assess overall changes in the extinction risk of groups of species as a result of these threats and the extent to which threats are being mitigated.  
  
  
  
The Red List Index value ranges from 1 (all species are categorized as ‘Least Concern’) to 0 (all species are categorized as ‘Extinct’), and so indicates how far the set of species has moved overall towards extinction. Thus, the Red List Index allows comparisons between sets of species in both their overall level of extinction risk (i.e., how threatened they are on average), and in the rate at which this risk changes over time. A downward trend in the Red List Index over time means that the expected rate of future species extinctions is worsening (i.e., the rate of biodiversity loss is increasing). An upward trend means that the expected rate of species extinctions is abating (i.e., the rate of biodiversity loss is decreasing), and a horizontal line means that the expected rate of species extinctions is remaining the same, although in each of these cases it does not mean that biodiversity loss has stopped. An upward Red List Index trend would indicate that the SDG Target 15.5 of reducing the degradation of natural habitats and protecting threatened species is on track. A Red List Index value of 1 would indicate that biodiversity loss has been halted.  
  
  
  
The name “Red List Index” should not be taken to imply that the indicator is produced as a composite indicator of a number of disparate metrics (in the same way that, e.g., the Multidimensional Poverty Index is compiled). The Red List Index provides an indicator of trends in species’ extinction risk, as measured using the IUCN Red List Categories and Criteria (Mace et al. 2008, IUCN 2012a), and is compiled from data on changes over time in the Red List Category for each species, excluding any changes driven by improved knowledge or revised taxonomy.  
  
  
  
The Red List Index is used as an indicator towards the 2011–2020 Strategic Plan for Biodiversity (CBD 2014, Tittensor et al. 2014), and was used as an indicator towards the Convention on Biological Diversity’s 2010 Target (Butchart et al. 2010) and Millennium Development Goal 7. It can also be projected to assess future development scenarios (Visconti et al. 2015).  
  
  
  
Concepts:  
  
Threatened species are those listed on The IUCN Red List of Threatened Species in the categories Vulnerable, Endangered, or Critically Endangered (i.e., species that are facing a high, very high, or extremely high risk of extinction in the wild in the medium-term future). Changes over time in the proportion of species threatened with extinction are largely driven by improvements in knowledge and changing taxonomy. The indicator excludes such changes to yield a more informative indicator than the simple proportion of threatened species. It therefore measures change in aggregate extinction risk across groups of species over time, resulting from genuine improvements or deteriorations in the status of individual species. It can be calculated for any representative set of species that have been assessed for The IUCN Red List of Threatened Species at least twice (Butchart et al. 2004, 2005, 2007).  
  
  
  
Comments and limitations:  
  
There are four main sources of uncertainty associated with Red List Index values and trends.  
  
  
  
Inadequate, incomplete or inaccurate knowledge of a species’ status. This uncertainty is minimized by assigning estimates of extinction risk to categories that are broad in magnitude and timing.  
  
  
  
Delays in knowledge about a species becoming available for assessment. Such delays apply to a small (and diminishing) proportion of status changes, and can be overcome in the Red List Index through back-casting.  
  
  
  
Inconsistency between species assessments. These can be minimized by the requirement to provide supporting documentation detailing the best available data, with justifications, sources, and estimates of uncertainty and data quality, which are checked and standardized by IUCN through Red List Authorities, a Red List Technical Working Group and an independent Standards and Petitions Sub-committee. Further, detailed Guidelines on the Application of the Categories and Criteria are maintained (IUCN SPSC 2016), as is an online training course (in English, Spanish and French).  
  
  
  
Species that are too poorly known for the Red List Criteria to be applied are assigned to the Data Deficient category, and excluded from the calculation of the Red List Index. For birds, only 0.8% of extant species are evaluated as Data Deficient, compared with 24% of amphibians. If Data Deficient species differ in the rate at which their extinction risk is changing, the Red List Index may give a biased picture of the changing extinction risk of the overall set of species. The degree of uncertainty this introduces is estimated through a bootstrapping procedure that randomly assigns each Data Deficient species a category based on the numbers of non-Data Deficient species in each Red List category for the set of species under consideration, and repeats this for 1,000 iterations, plotting the 2.5 and 97.5 percentiles as lower and upper confidence intervals for the median.  
  
  
  
The main limitation of the Red List Index is related to the fact that the Red List Categories are relatively broad measures of status, and thus the Red List Index for any individual taxonomic group can practically be updated at intervals of at least four years. As the overall index is aggregated across multiple taxonomic groups, it can be updated typically annually. In addition, the Red List Index does not capture particularly well the deteriorating status of common species that remain abundant and widespread but are declining slowly.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
The Red List Index is calculated at a point in time by first multiplying the number of species in each Red List Category by a weight (ranging from 1 for ‘Near Threatened’ to 5 for ‘Extinct’ and ‘Extinct in the Wild’) and summing these values. This is then divided by a maximum threat score which is the total number of species multiplied by the weight assigned to the ‘Extinct’ category. This final value is subtracted from 1 to give the Red List Index value.  
  
  
  
Mathematically this calculation is expressed as:   
  
RLIt = 1 – [(Ss Wc(t,s) / (WEX \* N)]  
  
Where Wc(t,s) is the weight for category (c) at time (t) for species (s) (the weight for ‘Critically Endangered’ = 4, ‘Endangered’ = 3, ‘Vulnerable’ = 2, ‘Near Threatened’ = 1, ‘Least Concern’ = 0. ‘Critically Endangered’ species tagged as ‘Possibly Extinct’ or ‘Possibly Extinct in the Wild’ are assigned a weight of 5); WEX = 5, the weight assigned to ‘Extinct’ or ‘Extinct in the Wild’ species; and N is the total number of assessed species, excluding those assessed as Data Deficient in the current time period, and those considered to be ‘Extinct’ in the year the set of species was first assessed.  
  
  
  
The formula requires that:  
  
Exactly the same set of species is included in all time periods, and  
  
The only Red List Category changes are those resulting from genuine improvement or deterioration in status (i.e., excluding changes resulting from improved knowledge or taxonomic revisions), and  
  
Data Deficient species are excluded.  
  
  
  
In many cases, species lists will change slightly from one assessment to the next (e.g., owing to taxonomic revisions). The conditions can therefore be met by retrospectively adjusting earlier Red List categorizations using current information and taxonomy. This is achieved by assuming that the current Red List Categories for the taxa have applied since the set of species was first assessed for the Red List, unless there is information to the contrary that genuine status changes have occurred. Such information is often contextual (e.g., relating to the known history of habitat loss within the range of the species). If there is insufficient information available for a newly added species, it is not incorporated into the Red List Index until it is assessed for a second time, at which point earlier assessments are retrospectively corrected by extrapolating recent trends in population, range, habitat and threats, supported by additional information. To avoid spurious results from biased selection of species, Red List Indices are typically calculated only for taxonomic groups in which all species worldwide have been assessed for the Red List, or for samples of species that have been systematically or randomly selected.  
  
  
  
The methods and scientific basis for the Red List Index were described by Butchart et al. (2004, 2005, 2007, 2010).   
  
  
  
Butchart et al. (2010) also described the methods by which Red List Indices for different taxonomic groups are aggregated to produce a single multi-taxon Red List Index. Specifically, aggregated Red List Indices are calculated as the arithmetic mean of modelled Red List Indices. Red List Indices for each taxonomic group are interpolated linearly for years between data points and extrapolated linearly (with a slope equal to that between the two closest assessed points) to align them with years for which Red List Indices for other taxa are available. The Red List Indices for each taxonomic group for each year are modelled to take into account various sources of uncertainty:   
  
  
  
Data Deficiency: Red List categories (from Least Concern to Extinct) are assigned to all Data Deficient species, with a probability proportional to the number of species in non-Data Deficient categories for that taxonomic group;   
  
  
  
Extrapolation uncertainty: although RLIs were extrapolated linearly based on the slope of the closest two assessed point, there is uncertainty about how accurate this slope may be. To incorporate this uncertainty, rather than extrapolating deterministically, the slope used for extrapolation is selected from a normal distribution with a probability equal to the slope of the closest two assessed points, and standard deviation equal to 60% of this slope (i.e., the CV is 60%);   
  
  
  
Temporal variability: the ‘true’ Red List Index likely changes from year to year, but because assessments are repeated only at multi-year intervals, the precise value for any particular year is uncertain.   
  
  
  
To make this uncertainty explicit, the Red List Index value for a given taxonomic group in a given year is assigned from a moving window of five years, centred on the focal year (with the window set as 3-4 years for the first two and last two years in the series). Note that assessment uncertainty cannot yet be incorporated into the index. Practically, these uncertainties are incorporated into the aggregated Red List Indices as follows: Data Deficient species were allotted a category as described above, and a Red List Index for each taxonomic group was calculated interpolating and extrapolating as described above. A final Red List Index value was assigned to each taxonomic group for each year from a window of years as described above. Each such ‘run’ produced a Red List Index for the complete time period for each taxonomic group, incorporating the various sources of uncertainty. Ten thousand such runs are generated for each taxonomic group, and the mean is calculated.  
  
  
  
Methods for generating national disaggregations of the Red List Index are described below.  
  
  
  
Disaggregation:  
  
The Red List Index can be downscaled to show national and regional Red List Indices, weighted by the fraction of each species’ distribution occurring within the country or region, building on the method published by Rodrigues et al. (2014) PLoS ONE 9(11): e113934. These show an index of aggregate survival probability (the inverse of extinction risk) for all birds, mammals, amphibians, corals and cycads occurring within the country or region. The index shows how well species are conserved in a country or region to its potential contribution to global species conservation. The index is calculated as:   
  
  
  
RLI(t,u) = 1 – [(Ss(W(t,s) \* (rsu/Rs)) / (WEX \* Ss (rsu/Rs))  
  
  
  
where t is the year of comprehensive reassessment, u is the spatial unit (i.e. country), W\_((t,s)) is the weight of the global Red List category for species s at time t (Least Concern =0, Near Threatened =1, Vulnerable =2, Endangered =3, Critically Endangered =4, Critically Endangered (Possibly Extinct) =5, Critically Endangered (Possibly Extinct in the Wild) =5, Extinct in the Wild =5 and Extinct =5), WEX = 5 is the weight for Extinct species, r\_su is the fraction of the total range of species s in unit u, and R\_s is the total range size of species s.  
  
  
  
The index varies from 1 if the country has contributed the minimum it can to the global RLI (i.e., if the numerator is 0 because all species in the country are LC) to 0 if the country has contributed the maximum it can to the global RLI (i.e., if the numerator equals the denominator because all species in the country are Extinct or Possibly Extinct).   
  
  
  
The taxonomic groups included are those in which all species have been assessed for the IUCN Red List more than once. Red List categories for years in which comprehensive assessments (i.e. those in which all species in the taxonomic group have been assessed) were carried out are determined following the approach of Butchart et al. 2007; PLoS ONE 2(1): e140, i.e. they match the current categories except for those taxa that have undergone genuine improvement or deterioration in extinction risk of sufficient magnitude to qualify for a higher or lower Red List category.  
  
  
  
The indicator can also be disaggregated by ecosystems, habitats, and other political and geographic divisions (e.g., Han et al. 2014), by taxonomic subsets (e.g., Hoffmann et al. 2011), by suites of species relevant to particular international treaties or legislation (e.g., Croxall et al. 2012), by suites of species exposed to particular threatening processes (e.g., Butchart 2008), and by suites of species that deliver particular ecosystem services, or have particular biological or life-history traits (e.g., Regan et al. 2015). In each case, information can be obtained from The IUCN Red List of Threatened Species to determine which species are relevant to particular subsets (e.g. which occur in particular ecosystems, habitats, and geographic areas of interest).  
  
  
  
Disaggregations of the Red List Index are also of particular relevance as indicators towards the following SDG targets (Brooks et al. 2015): SDG 2.4 Red List Index (species used for food and medicine); SDG 2.5 Red List Index (wild relatives and local breeds); SDG 12.2 Red List Index (impacts of utilisation) (Butchart 2008); SDG 12.4 Red List Index (impacts of pollution); SDG 13.1 Red List Index (impacts of climate change); SDG 14.1 Red List Index (impacts of pollution on marine species); SDG 14.2 Red List Index (marine species); SDG 14.3 Red List Index (reef-building coral species) (Carpenter et al. 2008); SDG 14.4 Red List Index (impacts of utilisation on marine species) – an ad hoc joint FAO-IUCN Technical Expert Group is currently working to develop agreed recommendations on the use and interpretation of this indicator; SDG 15.1 Red List Index (terrestrial & freshwater species); SDG 15.2 Red List Index (forest-specialist species); SDG 15.4 Red List Index (mountain species); SDG 15.7 Red List Index (impacts of utilisation) (Butchart 2008); and SDG 15.8 Red List Index (impacts of invasive alien species) (Butchart 2008, McGeoch et al. 2010).  
  
  
  
Treatment of missing values:  
  
At country level  
  
Red List Indices for each taxonomic group are interpolated linearly for years between data points and extrapolated linearly (with a slope equal to that between the two closest assessed points, except for corals) back to the earliest time point and forwards to the present for years for which estimates are not available. The start year of the aggregated index is set as ten years before the first assessment year for the taxonomic group with the latest starting point. Corals are not extrapolated linearly because declines are known to have been much steeper subsequent to 1996 (owing to extreme bleaching events) than before. Therefore the rate of decline prior to 1996 is set as the average of the rates for the other taxonomic groups.  
  
  
  
At regional and global levels  
  
The Red List Index is calculated globally based on assessments of extinction risk of each species included, because many species have distributions which span many countries. Thus, while there is certainly uncertainty around the Red List Index, there are no missing values as such, and so no imputation is necessary.  
  
  
  
Regional aggregates:  
  
The Red List Categories and Criteria are applied for each species on The IUCN Red List of Threatened Species and are determined globally and provided principally by the Specialist Groups and stand-alone Red List Authorities of the IUCN Species Survival Commission, IUCN Secretariat-led initiatives, the BirdLife International partnership, and the other IUCN Red List partner organizations. The staff of the IUCN Global Species Programme compile, validate, and curate these data, and are responsible for publishing and communicating the results. Each individual species assessment is supported by the application of metadata and documentation standards (IUCN 2013), including classifications of, for example, threats and conservation actions (Salafsky et al. 2008).   
  
  
  
Red List assessments are undertaken through either open workshops or through open-access web-based discussion fora. Assessments are reviewed by the appropriate Red List Authority (an individual or organization appointed by the IUCN Species Survival Commission to review assessments for specific species or groups of species) to ensure standardisation and consistency in the interpretation of information and application of the criteria. A Red List Technical Working Group and the IUCN Red List Unit work to ensure consistent categorization between species, groups and assessments. Finally, a Standards and Petitions Sub-committee monitors the process and resolves challenges and disputes over Red List assessments.  
  
  
  
In addition, IUCN publishes guidelines on applying the IUCN Red List Categories and Criteria at regional or national scales (IUCN 2012b). Based on these, many countries have initiated programmes to assess the extinction risk of species occurring within their borders. These countries will be able to implement the Red List Index based on national extinction risk, once they have carried out at least two national Red Lists using the IUCN system in a consistent way (Bubb et al. 2009). An increasing number of countries have now completed national Red List Indices for a range of taxa (e.g., Gärdenfors 2010, Pihl & Flensted 2011).  
  
  
  
While global Red List Indices can be disaggregated to show trends for species at smaller spatial scales, the reverse is not true. National or regional Red List Indices cannot be aggregated to produce Red List Indices showing global trends. This is because a taxon’s global extinction risk has to be evaluated at the global scale and cannot be directly determined from multiple national scale assessments across its range (although the data from such assessments can be aggregated for inclusion in the global assessment).  
  
  
  
Sources of discrepancies:  
  
Some countries have assessed the national extinction risk of species occurring in the country, and have repeated such assessments, allowing a national Red List Index to be produced. This may differ from the indicator described here because (a) it considers national rather than global extinction risk, and (b) because it takes no account of the national responsibility for the conservation of each species, treating as equal both those species that occur nowhere outside the country (i.e. national endemics) and those with large ranges that occur in many other countries. Any such differences will be smaller for countries within which a high proportion of species are endemic (i.e., only found in that country), as in many island nations and mountainous countries, especially in the tropics. The differences will be larger for countries within which a high proportion of species have widespread distributions across many nations.  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
See existing metadata for the Red List Index SDG indicator 15.5.1, especially the section on “Methodology”. In sum: the data underlying the Red List Index are compiled under the authority of the IUCN Red List Committee, through application of the IUCN Red List Categories & Criteria (https://portals.iucn.org/library/node/10315). This includes submissions of endemics from national red list processes, where these have been conducted following the “Guidelines for application of IUCN Red List Criteria at Regional and National Levels” (https://portals.iucn.org/library/node/10336) and following the “Required and Recommended Supporting Information for IUCN Red List Assessments” (http://goo.gl/O52euG). Assessments may be submitted in all three IUCN languages (English, French and Spanish) and Portuguese. All assessments are peer reviewed through the relevant Red List Authority for the species or species group in question, as documented in the Red List Rules of Procedure (https://cmsdocs.s3.amazonaws.com/keydocuments/Rules\_of\_Procedure\_for\_IUCN\_Red\_List\_Assessments\_2017-2020.pdf); see in particular Annex 3, the “Details of the Steps Involved in the IUCN Red List Process” (https://cmsdocs.s3.amazonaws.com/keydocuments/Details\_of\_the\_Steps\_Involved\_in\_the\_IUCN\_Red\_List\_Process.pdf).  
  
  
  
See existing metadata for the Red List Index SDG indicator 15.5.1, especially the section on “Methodology”. In sum: the key document providing international recommendations and guidelines to countries and all involved in application of the IUCN Red List Categories & Criteria (https://portals.iucn.org/library/node/10315) is the “Guidelines for Using the IUCN Red List Categories and Criteria” (in English - http://cmsdocs.s3.amazonaws.com/RedListGuidelines.pdf and in French - http://cmsdocs.s3.amazonaws.com/keydocuments/RedListGuidelines\_FR.pdf) accompanied by the “Required and Recommended Supporting Information for IUCN Red List Assessments”. For countries (and regions), this is supplemented by the “Guidelines for application of IUCN Red List Criteria at Regional and National Levels” (https://portals.iucn.org/library/node/10336). To support the calculation of Red List Indices for any given country (or region), “R code to calculate and plot national RLIs weighted by the proportion of each species’ distribution within a country or region” is posted online (https://cmsdocs.s3.amazonaws.com/keydocuments/R\_code\_for\_calculating\_RLIs\_weighted\_by\_proportion\_of\_each\_species'\_range\_within\_a\_country\_or\_region.pdf).  
  
  
  
Quality assurance  
  
See existing metadata for the Red List Index SDG indicator 15.5.1, especially the section on “Methodology”, with full documentation in the Red List Rules of Procedure (https://cmsdocs.s3.amazonaws.com/keydocuments/Rules\_of\_Procedure\_for\_IUCN\_Red\_List\_Assessments\_2017-2020.pdf) in particular Annex 3, the “Details of the Steps Involved in the IUCN Red List Process” (https://cmsdocs.s3.amazonaws.com/keydocuments/Details\_of\_the\_Steps\_Involved\_in\_the\_IUCN\_Red\_List\_Process.pdf). In sum: all Red List assessments are peer reviewed through the relevant Red List Authority for the species or species group in question; and all Red List assessments undergo consistency checks (to ensure consistency with assessments submitted for other taxonomic groups, regions, processes, etc.) by the Red List Unit before publication on the Red List website (http://www.iucnredlist.org/). Finally, the Chair of the IUCN Species Survival Commission (elected each four years by the government and non-governmental Members of IUCN) appoints a Chair for a Standards and Petitions Sub-Committee (https://www.iucn.org/theme/species/about/species-survival-commission/ssc-leadership-and-steering-committee/sub-committees/standards-and-petitions-subcommittee), which is responsible for ensuring the quality and standards of the IUCN Red List and for ruling on petitions against the listings of species on the IUCN Red List.   
  
  
  
In addition to dissemination via the Red List website (http://www.iucnredlist.org/), Red List data are disseminated through the Integrated Biodiversity Assessment Tool, available for research and conservation online (https://www.ibat-alliance.org/ibat-conservation/). This incorporates Country Profile documents for all of the world’s countries, which includes documentation of the Red List Index indicator for the current year, starting from 2016. The first edition of each of these Country Profiles was sent for consultation to National Focal Points of the Convention on Biological Diversity (https://www.cbd.int/information/nfp.shtml), at the 13th meeting of the Conference of the Parties of the Convention on Biological Diversity; and this process will be repeated annually.  
  
  
  
Data Sources  
  
  
  
Description:  
  
National agencies producing relevant data include government, non-governmental organisations (NGOs), and academic institutions working jointly and separately. Data are gathered from published and unpublished sources, species experts, scientists, and conservationists through correspondence, workshops, and electronic fora. Data are submitted by national agencies to IUCN, or are gathered through initiatives of the Red List Partnership. From 2013–6, the Red List Partnership encompassed: BirdLife International; Botanic Gardens Conservation International; Conservation International; Microsoft; NatureServe; Royal Botanic Gardens, Kew; Sapienza University of Rome; Texas A&M University; Wildscreen; and Zoological Society of London.  
  
  
  
Collection process:  
  
See information under other categories.  
  
  
  
Data Availability  
  
  
  
Description:  
  
The Red List Index has been classified by the IAEG-SDGs as Tier 1. Current data are available for all countries in the world, and these are updated on a regular basis (approximately once every four years).  
  
  
  
Time series:  
  
Since 1980 (approximately 35 years).   
  
  
  
Calendar  
  
  
  
Data collection:  
  
The IUCN Red List of Threatened Species is updated annually. Red List Indices for any sets of species that have been comprehensively reassessed in that year are usually released alongside the update of the IUCN Red List. Data are stored and managed in the Species Information Service database, and are made freely available for non-commercial use through the IUCN Red List website. Re-assessments of extinction risk are required for every species assessed on The IUCN Red List of Threatened Species once every ten years, and ideally undertaken once every four years. A Red List Strategic Plan details a calendar of upcoming re-assessments for each taxonomic group.   
  
  
  
Data release:  
  
New data typically become available for the Red List Index every year. For example, the first Red List Index for cycads was released in 2015, updates to the Red List Indices for birds and mammals will be released in 2016, and updates for conifers and sharks are anticipated in 2017.  
  
  
  
Data providers  
  
  
  
National agencies producing relevant data include government, non-governmental organisations (NGOs), and academic institutions working jointly and separately. Data are gathered from published and unpublished sources, species experts, scientists, and conservationists through correspondence, workshops, and electronic fora. Data are submitted by national agencies to IUCN, or are gathered through initiatives of the Red List Partnership.  
  
  
  
Data compilers  
  
  
  
Name:  
  
IUCN  
  
  
  
Description:  
  
Compilation and reporting of the Red List Index at the global level is conducted by the International Union for Conservation of Nature (IUCN) and BirdLife International, on behalf of the Red List Partnership. Comprehensive syntheses of The IUCN Red List of Threatened Species have been published by, for example, Baillie et al. (2004) and Hoffmann et al. (2010).  
  
  
  
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URL:  
  
http://www.iucn.org/; http://www.birdlife.org/  
  
  
  
References:  
  
These metadata are based on http://mdgs.un.org/unsd/mi/wiki/7-7-Proportion-of-species-threatened-with-extinction.ashx, supplemented by http://www.bipindicators.net/rli/2010 and the references listed below.  
  
  
  
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Last updated: 11 July 2017  
  
  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.4: By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development  
  
Indicator 15.4.2: Mountain Green Cover Index  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
  
  
Food and Agriculture Organization of the United Nations (FAO)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
  
  
The Green Cover Index is meant to measure the changes of the green vegetation in mountain areas - i.e. forest, shrubs, trees, pasture land, crop land, etc. – in order to monitor progress on the mountain target.   
  
  
  
The index, will provide information on the changes in the vegetation cover and, as such, will provide an indication of the status of the conservation of mountain environments.  
  
  
  
Rationale:  
  
  
  
The scientific mountain community recognizes that there is a direct correlation between the green coverage of mountain areas and their state of health, and as a consequence their capacity of fulfilling their ecosystem roles. Monitoring mountain vegetation changes over time provides an adequate measure of the status of conservation of mountain ecosystems. Monitoring the mountain “Green Cover Index” over time can provide information on the forest, woody and vegetal cover in general. For instance, its reduction will be generally linked to overgrazing, land clearing, urbanization, forest exploitation, timber extraction, fuelwood collection, fire. Its increase will be due to vegetation growth possibly linked to land restoration, reforestation or afforestation programmes.  
  
  
  
Concepts:  
  
  
  
Mountains are defined according to the UNEP-WCMC classification that identifies them according to altitude, slope and local elevation range as described by Kapos et al. 2000:   
  
  
  
Class 1: elevation > 4,500 meters  
  
Class 2: elevation 3,500–4,500 meters  
  
Class 3: elevation 2,500–3,500 meters  
  
Class 4: elevation 1,500–2,500 meters and slope > 2  
  
Class 5: elevation 1,000–1,500 meters and slope > 5 or local elevation range (LER 7 kilometer radius) > 300 meters  
  
Class 6: elevation 300–1,000 meters and local elevation range (7 kilometer radius) > 300 meters  
  
  
  
Comments and limitations:  
  
  
  
The indicator is based on Collect Earth, the most modern technology available. Its user friendliness and smooth learning curve make it a perfect tool for performing fast, accurate and cost-effective assessments. It is free, open source and highly customizable for the specific data collection needs and methodologies. It builds upon very high resolution multi-temporal images from Google Earth and Bing Maps and Landsat 7 and 8 datasets from Google Earth Engine. Data and images are stored and globally available for any year from 2000, making possible the monitoring of the change over time.   
  
  
  
The indicator has a global accuracy of 99%, but at national level for small countries the degree of accuracy is lower. This will be improved over time as more countries expand the data collection within their territory.   
  
  
  
Data on mountain coverage are provided by the 2015 FAO/MPS global map of mountains.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
The indicator results from the juxtaposition of land cover data extracted from FAO Collect Earth tool and the global map of mountains produced by FAO/MPS in 2015 based on the UNEP-WMCM mountain classification.   
  
  
  
Collect Earth (http://www.openforis.org/tools/collect-earth.html) is a free and open source tool that enables data collection through Google Earth for a wide variety of purposes, including:  
  
Support multi-phase National Forest Inventories  
  
Land Use, Land Use Change and Forestry (LULUCF) assessments  
  
Monitoring agricultural land and urban areas  
  
Validation of existing maps  
  
Collection of spatially explicit socio-economic data  
  
Quantifying deforestation, reforestation and desertification  
  
  
  
Disaggregation:  
  
  
  
The indicator is disaggregated by mountain elevation class.  
  
  
  
Regional aggregates:  
  
  
  
The estimate will generated through a probabilistic sampling approach. The sampling design has been developed in order to achieve an uncertainty on the forest and vegetation cover parameters of +-2% at global level and +-4 at regional level. Remote sensing data systematically collected from 2000 will be used to generate annual series from 2000 to 2015. The satellite data will be analysed using Collect Earth.  
  
  
  
Collect Earth is a tool that enables data collection through augmented visual interpretation of high resolution imagery using Google Earth. In conjunction with Google Earth, Bing Maps and Google Earth Engine, users can analyse high and very high resolution satellite imagery and historical trends in vegetation. It can be used to collect data at the local, regional and global level and has been successfully used by many country partners (Papua New Guinea, Tunisia, Uruguay, others).  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
  
  
The indicator results from the juxtaposition of land cover data extracted from FAO Collect Earth tool (that was used to build the Global Forest Survey (GFS) Global Assessment map) and the global map of mountains produced by FAO/MPS in 2015 based on the UNEP-WMCM mountain classification.   
  
  
  
Mountains are defined according to the UNEP-WCMC classification that identifies them according to altitude, slope and local elevation range as described by Kapos et al. 2000:   
  
Class 1: elevation > 4,500 meters  
  
Class 2: elevation 3,500–4,500 meters  
  
Class 3: elevation 2,500–3,500 meters  
  
Class 4: elevation 1,500–2,500 meters and slope > 2  
  
Class 5: elevation 1,000–1,500 meters and slope > 5 or local elevation range (LER 7 kilometer radius) > 300 meters  
  
Class 6: elevation 300–1,000 meters and local elevation range (7 kilometer radius) > 300 meters   
  
http://www.fao.org/mountain-partnership/our-work/focusareas/foodsecurity/en/g   
  
  
  
Collect Earth (http://www.openforis.org/tools/collect-earth.html) is a free and open source tool that enables data collection through Google Earth for a wide variety of purposes, including Land Use, Land Use Change and Forestry (LULUCF) assessments. The Global Forest Survey (GFS) Global Assessment built on the visual interpretation of satellite images in publicly available repositories, such as Google Earth Engine and Bing Maps, to provide a map of land cover/land use data.  
  
  
  
Land cover data are classified according to the Intergovernmental Panel on Climate Change (IPCC) scheme, which defines six main classes: Forest land; Cropland; Grassland; Wetlands; Settlements; Other Land. Each plot is classified according to the dominant land cover.   
  
(http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4\_Volume4/V4\_03\_Ch3\_Representation.pdf)   
  
  
  
The baseline statistics for the Mountain Green Cover Index are based on the GFS Global Assessment map released in January 2017. Green cover includes forest land, grassland/shrubland and cropland. The amounts of land in square kilometers covered by each of these three IPCC land cover/land use classes are aggregated to calculate the size of the total mountain area that they cover in each country. This figure is then expressed as a ratio of the total mountain area and converted to a percentage, providing the value of the Mountain Green Cover Index of each country. This percentage is the value displayed in the SDGs global database.  
  
  
  
Quality assurance:  
  
  
  
The GFS Global Assessment was carried out with standard protocols applied to the entire area of interest. Documents on the system tools and survey can be accessed at:   
  
  
  
http://openforis.org/fileadmin/user\_upload/Collect\_Earth\_Tutorials/Collect\_Earth\_User\_Manual\_20150618\_highres\_full.pdf  
  
  
  
http://www.fao.org/in-action/global-forest-survey/en/  
  
  
  
Data for all countries have been produced by FAO/MPS and are in the process of being distributed to governments for their validation.   
  
  
  
  
  
Data Sources  
  
  
  
Description:  
  
  
  
The source of data is FAO Collect Earth.  
  
  
  
Collection process:  
  
  
  
The estimate will be generated through regional assessment carried out by circa 30 partners all around the world. The data will be collected in with the same methodology in order to guarantee data consistency. The methodology enables intensification of the sampling in order to obtain same level of uncertainties at regional and sub regional levels. The data collection will be also harmonized according to the Forest Resources Assessment definition schemes.  
  
  
  
Data Availability  
  
  
  
All  
  
  
  
Calendar  
  
  
  
Data collection:  
  
  
  
By the end of 2016  
  
  
  
Data release:  
  
  
  
FAO Collect Earth is constantly updated; the mountain map doesn’t need any update.   
  
  
  
Data providers  
  
  
  
As data are all already available, the analysis will be conducted by MPS/FAO and data will be validated by countries.  
  
  
  
Data compilers  
  
  
  
FAO  
  
  
  
References  
  
  
  
URL:  
  
  
  
www.fao.org; www.mountainpartnership.org   
  
  
  
References:  
  
  
  
http://www.mountainpartnership.org/   
  
  
  
http://www.mountainpartnership.org/our-work/focusareas/foodsecurity/en/ (GIS raster of mountains is available for download from the right-side bar)   
  
  
  
http://www.openforis.org/tools/collect-earth.html   
  
  
  
http://www.fao.org/3/a-i5175e.pdf   
  
  
  
http://www.fao.org/   
  
  
  
Related indicators as of February 2020  
  
  
  
6.6, 15.1

Last updated: 19 July 2016  
  
  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.c: Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities  
  
Indicator 15.c.1: Proportion of traded wildlife that was poached or illicitly trafficked  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
  
  
United Nations Office on Drugs and Crime (UNODC)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
  
  
The share of all trade in wildlife detected as being illegal  
  
  
  
Rationale:  
  
  
  
There are over 35,000 species under international protection, so it is impossible to monitor all poaching. Illegal trade, however, is an indirect indicator of poaching. Wildlife seizures represent concrete instances of illegal trade, but the share of overall wildlife crime they represent is unknown and variable. In addition, the number of species under international protection continues to grow. Legal international trade in protected species, by definition, is 100% captured in the CITES Trade Database, which now contains over 16 million records of trade in CITES-listed species. To ground the illegal trade data in a complete indicator, the ratio of aggregated seizures to total trade is estimated. An increase in the share of total wildlife trade that is illegal would be interpreted as a negative indicator, and a decrease as a positive one.  
  
  
  
Because the illegal wildlife trade represents thousands of distinct products, a means of aggregation is necessary. The legal trade value does not represent the true black market value of the items seized, nor the true value of the legal shipments, because it is derived from a single market source (US LEMIS). It does, however, present a logical and consistent means of aggregating unlike products.  
  
  
  
Concepts:  
  
  
  
“All trade in wildlife” is the sum of the values of legal and illegal trade  
  
  
  
“Legal trade” is the sum of the value of all shipments made in compliance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), using valid CITES permits and certificates.  
  
  
  
“Illegal trade” is the sum of the value of all CITES/listed specimens seized.  
  
  
  
Comments and limitations:  
  
  
  
Seizures are an incomplete indicator of trafficking, and subject to considerable volatility. Universal coverage is not presently available, although 120 countries are represented in the present database. Since the indicator looks at the relationship between two values, changes in the relationship could be due to changes in either value.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
The value of a species-product unit is derived from the weighted average of prices declared for legal imports of analogous species product units, as acquired from United States Law Enforcement Monitoring and Information System of the Fish and Wildlife Service.  
  
  
  
The value of legal trade is the sum of all species-product units documented in CITES export permits as reported in the CITES Annual Reports times the species-product unit prices as specified above.  
  
  
  
The value of illegal trade is the sum of all species-product units documented in the World WISE seizure database times the species-product unit prices as specified above.  
  
  
  
The indicator is value of illegal trade/(value of legal trade + value of illegal trade)  
  
  
  
Disaggregation:  
  
  
  
Where source data are available, the data could be disaggregated to the national level. As a form of trade data, issues of gender, age, and disability status are not applicable.  
  
  
  
Treatment of missing values:  
  
  
  
At country level  
  
  
  
Given the number of products and volatility of these markets, there is presently no mechanism for imputing missing data.  
  
  
  
At regional and global levels  
  
  
  
As above  
  
  
  
Regional aggregates:  
  
  
  
National data are added.  
  
  
  
Sources of discrepancies:  
  
  
  
The global figure is the aggregate of national figures provided by countries.  
  
  
  
Data Sources  
  
  
  
Description:  
  
  
  
The legal trade data are reported annually by Parties to CITES and stored in the CITES Trade Database, managed by the UNEP World Conservation Monitoring Centre in Cambridge.  
  
  
  
The detected illegal trade data have been gathered from a number of sources and combined in a UNODC database called “World WISE”. This database will be filled, from 2017, with data from the new annual CITES Illegal Trade reporting requirement.  
  
  
  
The US LEMIS price data for CITES-listed species are also provided to UNEP-WCMC within the U.S. annual report to CITES.  
  
  
  
Collection process:  
  
  
  
Some adjustment/validation is necessary between countries, but standardized codes for the legal wildlife trade have been developing since 1975. The basic fields necessary for the global indicator (species, product, and unit) are well established and present in every seizure. Some unit conversions (e.g. logs to MT to m3 for timber) are necessary for some products. For many commodities, for instance trade in live animals and trophies, it is possible to aggregate based on “whole individuals”. To do regional or national breakdowns, however, data on the source of the shipment are necessary (as the impact of poaching pertains to the source country, not the seizure country), and these data are not available for every seizure.  
  
  
  
Data Availability  
  
  
  
60  
  
  
  
Calendar  
  
  
  
Data collection:  
  
  
  
The first tranche of data from the Illicit Trade Report should be available in November 2017.   
  
  
  
Data release:  
  
  
  
To be determined  
  
  
  
Data providers  
  
  
  
The CITES Management Authority of each country  
  
  
  
Data compilers  
  
  
  
UNODC and UNEP-WCMC  
  
  
  
References  
  
  
  
URL:  
  
  
  
www.unodc.org  
  
  
  
References:  
  
  
  
http://www.unodc.org/documents/data-and-analysis/wildlife/Methodological\_Annex\_final.pdf  
  
  
  
http://trade.cites.org/cites\_trade\_guidelines/en-CITES\_Trade\_Database\_Guide.pdf

Last update: March 2020  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.2: By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally  
  
Indicator 15.2.1: Progress towards sustainable forest management   
  
  
  
Institutional information   
  
  
  
Organization(s):   
  
  
  
Food and Agriculture Organization of the United Nations (FAO)   
  
  
  
Concepts and definitions   
  
  
  
Definition:   
  
  
  
“Sustainable forest management” (SFM) is a central concept for Goal 15 and target 15.1 as well as for target 15.2. It has been formally defined, by the UN General Assembly, as follows:   
  
  
  
[a] dynamic and evolving concept [that] aims to maintain and enhance the economic, social and environmental values of all types of forests, for the benefit of present and future generations” (Resolution A/RES/62/98)   
  
  
  
The indicator is composed of five sub-indicators that measure progress towards all dimensions of sustainable forest management. The environmental values of forests are covered by three sub-indicators focused on the extension of forest area, biomass within the forest area and protection and maintenance of biological diversity, and of natural and associated cultural resources. Social and economic values of forests are reconciled with environmental values through sustainable management plans. The sub-indicator provides further qualification to the management of forest areas, by assessing areas which are independently verified for compliance with a set of national or international standards.   
  
  
  
The sub-indicators are:   
  
Forest area annual net change rate   
  
Above-ground biomass stock in forest   
  
Proportion of forest area located within legally established protect areas   
  
Proportion of forest area under a long term forest management plan   
  
Forest area under an independently verified forest management certification scheme   
  
  
  
A dashboard is used to assess progress related to the five sub-indicators. The adoption of the dashboard approach aims at ensuring consideration of all dimensions of sustainable forest management and provides for clear view of areas where progress has been achieved.   
  
  
  
Rationale:   
  
  
  
The definition of SFM by the UN General Assembly contains several key aspects, notably that sustainable forest management is a concept which varies over time and between countries, whose circumstances – ecological, social and economic – vary widely, but that it should always address a wide range of forest values, including economic, social and environmental values, and take intergenerational equity into account.   
  
Clearly a simple measure of forest area is insufficient to monitor sustainable forest management as a whole. The significance of the five sub-indicators can be briefly explained as follows:   
  
Trends in forest area are crucial for monitoring SFM. The first sub-indicator focuses on both the direction of change (whether there is a loss or gain in forest area) and how the change rate is changing over time; the latter is important in order to capture progress among countries that are losing forest area, but have managed to reduce the rate of annual forest area loss.   
  
Changes in the above-ground biomass stock in forest indicate the balance between gains in biomass stock due to forest growth and losses due to wood removals, natural losses, fire, wind, pests and diseases. At country level and over a longer period, sustainable forest management would imply a stable or increasing biomass stock per hectare, while a long-term reduction of biomass stock per hectare would imply either unsustainable management of the forests and degradation or unexpected major losses due to fire, wind, pests or diseases.   
  
The change in forest area within legally protected areas is a proxy for trends in conservation of forest biodiversity as well as cultural and spiritual values of forests and thus a clear indication of the political will to protect and conserve forests. This indicator is related to the CBD Aichi Target 11 which calls for each country to conserve at least 17 per cent of terrestrial and inland water areas.   
  
The fourth sub-indicator looks at the forest area that is under a long term forest management plan. The existence of a documented forest management plan is the basis for long term and sustainable management of the forest resources for a variety of management objectives such as for wood and non-wood forest products, protection of soil and water, biodiversity conservation, social and cultural use, and a combination of two or several of these. An increasing area under forest management plan is therefore an indicator of progress towards sustainable forest management.   
  
The fifth sub-indicator is the forest area that is certified by an independently verified forest management certification scheme. Such certification schemes apply standards that generally are higher than those established by the countries’ own normative frameworks, and compliance is verified by an independent and accredited certifier. An increase in certified forest area therefore provides an additional indication of progress towards sustainable forest management. It should however be noted that there are significant areas of sustainably managed forest which are not certified, either because their owners have chosen not to seek certification (which is voluntary and market-based) or because no credible or affordable certification scheme is in place for that area.   
  
  
  
Concepts:   
  
  
  
See Annex 1 with Terms and Definitions.   
  
  
  
Comments and limitations:   
  
  
  
The five sub-indicators chosen to illustrate progress towards sustainable forest management do not fully cover all aspects of sustainable forest management. In particular, social and economic aspects are summarized under the sub-indicators on areas under sustainable forest management plans. Furthermore, as the trends are calculated using only those countries which have data complete time series, different sub-indicators may reflect different sets of countries.   
  
  
  
While the dashboard illustrates the progress on the individual sub-indicators, there is no weighting of the relative importance of the sub-indicators.   
  
  
  
Methodology   
  
  
  
Computation Method:   
  
  
  
National data on forest area, biomass stock, forest area within protected areas, and forest area under management plan are reported directly by countries to FAO for pre-established reference years. Based on the country reported data, FAO then makes country-level estimates of the forest area net change rate using the compound interest formula. The proportion of forest area within protected area and under management plan is calculated using the reported areas and the official FAOSTAT land area for reference year 2015. Data on forest area under an independently verified forest management certification scheme are reported to FAO by the head offices of respective forest certification scheme, who are jointly adjusting the figures to remove any double accounting.   
  
No dashboard traffic lights are made at country level.   
  
  
  
Disaggregation:   
  
  
  
No further disaggregation of this indicator.   
  
  
  
Treatment of missing values:   
  
  
  
At country level   
  
For countries and territories where no information was provided to FAO for FRA 2020 (47 countries and territories representing 0.5 percent of the global forest area), a report was prepared by FAO using existing information from previous assessments, literature search, remote sensing or a combination of two or more of them.   
  
For aboveground biomass subindicator, imputation of the missing values has been carried out by FAO for those countries with incomplete time series. For those countries where no value is available for any of the reporting years, no imputation has been implemented and the values for all years are set as “Not Available”.   
  
At regional and global levels   
  
See above.   
  
  
  
Regional aggregates:   
  
  
  
See Annex 2 – Methodology. It should be noted that for those sub-indicators where there are gaps in the data set, only the countries with complete data for the relevant years (either provided by the countries or estimated by FAO) are included in the regional and global aggregates. Annex 2 also shows how the dashboard traffic lights are applied at global and regional level.   
  
  
  
Sources of discrepancies:   
  
  
  
The national figures in the database are reported by the countries themselves following a standardized format, definitions and reporting years, thus eliminating any discrepancies between global and national figures. The reporting template requests that countries provide the full reference for original data sources as well as national definitions and terminology. Separate sections in the template country reports deal with the analysis of data (including any assumptions made and the methods used for estimates and projections to the common reporting years); calibration of data to the official land area as held by FAO; and reclassification of data to the classes used in FAO’s Global Forest Resources Assessments.   
  
Regarding the data on forest area under an independently verified forest management certification scheme, these are usually not part of official national statistics, and are maintained by local offices of the respective certification schemes. They in turn report their data to their head offices. As certified forest area is dynamic and can change monthly as some certificates expire and new certificates come. Therefore, the data are requested to correspond to the end of June each year. However, data are not always reported by the local offices according to that date.   
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:   
  
  
  
Detailed methodology and guidance on how to prepare the country reports through an online reporting platform and to convert national data according to national categories and definitions to FAO’s global categories and definitions is found in the documents “Guidelines and Specifications” (www.fao.org/3/I8699EN/i8699en.pdf) and “Terms and Definitions” (www.fao.org/3/I8661EN/i8661en.pdf).   
  
  
  
Quality assurance:   
  
  
  
Once received, the country reports undergo a rigorous review process to ensure correct use of definitions and methodology as well as internal consistency. A comparison is made with past assessments and other existing data sources. Regular contacts between national correspondents and FAO staff by e-mail and regional/sub-regional review workshops form part of this review process.   
  
All country reports (including those prepared by FAO) are sent to the respective Head of Forestry for validation before finalization and publishing of data. The data are then aggregated at sub-regional, regional and global levels by the FRA team at FAO.   
  
  
  
Data Sources   
  
Sub-indicators 1 to 4  
  
  
  
Description:   
  
  
  
FAO has been monitoring the world's forests at 5 to 10 year intervals since 1946. The Global Forest Resources Assessments (FRA) are now produced every five year. The latest of these assessments, FRA 2020, contains information for 236 countries and territories on about 60 variables related to the extent of forests, their conditions, uses and values for several points in time.   
  
  
  
Collection process:   
  
  
  
Data on the sub-indicators are collected periodically (until now every 5 years) by FAO’s Global Forest Resources Assessment (FRA) programme. Officially nominated national correspondents and their teams prepare the country reports for the assessment. Some prepare more than one report as they also report on dependent territories. For the remaining countries and territories where no information is provided, a report is prepared by FAO using existing information and a literature search.   
  
All data are provided to FAO by countries in the form of a country report through an on-line platform following a standard format, which includes the original data and reference sources and descriptions of how these have been used to estimate the forest area for different points in time. The on-line platform was used for all data entry, review and quality control.  
  
In order to obtain internationally comparable data, countries are requested to provide national categories and definitions, and in case these are different than the FAO categories and definitions, countries are requested to perform a reclassification of national data to correspond to the FAO categories and definitions and to document this step in the country report. Countries are also requested to use interpolation or extrapolation of national data in order to provide estimates for the specific reporting years.   
  
  
  
Sub-indicator 5  
  
  
  
Description:   
  
  
  
Data on forest certification is submitted annually to FAO by the head offices of the respective forest certification scheme. Data include the area certified by each scheme, as well as areas that are double-certified by the two main schemes. That allows for estimating the total certified forest area, adjusted for double certified area.   
  
  
  
Collection process:   
  
  
  
Currently, forest certification by the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) are included in the data submissions. The latter includes several national/regional certification schemes that have been endorsed according to the PEFC standards.   
  
Data reported by the certification bodies and consolidated into estimates of total certified forest area are made available to the countries through an online platform where country officials can view the data that are being submitted.   
  
Data Availability   
  
  
  
Description:   
  
  
  
The Global Forest Resources Assessment 2020 collected data from 236 countries and territories. Below is a breakdown of the number of countries covered by region and by sub-indicator:   
  
  
  
Region Name  
  
Total number of countries  
  
Number of countries reporting latest year  
  
Percentage of countries reporting latest year  
  
  
  
  
  
Forest area annual net change rate   
  
Above-ground biomass stock in forest   
  
Proportion of forest area located within legally established protect areas   
  
Proportion of forest area under a long term forest management plan   
  
Forest area under an independently verified forest management certification scheme  
  
Forest area annual net change rate   
  
Above-ground biomass stock in forest   
  
Proportion of forest area located within legally established protect areas   
  
Proportion of forest area under a long term forest management plan   
  
Forest area under an independently verified forest management certification scheme  
  
World  
  
236  
  
236  
  
205  
  
162  
  
128  
  
236  
  
100%  
  
87%  
  
69%  
  
54%  
  
100%  
  
Central and Southern Asia  
  
14  
  
14  
  
12  
  
9  
  
9  
  
14  
  
100%  
  
86%  
  
64%  
  
64%  
  
100%  
  
Central Asia  
  
5  
  
5  
  
4  
  
3  
  
3  
  
5  
  
100%  
  
80%  
  
60%  
  
60%  
  
100%  
  
Southern Asia  
  
9  
  
9  
  
8  
  
6  
  
6  
  
9  
  
100%  
  
89%  
  
67%  
  
67%  
  
100%  
  
Eastern and South-Eastern Asia  
  
16  
  
16  
  
16  
  
11  
  
9  
  
16  
  
100%  
  
100%  
  
69%  
  
56%  
  
100%  
  
Eastern Asia  
  
5  
  
5  
  
5  
  
3  
  
4  
  
5  
  
100%  
  
100%  
  
60%  
  
80%  
  
100%  
  
South-Eastern Asia  
  
11  
  
11  
  
11  
  
8  
  
5  
  
11  
  
100%  
  
100%  
  
73%  
  
45%  
  
100%  
  
Northern Africa and Western Asia  
  
25  
  
25  
  
21  
  
13  
  
10  
  
25  
  
100%  
  
84%  
  
52%  
  
40%  
  
100%  
  
Northern Africa  
  
7  
  
7  
  
7  
  
4  
  
4  
  
7  
  
100%  
  
100%  
  
57%  
  
57%  
  
100%  
  
Western Asia  
  
18  
  
18  
  
14  
  
9  
  
6  
  
18  
  
100%  
  
78%  
  
50%  
  
33%  
  
100%  
  
Sub-Saharan Africa  
  
51  
  
51  
  
48  
  
43  
  
30  
  
51  
  
100%  
  
94%  
  
84%  
  
59%  
  
100%  
  
Europe and Northern America  
  
55  
  
55  
  
47  
  
40  
  
38  
  
55  
  
100%  
  
85%  
  
73%  
  
69%  
  
100%  
  
Europe  
  
50  
  
50  
  
44  
  
36  
  
34  
  
50  
  
100%  
  
88%  
  
72%  
  
68%  
  
100%  
  
Northern America  
  
5  
  
5  
  
3  
  
4  
  
4  
  
5  
  
100%  
  
60%  
  
80%  
  
80%  
  
100%  
  
Latin America and the Caribbean  
  
50  
  
50  
  
43  
  
37  
  
23  
  
50  
  
100%  
  
86%  
  
74%  
  
46%  
  
100%  
  
Oceania  
  
25  
  
25  
  
18  
  
9  
  
9  
  
25  
  
100%  
  
72%  
  
36%  
  
36%  
  
100%  
  
Oceania (exc. Australia and New Zealand)  
  
22  
  
22  
  
16  
  
7  
  
6  
  
22  
  
100%  
  
73%  
  
32%  
  
27%  
  
100%  
  
Australia and New Zealand  
  
3  
  
3  
  
2  
  
2  
  
3  
  
3  
  
100%  
  
67%  
  
67%  
  
100%  
  
100%  
  
Landlocked developing countries (LLDCs)  
  
32  
  
32  
  
28  
  
22  
  
17  
  
32  
  
100%  
  
88%  
  
69%  
  
53%  
  
100%  
  
Least Developed Countries (LDCs)  
  
47  
  
47  
  
42  
  
36  
  
23  
  
47  
  
100%  
  
89%  
  
77%  
  
49%  
  
100%  
  
Small island developing States (SIDS)  
  
53  
  
53  
  
42  
  
27  
  
12  
  
53  
  
100%  
  
79%  
  
51%  
  
23%  
  
100%  
  
  
  
Time series:   
  
  
  
2000, 2010, 2015, 2016, 2017, 2018, 2019, 2020   
  
  
  
Calendar   
  
  
  
Data collection:   
  
  
  
Source data collection was initiated in 2018 and concluded in 2019.   
  
  
  
Data release:   
  
Data with updated time series and including year 2020 will be released June 2020. The possibilities of a more frequent reporting on forest area and other key indicators are currently being evaluated.  
  
  
  
Data providers   
  
  
  
The data are provided by the countries through a global network of officially nominated national correspondents. For the countries and territories which do not have a national correspondent, a report is prepared by FAO using previously reported information, literature search, remote sensing or their combination.  
  
   
  
For subindicator 5, forest certification, data are provided by head offices of respective forest certification scheme.  
  
  
  
Data compilers   
  
  
  
Food and Agriculture Organisation of the United Nations (FAO)   
  
  
  
References   
  
  
  
URL: http://www.fao.org/forest-resources-assessment/en/   
  
  
  
References:  
  
  
  
http://www.fao.org/forest-resources-assessment/current-assessment/en/  
  
  
  
Related indicators as of February 2020  
  
  
  
15.1.1: Forest area as a proportion of total land area   
  
  
  
  
  
  
Annex 1 – Terms and Definitions   
  
  
  
FOREST  
  
Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.   
  
Explanatory notes  
  
Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters.   
  
Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of at least 10 percent and tree height of 5 meters or more. It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used.  
  
Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest.  
  
Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters.  
  
Includes abandoned shifting cultivation land with a regeneration of trees that have, or are expected to reach, a canopy cover of at least 10 percent and tree height of at least 5 meters.  
  
Includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.  
  
Includes rubberwood, cork oak and Christmas tree plantations.   
  
Includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met.  
  
Excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations, olive orchards and agroforestry systems when crops are grown under tree cover. Note: Some agroforestry systems such as the “Taungya” system where crops are grown only during the first years of the forest rotation should be classified as forest.  
  
  
  
ABOVE-GROUND BIOMASS  
  
All living biomass above the soil including stem, stump, branches, bark, seeds, and foliage.  
  
Explanatory note   
  
In cases where forest understorey is a relatively small component of the aboveground biomass carbon pool, it is acceptable to exclude it, provided this is done in a consistent manner throughout the inventory time series.  
  
  
  
PROTECTED AREAS  
  
Areas especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.  
  
  
  
FOREST AREA WITHIN PROTECTED AREAS  
  
Forest area within formally established protected areas independently of the purpose for which the protected areas were established.   
  
Explanatory notes  
  
Includes IUCN Categories I – IV  
  
Excludes IUCN Categories V-VI  
  
  
  
FOREST AREA WITH MANAGEMENT PLAN  
  
Forest area that has a long-term documented management plan, aiming at defined management goals, which is periodically revised.   
  
Explanatory notes  
  
 A forest area with management plan may refer to forest management unit level or aggregated forest management unit level (forest blocks, farms, enterprises, watersheds, municipalities, or wider units).  
  
 A management plan must include adequate detail on operations planned for individual operational units (stands or compartments) but may also provide general strategies and activities planned to reach management goals.  
  
 Includes forest area in protected areas with management plan.  
  
  
  
INDEPENDENTLY VERIFIED FOREST MANAGEMENT CERTIFICATION  
  
Forest area certified under a forest management certification scheme with published standards and is independently verified by a third-party.  
  
  
  
  
Annex 2 – Methodology  
  
Sub-indicator 1 - Forest area annual net change rate  
  
Unit: Percent  
  
Reference period: Most recent period  
  
Method of estimation: Compound interest formula  
  
Translation to dashboard/traffic light:  
  
The following flowchart explains the logic behind the translation of this indicator to a dashboard/traffic light:  
  
  
  
Forest area change direction  
  
Forest area stable   
  
or increasing  
  
Forest area decreasing  
  
Change in forest area loss rate   
  
Loss rate  
  
decreasing  
  
Loss rate stable  
  
or increasing  
  
Forest area change direction  
  
Forest area stable   
  
or increasing  
  
Forest area decreasing  
  
Change in forest area loss rate   
  
Loss rate  
  
decreasing  
  
Loss rate stable  
  
or increasing  
  
  
  
The forest area change direction is determined by examining the value of the forest area change rate for the most recent period, a negative value indicate a loss of forest area, a zero value means that forest area is stable and a positive value means that forest area has increased. The change in forest area loss rate is based on a comparison of the current forest area net change rate with the baseline forest area net change rate for the period 2000-2010.  
  
  
  
Comments:  
  
This traffic light takes into consideration both the direction of forest area change (if forest area increases or decreases) as well as changes in the rate of forest area loss – the latter important in order to indicate progress among countries that are losing forest area but manage to reduce the loss rate.   
  
For annual reporting, FAO can provide countries with imputed values based on previous trends that they can use in case they don’t have new/updated information. The baseline should be updated every 5 years. In 2020 a new baseline was calculated. Also, at country level, if a country gets new information and updates the historical time series, the baseline for the country will be recalculated, respecting the 2000-2010 period.  
  
  
  
Sub-indicator 2 – Above-ground biomass stock in forest   
  
Unit: tonnes/hectare  
  
Reference year: Latest reporting year  
  
Method of estimation: Reported directly by countries  
  
Translation to dashboard/traffic light:  
  
The indicator value for the latest reporting year is compared with the indicator value for previous reporting year for assessment of continuity of progress since last report.  
  
The ratio (r) between the current indicator value and the previously reported value is calculated; r>1 means an increase in stock per hectare, r<1 means a decrease while 1 indicates no change. A narrow interval for r has been established to indicate a stable condition, and traffic-light colors are assigned as follows:  
  
 r ≥ 1.01   
  
 0.99 < r < 1.01  
  
 r ≤ 0.99  
  
  
  
Sub-indicator 3 – Proportion of forest area located within legally established protected areas.  
  
Unit: Percent  
  
Reference year: Latest reporting year  
  
Method of estimation: Forest area within legally established protected areas / forest area 2015 \* 100  
  
Translation to dashboard/traffic light:  
  
The indicator value for latest reporting year is compared the indicator value for previous reporting year for assessment of continuity of progress since last report.  
  
The ratio (r) between the current indicator value and the previously reported value is calculated; r>1 means an increase in forest area within protected areas, r<1 means a decrease while 1 indicates no change. A narrow interval for r has been established to indicate a stable condition, and traffic-light colors are assigned as follows:  
  
 r ≥ 1.01   
  
 0.99 < r < 1.01  
  
 r ≤ 0.99  
  
  
  
Comment:  
  
Using forest area in 2015 as denominator for estimating this indicator ensures that the time series of percentages reflect real changes in the forest area within legally established protected areas and is not affected by changes (losses or gains) in total forest area.   
  
  
  
  
  
  
Sub-indicator 4 – Proportion of forest area under a long-term forest management plan.  
  
Unit: Percent  
  
Reference year: Latest reporting year  
  
Method of estimation: Forest area under a long term forest management plan / forest area 2015 \* 100  
  
Translation to dashboard/traffic light: The indicator value for latest reporting year is compared with the indicator value for previous reporting year for assessment of continuity of progress since last report.  
  
The ratio (r) between the current indicator value and the previously reported value is calculated; r>1 means an increase in areas under forest management plan, r<1 means a decrease while 1 indicates no change. A narrow interval for r has been established to indicate a stable condition, and traffic-light colors are assigned as follows:  
  
 r ≥ 1.01   
  
 0.99 < r < 1.01  
  
 r ≤ 0.99  
  
Comment:  
  
Using forest area in 2015 as denominator for estimating this indicator ensures that the time series of percentages reflect real changes in the forest area under forest management plan and is not affected by changes (losses or gains) in total forest area.   
  
  
  
Sub-indicator 5 – Forest area under an independently verified forest management certification scheme.  
  
Unit: Thousand hectares  
  
Reference year: Latest reporting year (as of June 30)  
  
Method of estimation: Data is collected directly from the databases of each certification scheme and provided to countries for validation.  
  
Translation to dashboard/traffic light: The indicator value for latest reporting year is compared with the indicator value for previous reporting year for assessment of continuity of progress since last report.  
  
The ratio (r) between the current indicator value and the previously reported value is calculated; r>1 means an increase in areas under an independent forest management certification scheme, r<1 means a decrease while 1 indicates no change. A small interval for r has been established to indicate a stable condition, and traffic-light colors are assigned as follows:  
  
 r ≥ 1.01   
  
 0.99 < r < 1.01  
  
 r ≤ 0.99  
  
  
  
Comments:  
  
Using June 30 as the date for reporting, allows for the certification bodies to have their databases updated so they can provide information to FAO by end of the year, and then be included in the annual reporting to SDG in the beginning of the following year.

Last updated: 20 April 2020  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
  
  
Target 15.a: Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems  
  
  
  
Indicator: 15.a.1/15.b.1 (a) Official development assistance on conservation and sustainable use of biodiversity; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
Organisation for Economic Cooperation and Development (OECD)  
  
  
  
Contact person(s):  
  
Yasmin Ahmad, Development Cooperation Directorate, OECD  
  
Katia Karousakis, Environment Directorate, OECD  
  
  
  
Email address (for internal use only)  
  
Yasmin.AHMAD@oecd.org  
  
Katia.KAROUSAKIS@oecd.org  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
  
  
This is a twin indicator consisting of:  
  
  
  
a) Official development assistance on conservation and sustainable use of biodiversity, defined as gross disbursements of total Official Development Assistance (ODA) from all donors for biodiversity.   
  
b) revenue generated and finance mobilised from biodiversity-relevant economic instruments, defined as revenue generated and finance mobilised from biodiversity-relevant economic instruments, covering biodiversity-relevant taxes, fees and charges, and positive subsidies. (New on-going work is underway to collect data on payments for ecosystem services and biodiversity offsets -- including the finance they mobilise for biodiversity).  
  
  
  
Rationale:  
  
a) Total ODA flows to developing countries quantify the public effort that donors provide to developing countries for biodiversity.  
  
  
  
b) Economic policy instruments can either generate revenue (e.g. biodiversity-relevant taxes) or mobilise finance directly for biodiversity conservation and sustainable use (e.g. biodiversity-relevant fees and charges; positive subsidies; PES and offsets) which is finance mobilised at domestic level.   
  
The data are collected in a consistent and comparable way across countries.  
  
  
  
Concepts:  
  
  
  
a) The Development Assistance Committee (DAC) defines ODA as those flows to countries and territories on the DAC list of ODA recipients and multilateral institutions which are:  
  
Provided by official agencies, including state and local governments, or by their executive agencies; and  
  
Each transaction of which:  
  
 is administered with the promotion of the economic development and welfare of developing countries as its main objective; and  
  
is concessional in character.  
  
 (See http://www.oecd.org/dac/stats/officialdevelopmentassistancedefinitionandcoverage.htm).  
  
  
  
  
  
b) The Environmental Policy Committee (EPOC) collects data on Policy Instruments for the Environment (to the OECD PINE database), including biodiversity-relevant economic instruments. Currently more than 110 countries are contributing data. For 2020 data, see Tracking Economic Instruments and Finance for Biodiversity -2020.   
  
  
  
Comments and limitations:  
  
  
  
a) OECD CRS data are available since 1973. However, the data coverage at an activity level is considered complete from 1995 for commitments and 2002 for disbursements. The Rio biodiversity marker was introduced in 2002.  
  
  
  
b) The OECD PINE database tracks the biodiversity-relevant economic instruments that countries have put in place, and countries are encouraged to also provide information on the revenue and finance channelled via each of the instruments. The comprehensiveness of data provided currently varies across the biodiversity-relevant economic instruments. The data on revenue generated by biodiversity-relevant taxes is currently the most comprehensive. For the data on biodiversity-relevant fees and charges, for example, of the total number of these instruments currently reported to the PINE database, 42% also include data on the finance they generate.   
  
  
  
Like all data provided by a diffuse set of respondents, the data is subject to missing values, human error, and differences in interpretation of the provided definitions. However, all possible efforts have been made to ensure that the data is complete, accurate, and comparable across countries.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
a) This indicator is calculated as the sum of all ODA flows from all donors to developing countries that have biodiversity as a principal or significant objective, thus marked with the Rio marker for biodiversity.  
  
  
  
b) Countries are requested to report on when the policy instrument was introduced, what it applies to, the geographical coverage, the environmental domain, the industries concerned; the revenues, costs or rates; whether the revenue is earmarked; and exemptions.  
  
  
  
Disaggregation:  
  
  
  
a) This indicator can be disaggregated by donor, by recipient country (or region), by type of finance, by type of aid, by sub-sector, by policy marker (e.g. gender), etc.  
  
  
  
b) Information is available by country at the individual policy instrument level.  
  
  
  
Treatment of missing values:  
  
  
  
At country level  
  
a) and b) No attempt is made to estimate missing values.  
  
At regional and global levels  
  
a) and b) No attempt is made to estimate missing values.  
  
  
  
Regional aggregates:  
  
  
  
a) Data are reported at a country level.   
  
  
  
b) Data are reported at national and sub-national level, depending on the scope of the policy instrument.  
  
  
  
Sources of discrepancies:  
  
   
  
a) DAC statistics are standardized on a calendar year basis for all donors and may differ from fiscal year data available in budget documents for some countries. Some countries provide more comprehensive information than others.  
  
  
  
b) Some countries provide more comprehensive information than others.  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
  
  
a) The DAC statistical Reporting Directives govern the reporting of DAC statistics, and are reviewed and agreed by the DAC Working Party of Development Finance Statistics, see: https://one.oecd.org/document/DCD/DAC/STAT(2018)9/FINAL/en/pdf  
  
  
  
b) The OECD provides instructions and a formatted questionnaire for countries to provide data.  
  
  
  
Quality assurance  
  
  
  
a) The data collected by the OECD/DAC Secretariat are official data provided by national statistical reporters in each providing country/agency. The OECD/DAC Secretariat is responsible for checking, validating and publishing these data.   
  
  
  
b) Data are provided by competent national authorities. The OECD Secretariat conducts regular checks to identify errors or missing data.  
  
  
  
  
  
Data Sources  
  
  
  
Description:  
  
  
  
a) The OECD/DAC has been collecting data on official and private resource flows from 1960 at an aggregate level and 1973 at an activity level through the CRS (CRS data are considered complete from 1995 for commitments at an activity level and 2002 for disbursements). The Rio marker for biodiversity was introduced in 2002. The data are provided by DAC donors, other bilateral providers of development cooperation and multilateral organizations.   
  
  
  
b) Information for the OECD PINE database is collected via a network of 200 country experts, including in government agencies (Ministries of Finance and Environment, statistical institutes) as well as research institutes and international organisations. Data is collected systematically for 37 OECD members as well as the active accession countries. A growing number of non-member countries also provide information. Currently, more than 110 countries are contributing data. Registered experts are asked to update data at least once a year, typically in January or February, through a password-protected interface. The data collection method may result in some reporting bias, as OECD members and active accession countries are likely to report more data on a regular basis, and all figures should be interpreted in this context.  
  
  
  
Collection process:  
  
  
  
a) Via and annual questionnaire reported by national statistical reporters in aid agencies, ministries of foreign affairs, etc.  
  
  
  
b) Via questionnaire and directly via the network of contacts.  
  
  
  
  
  
Data Availability  
  
  
  
Description:  
  
  
  
a) The Rio biodiversity marker was introduced in 2002 and data are available since then for most DAC members, with improvements in reporting over time. Not all other providers report their data at an activity level though.  
  
  
  
Provisional data classification: Tier I  
  
  
  
b) Currently more than 110 countries are contributing data to the PINE database. As of March 2020, the database contained more than 3 500 policy instruments for the environment, of which 3 100 were in force. The environmental domains covered by the database include biodiversity, climate, air pollution, among others.  
  
  
  
Time series:  
  
a) The data are available since 1996 on an annual basis, with time series since 1950.  
  
  
  
b) The data series is annual and data is available from before 1980.   
  
The PINE database exists since 1996, with the added feature of tagging biodiversity-relevant instruments introduced in 2017. The biodiversity-relevant information in the PINE database is being used to monitor progress towards Aichi Target 3 on positive incentives, under the Convention on Biological Diversity. For more information on this, see Aichi Target 3 under the website of the Biodiversity Indicators Partnership (BIP).  
  
  
  
Calendar  
  
  
  
Data collection:  
  
 a) On an annual basis.   
  
b) On an on-going basis.   
  
   
  
Data release:  
  
  
  
 a) The data are published at the end of each year for year -1.  
  
  
  
b) An updated and expanded brochure on “Tracking Economic Instruments and Finance for Biodiversity” is planned to be released in mid-2020.   
  
 The 2020 version is available here: OECD (2020), Tracking Economic Instruments and Finance for Biodiversity -2020.  
  
   
  
  
  
Data providers  
  
a) A statistical reporter is responsible for the collection of DAC statistics in each providing country/agency. This reporter is usually located in the national aid agency, Ministry of Foreign Affairs or Finance etc.  
  
  
  
b) Information for the PINE database is collected via a network of 200 country experts, including in government agencies (Ministries of Finance and Environment, statistical institutes) as well as research institutes and international organisations. Data is collected systematically for 37 OECD members as well as the active accession countries. A growing number of non-member countries also provide information. Registered experts are asked to update data at least once a year, typically in January or February, through a password-protected interface. The data collection method may result in some reporting bias, as OECD members and active accession countries are likely to report more data on a regular basis, and all figures should be interpreted in this context.   
  
  
  
The OECD Secretariat, in consultation with countries, validates the data before they are published online. The management of PINE is overseen by OECD Committees and Working Parties.  
  
  
  
Data compilers  
  
  
  
a) OECD, Development Cooperation Directorate. The OECD is the only International Organisation collecting this data.  
  
  
  
b) OECD, Environment Directorate. The OECD is the only International Organisation collecting this data.  
  
  
  
References  
  
  
  
URL:  
  
  
  
a) See all links here: http://www.oecd.org/dac/stats/methodology.htm  
  
  
  
References:   
  
  
  
a) See all links here: http://www.oecd.org/dac/stats/methodology.htm  
  
b) OECD (2020), Tracking Economic Instruments and Finance for Biodiversity - 2020.   
  
The brochure also highlights on-going work to scale up the policy instruments to include Payments for Ecosystem Services, and Biodiversity Offsets, and the finance these two policy instruments mobilise. The PINE data is available at https://oe.cd/pine  
  
   
  
Additional information extracted from the PINE database is reported in OECD (2019) Biodiversity: Finance and the Economic and Business Case for Action  
  
  
  
  
  
  
  
Related indicators  
  
  
  
A related indicator is that on public expenditure on biodiversity. Public expenditure on biodiversity is currently a Tier III indicator and is to be improved. For expenditure the methodology is agreed upon, i.e. SEEA Environmental Expenditure Accounts and National accounts COFOG.   
  
  
  
  
  
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Last Updated: 1 July 2019  
  
  
  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.9: By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts  
  
Indicator 15.9.1: (a) Number of countries that have established national targets in accordance with or similar to Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020 in their national biodiversity strategy and action plans and the progress reported towards these targets; and (b) integration of biodiversity into national accounting and reporting systems, defined as implementation of the System of Environmental-Economic Accounting  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
United Nations Environment Programme (UN Environment), Convention on Biological Diversity (CBD), United Nations Statistics Division (UNSD) and UNEP-WCMC  
  
  
  
Concepts and definitions  
  
Definition:  
  
The indicator measures the progress towards national targets established in accordance with Target 2 of the Strategic Plan for Biodiversity 2011-2020: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.  
  
  
  
The indicator is divided in two sub-indicators.:   
  
Sub-indicator (a)   
  
15.9.1.a: Number of countries that established national targets in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020 in their National Biodiversity Strategy and Action Plans (NBSAP) and the progress reported towards these targets.  
  
  
  
Sub-indicator (b)   
  
15.9.1.b: Number of countries that have integrated biodiversity values into national accounting and reporting systems, defined as implementation of the System of Environmental-Economic Accounting (SEEA).  
  
  
  
  
  
Rationale:  
  
The objective of this target is to ensure that the diverse values of biodiversity and opportunities derived from its conservation and sustainable use are recognized and reflected in all relevant public and private decision-making.  
  
  
  
Sub-indicator (a)   
  
National Biodiversity Strategies and Action Plans are described in Article 6 of the Convention on General Measures for Conservation and Sustainable Use. Each Contracting Party shall, at intervals to be determined by the Conference of the Parties, present to the Conference of the Parties, reports on measures which it has taken for the implementation of the provisions of this Convention and their effectiveness in meeting the objectives of this Convention.  
  
  
  
Sub-indicator (b)  
  
Integration of biodiversity values into national accounting and reporting systems can be achieved through implementation of the international statistical standard, the System for Environmental-Economic Accounting (SEEA). The SEEA Central Framework (SEEA CF) was adopted by the UN Statistical Commission in 2012 as the first international standard for environmental-economic accounting. In addition, the SEEA Experimental Ecosystem Accounting (SEEA EEA) was endorsed by the UN Statistical Commission in 2013 as the basis for further development of this new field of national accounting, and the SEEA EEA was formally published in 2014. Following the decision of the United Nations Statistical Commission in March 2017, a revision of the SEEA EEA is now taking place, with the intention to reach agreement on as many aspects of ecosystem accounting as possible by 2020. Results of The Global Assessment of Environmental-Economic Accounting and Supporting Statistics provide the data needed for Sub-indicator (b) of the indicator.  
  
  
  
  
  
Concepts:  
  
Biodiversity  
  
The 1992 United Nations Earth Summit defined "biological diversity" as "the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems".  
  
  
  
Aichi Biodiversity Target 2  
  
Aichi Biodiversity Target 2 is in accordance with the Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.  
  
  
  
Aichi Biodiversity Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.  
  
  
  
SEEA-CF   
  
The System for Environmental-Economic Accounting Central Framework (SEEA-CF) is an international statistical standard for measuring the environment and its relationship with the economy. It integrates economic and environmental data to provide a more comprehensive and multipurpose view of the interrelationships between the economy and the environment and the stocks and changes in stocks of environmental assets, as they bring benefits to humanity.  
  
  
  
SEEA-EEA   
  
The System for Environmental-Economic Accounting-Experimental Ecosystem Accounting (SEEA-EEA) is an integrated statistical framework for organizing biophysical data, measuring ecosystem services, tracking changes in ecosystem assets and linking this information to economic and other human activity. The SEEA-EEA takes the perspective of ecosystems and considers how individual environmental assets interact as part of natural processes within a given spatial area.  
  
  
  
  
  
NBSAP  
  
The National Biodiversity Strategy and Action Plan (NBSAP) is intended to define the current status of biodiversity, the threats leading to its degradation and the strategies and priority actions to ensure its conservation and sustainable use within the framework of the socio-economic development of the country.  
  
  
  
National Reports  
  
The Clearing-House Mechanism is constantly being improved to better contribute to the implementation of the Strategic Plan for Biodiversity 2011-2020 and the achievement of the Aichi Biodiversity Targets. The objective of national reporting, as specified in Article 26 of the Convention on Biological Diversity, is to provide information on measures taken for the implementation of the Convention and the effectiveness of these measures. The format for the sixth national reports requested that Parties, among other things, provide an assessment of their progress towards their national targets and/or the Aichi Biodiversity Targets.   
  
  
  
The Global Assessment of Environmental-Economic Accounting and Supporting Statistics  
  
The Global Assessment of Environmental-Economic Accounting and Supporting Statistics is a survey administered by the UNSD under the auspices of the UN Committee of Experts on Environmental Economic Accounting (UNCEEA). The aim of the Global Assessment is to assess the progress in reaching the implementation targets of the UNCEEA.  
  
  
  
  
  
Comments and limitations:  
  
Sub-indicator (a) Some countries have more than one national target corresponding to a particular Aichi Target and may have different degrees of progress in achieving these different national targets. This can be addressed by a general rule (i.e. either take the more optimistic or the more pessimistic progress label). As this is possibly a cross-cutting issue, such a rule would best be formulated at the level of the entire group and be applicable to all indicators. There are countries that do have existing national targets that are less elaborate than the corresponding Aichi Targets. This case similarly applies to Aichi Biodiversity Target 2 that is flexible but still needs to be borne in mind.  
  
Sub-indicator (b) The SEEA EEA is still under development. Thus the way that the SEEA EEA is implemented by countries is still developing over time.  
  
  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
Sub-indicator (a)   
  
The sixth national reports provide semi-quantitative information on progress made in achieving the national targets and/or the global Aichi Targets, which are amenable to the development of a scoring system.   
  
The progress assessment for Aichi Biodiversity Target 2 would thus provide critical information for indicator 15.9.1. The latest analysis is contained in document CBD/COP/14/5/Add.2, available here: https://www.cbd.int/conferences/2018/cop-14/documents (see paragraphs 16-17 and figure 1 in Annex). The CBD Secretariat will collect data from the National Reports as follows:   
  
  
  
Parties establish national targets based on the Aichi Biodiversity Targets (ABT) in their National Biodiversity Strategic Action Plan (NBSAP) and report progress against these ABT national targets in their National Reports. The template for the National Reports allows them to check one of the progress labels below and the online reporting framework assigns numbers as below. Hence, the system would be based on self-reporting by Parties and consistent with the established reporting template.  
  
  
  
0 no national target reflecting ABT 2  
  
1 national target exists, but moving away from it  
  
2 national target exists, but no progress  
  
3 national target exists and progress is there, but at as insufficient rate  
  
4 national target exists and progress is on track to achieve it  
  
5 national target exists and progress is on track to exceed it  
  
  
  
These will be rescored to be between 0 and 1 as follows:  
  
  
  
0.0 no national target reflecting ABT 2  
  
0.2 national target exists, but moving away from it  
  
0.4 national target exists, but no progress  
  
0.6 national target exists and progress is there, but at as insufficient rate  
  
0.8 national target exists and progress is on track to achieve it  
  
1.0 national target exists and progress is on track to exceed it  
  
  
  
Sub-indicator (b)   
  
Results of the Global Assessment of Environmental-Economic Accounting and Supporting Statistics provide the data needed for Sub-indicator (b). The Global Assessment is a survey administered by UNSD, as Secretariat to and under the auspices of the UN Committee of Experts on Environmental Economic Accounting (UNCEEA). Sub-indicator (b) is defined as the number of countries which indicate they have implemented the SEEA in their response to the Global Assessment. The aim of the Global Assessment is to assess the progress in reaching the implementation targets of the UNCEEA of 100 countries with SEEA CF programmes and 50 countries with SEEA EEA programmes by 2020. The Global Assessment collects information on whether countries are currently planning or implementing SEEA accounts, the specific accounts being implemented and plans for new/future accounts.   
  
The survey was first administered to the national statistical offices of UN Member States and additional territories in 2006. It was again administered in 2014, and most recently, the Global Assessment was sent to national statistical offices in June 2017. The next Global Assessment will be held in 2020.  
  
  
  
Disaggregation:  
  
The indicator is available at country level.   
  
  
  
Treatment of missing values:  
  
At country level  
  
Missing values are not imputed.   
  
At regional and global levels  
  
Sub-indicator (a) Missing values are considered to be 0 as this indicator refers to reporting processes. Thus if a country does not report then this means that the country did not report.  
  
 Sub-indicator (b): Missing values will occur if a country does not respond to the Global Assessment. If a country does not respond, no assumption will be made on the country’s implementation of the SEEA.  
  
  
  
   
  
Regional aggregates:  
  
For sub-indicator (a), weighted averages will be developed using the method described here:  
  
http://pre-uneplive.unep.org/media/docs/graphs/aggregation\_methods.pdf.   
  
For sub-indicator (b), a simple count of countries will be used.  
  
  
  
Sources of discrepancies: NA  
  
  
  
Data Sources  
  
  
  
Description:  
  
National Statistical Systems contribute directly to the NBSAP reporting and to reporting to the UNCEEA.  
  
Sub-indicator (a): NBSAPs and National Reports   
  
Sub-indicator (b): Global Assessments of Environmental-Economic Accounting and Supporting Statistics  
  
  
  
Collection process:  
  
Data collection is through submission of reports (sub-indicator (a)) and a dedicated survey on SEEA implementation (sub-indicator (b)).  
  
  
  
The data for Sub-indicator (a) is currently collected by the Secretariat of the CBD. Collection of NBSAPs and of National Reports are regularly updated by the Secretariat of the CBD here:  
  
https://www.cbd.int/nbsap/   
  
https://www.cbd.int/reports/  
  
The number of parties considered to have submitted post-2010 NBSAPs that take the Strategic Plan for Biodiversity (2011-2020) into account is regularly updated as well.   
  
  
  
The data source for sub-indicator (b) is the results of the Global Assessments, for which previous reports can be found here: https://seea.un.org/content/global-assessment-environmental-economic-accounting. The results of the 2020 Global Assessment are expected to be available in March 2021.  
  
  
  
  
  
Data Availability  
  
  
  
Description:  
  
For Sub-indicator (a), there have been six rounds of national reporting to date. The most recent round of national reporting had a deadline of 31 December 2018.   
  
  
  
For Sub-indicator (b), the Global Assessment was last sent to national statistical offices in June 2017. The next Global Assessment will be administered in 2020.  
  
  
  
  
  
Time series:  
  
Collection of NBSAPs and of National Reports are regularly updated by the Secretariat of the CBD here: https://www.cbd.int/nbsap/ and here: https://www.cbd.int/reports/. The data will be updated annually for countries that submit a report during the year. It is mandated by the Convention of Biological Diversity (CBD) Committee of the Parties (COP) – reporting typically occurs every 4 years.  
  
The reports for previous Global Assessments can be found here: https://seea.un.org/content/global-assessment-environmental-economic-accounting. This data will be collected every 3 years. (2020, 2023, etc.)  
  
  
  
  
  
Calendar  
  
  
  
Data collection:  
  
 Existing reporting to the CBD and to UNSD.  
  
Data release:  
  
Data will be released in the year following the data collection.   
  
Data providers  
  
Ministries of Environment (or similar) through the National CBD focal points.   
  
National Statistical Offices through the UNCEEA focal points.  
  
  
  
Data compilers  
  
CBD collects data on Sub-indicator (a). UN Environment and UNEP-WCMC will help process the data.  
  
  
  
UNSD collects data on Sub-indicator (b)  
  
  
  
  
  
References  
  
  
  
URL: All information on CBD reporting can be found at: https://www.cbd.int/nr6/default.shtml. All information on the SEEA can be found at: https://seea.un.org   
  
  
  
  
  
References:  
  
Biodiversity Indicators Partnership: https://www.bipindicators.net/bip-dashboard-of-indicator-visualisations-is-now-live   
  
  
  
SEEA Central Framework: https://seea.un.org/content/seea-central-framework   
  
  
  
SEEA Experimental Ecosystem Accounting: https://seea.un.org/ecosystem-accounting   
  
  
  
CBD 6th National Reporting Guidelines: https://www.cbd.int/nr6/default.shtml   
  
  
  
Related indicators as of February 2020  
  
  
  
15.a.1, 15.b.1 – These indicators related to funding for biodiversity and conservation which links to indicator 15.9.1, but not directly.

Last updated: 12 February 2020  
  
  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.1: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements  
  
Indicator 15.1.2: Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
UN Environment World Conservation Monitoring Centre (UNEP-WCMC)  
  
BirdLife International (BLI)  
  
International Union for Conservation of Nature (IUCN)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
This indicator Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas shows temporal trends in the mean percentage of each important site for terrestrial and freshwater biodiversity (i.e., those that contribute significantly to the global persistence of biodiversity) that is covered by designated protected areas.  
  
  
  
Rationale:  
  
The safeguard of important sites is vital for stemming the decline in biodiversity and ensuring long term and sustainable use of terrestrial and freshwater natural resources. The establishment of protected areas is an important mechanism for achieving this aim, and this indicator serves as a means of measuring progress toward the conservation, restoration and sustainable use of terrestrial and freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements. Importantly, while it can be disaggregated to report on any given single ecosystem of interest (e.g., forests), it is not restricted to any single ecosystem type, and so faithfully reflects the intent of SDG target 15.1.  
  
  
  
Levels of access to protected areas vary among the protected area management categories. Some areas, such as scientific reserves, are maintained in their natural state and closed to any other use. Others are used for recreation or tourism, or even open for the sustainable extraction of natural resources. In addition to protecting biodiversity, protected areas have high social and economic value: supporting local livelihoods; protecting watersheds from erosion; harbouring an untold wealth of genetic resources; supporting thriving recreation and tourism industries; providing for science, research and education; and forming a basis for cultural and other non-material values.  
  
  
  
This indicator adds meaningful information to, complements and builds from traditionally reported simple statistics of terrestrial and freshwater area covered by protected areas, computed by dividing the total protected area within a country by the total territorial area of the country and multiplying by 100 (e.g., Chape et al. 2005). Such percentage area coverage statistics do not recognise the extreme variation of biodiversity importance over space (Rodrigues et al. 2004), and so risk generating perverse outcomes through the protection of areas which are large at the expense of those which require protection.  
  
  
  
The indicator is used to track progress towards the 2011–2020 Strategic Plan for Biodiversity (CBD 2014, Tittensor et al. 2014), and was used as an indicator towards the Convention on Biological Diversity’s 2010 Target (Butchart et al. 2010).  
  
  
  
Concepts:  
  
Protected areas, as defined by the International Union for Conservation of Nature (IUCN; Dudley 2008), are clearly defined geographical spaces, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. Importantly, a variety of specific management objectives are recognised within this definition, spanning conservation, restoration, and sustainable use:  
  
  
  
Category Ia: Strict nature reserve  
  
Category Ib: Wilderness area  
  
Category II: National park  
  
Category III: Natural monument or feature  
  
Category IV: Habitat/species management area  
  
Category V: Protected landscape/seascape  
  
Category VI: Protected area with sustainable use of natural resources  
  
  
  
The status "designated" is attributed to a protected area when the corresponding authority, according to national legislation or common practice (e.g., by means of an executive decree or the like), officially endorses a document of designation. The designation must be made for the purpose of biodiversity conservation, not de facto protection arising because of some other activity (e.g., military).  
  
  
  
Sites contributing significantly to the global persistence of biodiversity are identified following globally criteria set out in A Global Standard for the Identification of Key Biodiversity Areas (IUCN 2016) applied at national levels. Key Biodiversity Areas encompass (a) Important Bird & Biodiversity Areas, that is, sites contributing significantly to the global persistence of biodiversity, identified using data on birds, of which >13,000 sites in total have been identified from all of the world’s countries (BirdLife International 2014, Donald et al. 2018); (b) Alliance for Zero Extinction sites (Ricketts et al. 2005), that is, sites holding effectively the entire population of at least one species assessed as Critically Endangered or Endangered on The IUCN Red List of Threatened Species, of which 853 sites have been identified for 1,483 species of mammals, birds, amphibians, reptiles, freshwater crustaceans, reef-building corals, conifers, cycads and other taxa; (c) Key Biodiversity Areas identified under an earlier version of the Key Biodiversity Area criteria (Langhammer et al. 2007), including those identified in Ecosystem Hotspot Profiles developed with support of the Critical Ecosystem Partnership Fund. These three subsets are being reassessed using the Global Standard, which unifies these approaches along with other mechanisms for identification of important sites for other species and ecosystems (IUCN 2016).  
  
  
  
Comments and limitations:  
  
Quality control criteria are applied to ensure consistency and comparability of the data in the World Database on Protected Areas. New data are validated at UNEP-WCMC through a number of tools and translated into the standard data structure of the World Database on Protected Areas. Discrepancies between the data in the World Database on Protected Areas and new data are minimised by provision of a manual (UNEP-WCMC 2019) and resolved in communication with data providers. Similar processes apply for the incorporation of data into the World Database of Key Biodiversity Areas (BirdLife International 2019).  
  
  
  
The indicator does not measure the effectiveness of protected areas in reducing biodiversity loss, which ultimately depends on a range of management and enforcement factors not covered by the indicator. A number of initiatives are underway to address this limitation. Most notably, numerous mechanisms have been developed for assessment of protected area management, which can be synthesised into an indicator (Leverington et al. 2010). This is used by the Biodiversity Indicators Partnership as a complementary indicator of progress towards Aichi Biodiversity Target 11   
  
(http://www.bipindicators.net/pamanagement). However, there may be little relationship between these measures and protected area outcomes (Nolte & Agrawal 2013). More recently, approaches to “green listing” have started to be developed, to incorporate both management effectiveness and the outcomes of protected areas, and these are likely to become progressively important as they are tested and applied more broadly.  
  
  
  
Data and knowledge gaps can arise due to difficulties in determining whether a site conforms to the IUCN definition of a protected area, and some protected areas are not assigned management categories. Moreover, “other effective area-based conservation measures”, as specified by Aichi Biodiversity Target   
  
11 of the Strategic Plan for Biodiversity 2011–2020, recognise that some sites beyond the formal protected area network, while not managed primarily for nature conservation, may nevertheless be managed in ways which are consistent with the persistence of the biodiversity for which they are important (Jonas et al. 2014). However, the formally agreed definition of an OECM (“A geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity, with associated ecosystem functions and services and, where applicable, cultural, spiritual, socioeconomic, and other locally relevant values”) were only agreed in November 2018 and measures are only recently in place for countries to submit OECM data to UNEP-WCMC. OECMs are now collated by UNEP-WCMC in a separate database, the WD-OECM.  
  
  
  
Regarding important sites, the biggest limitation is that site identification to date has focused mainly on specific subsets of biodiversity, for example birds (for Important Bird and Biodiversity Areas) and highly threatened species (for Alliance for Zero Extinction sites). While Important Bird and Biodiversity Areas have been documented to be good surrogates for biodiversity more generally (Brooks et al. 2001, Pain et al. 2005), the application of the unified standard for identification of Key Biodiversity Areas (IUCN 2016) sites across different levels of biodiversity (genes, species, ecosystems) and different taxonomic groups remains a high priority, building from efforts to date (Eken et al. 2004, Knight et al. 2007, Langhammer et al. 2007, Foster et al. 2012). Birds now comprise <50% of the species for which Key Biodiversity Areas have been identified, and as Key Biodiversity Area identification for other taxa and elements of biodiversity proceeds, such bias will become a less important consideration in the future.  
  
  
  
Key Biodiversity Area identification has been validated for a number of countries and regions where comprehensive biodiversity data allow formal calculation of the site importance (or “irreplaceability”) using systematic conservation planning techniques (Di Marco et al. 2016, Montesino Pouzols et al. 2014).  
  
  
  
Future developments of the indicator will include: a) expansion of the taxonomic coverage of terrestrial and freshwater Key Biodiversity Areas through application of the Key Biodiversity Areas standard (IUCN 2016) to a wide variety of terrestrial and freshwater vertebrates, invertebrates, plants and ecosystem type; b) improvements in the data on protected areas by continuing to increase the proportion of sites with documented dates of designation and with digitised boundary polygons (rather than coordinates).  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
This indicator is calculated from data derived from a spatial overlap between digital polygons for protected areas from the World Database on Protected Areas (UNEP-WCMC & IUCN 2020) and digital polygons for terrestrial and freshwater Key Biodiversity Areas (from the World Database of Key   
  
Biodiversity Areas, including Important Bird and Biodiversity Areas, Alliance for Zero Extinction sites, and other Key Biodiversity Areas). Sites were classified as terrestrial Key Biodiversity Areas by undertaking a spatial overlap between the Key Biodiversity Area polygons and an ocean raster layer (produced from the ‘adm0’ layer from the database of Global Administrative Areas (GADM 2019)), classifying any Key Biodiversity Area as a terrestrial Key Biodiversity Area where it had ≤95% overlap with the ocean layer (hence some sites were classified as both terrestrial and marine). Sites were classified as freshwater Key Biodiversity Areas if the resident species for which they were identified were documented in the IUCN Red List as dependent on ‘Inland Water’ systems. For non-resident or migrant species, or species that shift habitats during the annual cycle, the site was tagged as freshwater if the species occurred at the site in the appropriate season of water-dependence (e.g. some species are only dependent on water during the breeding season). Sites were then screened (using the satellite imagery base layer within ArcGIS) as to whether they lay wholly in the Coastal Zone (defined here as within 10 km of the coast), and these sites were then untagged as Freshwater and instead tagged as Marine if the wetland habitats present at the site fell purely within the IUCN Habitat Classification Scheme class ‘Marine Supratidal’ (i.e. estuaries, lagoons, etc.). If the site was within the Coastal Zone, but contained a mixture of Marine Supratidal and Inland Water classes, then it was tagged as both Freshwater and Marine. Each site was then manually cross-checked against other (less comprehensively available) site attributes, such as the habitat preferences of its trigger species, the site’s name (Delta, River, Humedal, etc.), its areal coverage by different habitat types, its overlap with Ramsar Sites, and its ‘shadow’ Ramsar status, so as to confirm or remove the Freshwater tag appropriately. The value of the indicator at a given point in time, based on data on the year of protected area establishment recorded in the World Database on Protected Areas, is computed as the mean percentage of each Key Biodiversity Area currently recognised that it covered by protected areas.  
  
  
  
Year of protected area establishment is unknown for ~12% of protected areas in the World Database on Protected Areas, generating uncertainty around changing protected area coverage over time. To reflect this uncertainty, a year was randomly assigned from another protected area within the same country, and then this procedure repeated 1,000 times, with the median plotted.   
  
  
  
Prior to 2017, the indicator was presented as the percentage of Key Biodiversity Areas completely covered by protected areas. However, it is now presented as the mean % of each Key Biodiversity Area that is covered by protected areas in order to better reflect trends in protected area coverage for countries or regions with few or no Key Biodiversity Areas that are completely covered.   
  
  
  
Disaggregation:  
  
Given that data for the global indicator are compiled at national levels, it is straightforward to disaggregate to national and regional levels (e.g., Han et al. 2014), or conversely to aggregate to the global level. Key Biodiversity Areas span all ecosystem types, including marine (Edgar et al. 2008), freshwater (Holland et al. 2012), and mountains (Rodríguez-Rodríguez et al. 2011). The indicator can therefore be reported in combination across terrestrial and freshwater (and indeed marine) systems, or disaggregated among them. However, individual Key Biodiversity Areas can encompass terrestrial, freshwater, and marine systems simultaneously, and so determining the results is not simply additive. Finally, the indicator can be disaggregated according to different protected area management categories (categories I–VI) to reflect differing specific management objectives of protected areas.  
  
  
  
In addition to the aggregation of the coverage of protected areas across important sites for terrestrial and freshwater biodiversity as an indicator towards SDG 15.1, other disaggregations of coverage of protected areas of particular relevance as indicators towards SDG targets (Brooks et al. 2016) include:  
  
  
  
SDG 14.5.1 Coverage of protected areas in relation to marine areas.  
  
SDG 15.4.1 Coverage by protected areas of important sites for mountain biodiversity.  
  
  
  
Protected area coverage data can be combined with other data sources to yield further, complementary, indicators. For example, protected area overlay with ecoregional maps can be used to provide information on protected area coverage of different broad biogeographical regions. Protected area coverage of the distributions of different groups of species (e.g., mammals, birds, amphibians) can similarly provide indicators of trends in coverage of biodiversity at the species level. Protected area coverage can be combined with the Red List Index to generate indicators of the impacts of protected areas in reducing biodiversity loss (Butchart et al. 2012). Finally, indicators derived from protected area overlay can also inform sustainable urban development; for example, the overlay of protected areas onto urban maps could provide an indicator of public space as a proportion of overall city space.  
  
  
  
Treatment of missing values:  
  
 At country level  
  
Data are available for protected areas and Key Biodiversity Areas in all of the world’s countries, and so no imputation or estimation of national level data is necessary.  
  
  
  
 At regional and global levels  
  
Global indicators of protected area coverage of important sites for biodiversity are calculated as the mean percentage of each Key Biodiversity Area that is covered by protected areas. The data are generated from all countries, and so while there is uncertainty around the data, there are no missing values as such and so no need for imputation or estimation.  
  
  
  
Regional aggregates:  
  
UNEP-WCMC is the agency in charge of calculating and reporting global and regional figures for this indicator, working with BirdLife International and IUCN to combine data on protected areas with those for sites of importance for biodiversity. UNEP-WCMC aggregates the global and regional figures on protected areas from the national figures that are calculated from the World Database on Protected Areas and disseminated through Protected Planet. The World Database on Protected Areas and Protected Planet are jointly managed by UNEP-WCMC and IUCN and its World Commission on Protected Areas. The World Database on Protected Areas is held within a Geographic Information System that stores information about protected areas such as their name, size, type, date of establishment, geographic location (point) and/or boundary (polygon). Protected area coverage is calculated using all the protected areas recorded in World Database on Protected Areas whose location and extent is known apart from protected areas without digital boundaries and those sites who have a status of ‘proposed’ or ‘not reported’.  
  
  
  
Sources of discrepancies:  
  
National processes provide the great bulk of the data that are subsequently aggregated into both the World Database on Protected Areas and the World Database of Key Biodiversity Areas, and so there are very few differences between national indicators and the global one. One minor source of difference is that the World Database on Protected Areas incorporates internationally-designated protected areas (e.g., UNESCO World Heritage sites, Ramsar sites, etc), a few of which are not considered by their sovereign nations to be protected areas.   
  
  
  
Note that because countries do not submit comprehensive data on degazetted protected areas to the WDPA, earlier values of the indictor may marginally underestimate coverage. Furthermore, there is also a lag between the point at which a protected area is designated on the ground and the point at which it is reported to the WDPA. As such, current or recent coverage may also be underestimated.  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
The WDPA has its origins in a 1959 UN mandate when the United Nations Economic and Social Council called for a list of national parks and equivalent reserves Resolution 713 (XXVIII). More details are available here: https://www.protectedplanet.net/c/world-database-on-protected-areas. The UN List of Protected Areas has been published in 1961/62, 1966/71, 1972 (addendum to the 1966/71 edition), 1973, 1974, 1975, 1980, 1982, 1985, 1990, 1993, 1997, 2003, 2014 and 2018 which have resulted in a global network of national data providers for the WDPA. For example, in 2014 all Convention on Biological Diversity (CBD) National Focal points and all National Focal points for the CBD Protected Areas Programme of Work (PoWPA) to request data for the 2014 Un List of Protected Areas (https://www.protectedplanet.net/c/united-nations-list-of-protected-areas/united-nations-list-of-protected-areas-2014). Protected areas data is therefore compiled directly from government agencies, regional hubs and other authoritative sources in the absence of a government source. All records have a unique metadata identifier (MetadataID) which links the spatial database to the Source table where all sources are described. The data is collated and standardised following the WDPA Data Standards and validated with the source. The process of collation, validation and publication of data as well as protocols and the WDPA data standards are regularly updated in the WDPA User Manual (https://www.protectedplanet.net/c/wdpa-manual) made available through www.protectedplanet.net where all spatial data and the Source table are also published every month and can be downloaded.  
  
  
  
The process for compilation of data on sites contributing significantly to the global persistence of biodiversity (Key Biodiversity Areas) is documented online (http://www.keybiodiversityareas.org/home). Specifically, (http://www.keybiodiversityareas.org/what-are-kbas), the Key Biodiversity Area identification process is a highly inclusive, consultative and bottom-up exercise. Although anyone with appropriate scientific data may propose a site to qualify as a Key Biodiversity Area, wide consultation with stakeholders at the national level (both non-governmental and governmental organizations) is required during the proposal process. Key Biodiversity Area identification builds off the existing network of Key Biodiversity Areas, including those identified as Important Bird & Biodiversity Areas through the BirdLife Partnership of 120 national organisations (http://www.birdlife.org/worldwide/partnership/birdlife-partners), for the Alliance for Zero Extinction by 93 national and international organisations (http://www.zeroextinction.org/partners.html), and as other Key Biodiversity Areas by civil society organisations supported by the Critical Ecosystem Partnership Fund in developing ecosystem profiles, named in each of the profiles listed here (http://www.cepf.net/resources/publications/Pages/ecosystem\_profiles.aspx), with new data strengthening and expanding expand the network of these sites. Any site proposal undergoes independent scientific review. This is followed by the official site nomination with full documentation meeting the Documentation Standards for Key Biodiversity Areas. Sites confirmed by the Key Biodiversity Areas Secretariat to qualify as Key Biodiversity Areas then appear on the Key Biodiversity Areas website (http://www.keybiodiversityareas.org/home).  
  
  
  
The WDPA User Manual (https://www.protectedplanet.net/c/wdpa-manual) published in English, Spanish, and French provides guidance to countries on how to submit protected areas data to the WDPA, what are the benefits of providing such data, which are the data standards and which quality checks are performed. We also provide a summary of our methods to calculate protected areas coverage to all WDPA users: https://www.protectedplanet.net/c/calculating-protected-area-coverage. The “Global Standard for the Identification of Key Biodiversity Areas” (https://portals.iucn.org/library/node/46259) comprises the standard recommendations available to countries in the identification of Key Biodiversity Areas, with further guidelines available on the Key Biodiversity Areas website (http://www.keybiodiversityareas.org/home). Specifically, (http://www.keybiodiversityareas.org/get-involved), the main steps of the Key Biodiversity Area identification process are the following:   
  
submission of Expressions of Intent to identify a Key Biodiversity Area to Regional Focal Points;   
  
proposal Development process, in which proposers compile relevant data and documentation and consult national experts, including organizations that have already identified Key Biodiversity Areas in the country, either through national Key Biodiversity Area Coordination Groups or independently;   
  
review of proposed Key Biodiversity Areas by Independent Expert Reviewers, verifying the accuracy of information within their area of expertise; and   
  
a Site Nomination phase comprising the submission of all the relevant documentation for verification by the Key Biodiversity Areas Secretariat (see section 3.3 below).   
  
Once a Key Biodiversity Area is identified, monitoring of its qualifying features and its conservation status is important. Proposers, reviewers and those undertaking monitoring can join the Key Biodiversity Areas Community to exchange their experiences, case studies and best practice examples.  
  
  
  
Quality assurance  
  
The process on how the data is collected, standardised and published is available in the WDPA User Manual at: https://www.protectedplanet.net/c/wdpa-manual which is available in English, French and Spanish. Specific guidance is provided at https://www.protectedplanet.net/c/world-database-on-protected-areas on, for example, predefined fields or look up tables in the WDPA: https://www.protectedplanet.net/c/wdpa-lookup-tables, how WDPA records are coded how international designations and regional designations data is collected, how regularly is the database updated, and how to perform protected areas coverage statistics.   
  
The process of identification of Key Biodiversity Areas is supported by the Key Biodiversity Areas Partnership (http://www.keybiodiversityareas.org/kba-partners). Among the roles of the partnership is establishment of the Key Biodiversity Areas Secretariat, which checks information submitted in the Site Nomination phase for the correct application of the Key Biodiversity Areas Standard ((https://portals.iucn.org/library/node/46259), and the adequacy of site documentation and then verifies the site, which is then published on the Key Biodiversity Areas Website (http://www.keybiodiversityareas.org/get-involved). In addition, the Chairs of the IUCN Species Survival Commission and World Commission on Protected Areas (both of whom are elected by the IUCN Membership of governments and non-governmental organisations), appoint the Chair of an independent Key Biodiversity Areas Standards and Appeals Committee, which ensures the correct application of the Global Standard for the identification of Key Biodiversity Areas. The R code for calculating protected area coverage of Key Biodiversity Areas is documented as Dias, M. (2017) “R code for calculating protected area coverage of KBAs” (http://www.keybiodiversityareas.org/userfiles/files/R\_code\_for\_calculating\_protected\_area\_coverage\_of\_KBAs\_March\_2017.pdf).   
  
  
  
In addition to dissemination via the Protected Planet website (https://www.protectedplanet.net/), the UN List process described in 3.1 the fact that protected areas data is collected from national agencies acknowledged in the WDPA metadata, and Key Biodiversity Areas website (http://www.keybiodiversityareas.org/home), Protected Planet and Key Biodiversity Areas data are disseminated through the Integrated Biodiversity Assessment Tool, available for research and conservation online (https://www.ibat-alliance.org/ibat-conservation/). This incorporates Country Profile documents for all of the world’s countries, which includes documentation of the indicator of protected area coverage of Key Biodiversity Areas. Each annual update to these Country Profiles are sent for consultation to National Focal Points of the Convention on Biological Diversity (https://www.cbd.int/information/nfp.shtml), National Statistics Offices SDG Representatives and UN Permanent Missions (Geneva) representatives.  
  
  
  
Data Sources  
  
  
  
Description:  
  
Protected area data are compiled by ministries of environment and other ministries responsible for the designation and maintenance of protected areas. Protected Areas data for sites designated under the Ramsar Convention and the UNESCO World Heritage Convention are collected through the relevant convention international secretariats. Protected area data are aggregated globally into the World Database on Protected Areas by the UN Environment World Conservation Monitoring Centre, according to the mandate for production of the United Nations List of Protected Areas (Deguignet et al. 2014). They are disseminated through Protected Planet, which is jointly managed by UNEP-WCMC and IUCN and its World Commission on Protected Areas (Juffe-Bignoli et al. 2014).  
  
  
  
Key Biodiversity Areas are identified at national scales through multi-stakeholder processes, following standard criteria and thresholds. Key Biodiversity Areas data are aggregated into the World Database on Key Biodiversity Areas, managed by BirdLife International. Specifically, data on Important Bird and Biodiversity Areas are available online at http://datazone.birdlife.org/site/search and data on Alliance for Zero Extinction sites are available online at https://zeroextinction.org. Both datasets, along with Key Biodiversity Areas identified through other processes, are available through the World Database on Key Biodiversity Areas, and, along with the World Database on Protected Areas, are also disseminated through the Integrated Biodiversity Assessment Tool for Research and Conservation Planning.   
  
  
  
Collection process:  
  
See information under other sections.  
  
  
  
Data Availability  
  
  
  
Description:  
  
This indicator has been classified by the IAEG-SDGs as Tier 1. Current data are available for all countries in the world, and these are updated on an ongoing basis.  
  
  
  
Time series:  
  
~150 years  
  
  
  
Calendar  
  
  
  
Data collection:  
  
UNEP-WCMC produces the UN List of Protected Areas every 5–10 years, based on information provided by national ministries/agencies. In the intervening period between compilations of UN Lists, UNEP-WCMC works closely with national ministries/agencies and NGOs responsible for the designation and maintenance of protected areas, continually updating the WDPA as new data become available. The World Database of Key Biodiversity Areas is also updated on an ongoing basis, as new national data are submitted.   
  
  
  
Data release:  
  
The indicator of protected area coverage of important sites for biodiversity is anticipated to be released annually.  
  
  
  
Data providers  
  
  
  
Protected area data are compiled by ministries of environment and other ministries responsible for the designation and maintenance of protected areas. Key Biodiversity Areas are identified at national scales through multi-stakeholder processes, following standard criteria and thresholds.  
  
  
  
Data compilers  
  
  
  
Name:  
  
UNEP-WCMC and IUCN  
  
  
  
Description:  
  
Protected area data are aggregated globally into the World Database on Protected Areas by the UN Environment World Conservation Monitoring Centre, according to the mandate for production of the United Nations List of Protected Areas (Deguignet et al. 2014). They are disseminated through Protected Planet, which is jointly managed by UNEP-WCMC and IUCN and its World Commission on Protected Areas (UNEP-WCMC 2016). Key Biodiversity Areas data are aggregated into the World Database on Key Biodiversity Areas, managed by BirdLife International (2019). Specifically, data on Important Bird and Biodiversity Areas are available online at http://datazone.birdlife.org/site/search and data on Alliance for Zero Extinction sites are available online at https://zeroextinction.org. Both datasets, along with the World Database on Protected Areas, are also disseminated through the Integrated Biodiversity Assessment Tool for Research and Conservation Planning.  
  
  
  
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URL:  
  
http://www.unep-wcmc.org/; http://www.birdlife.org/; http://www.iucn.org/  
  
  
  
References:  
  
These metadata are based on http://mdgs.un.org/unsd/mi/wiki/7-6-Proportion-of-terrestrial-and-marine-areas-protected.ashx, supplemented by http://www.bipindicators.net/paoverlays and the references listed below.  
  
  
  
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Last updated: 20 April 2020  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
  
  
Target 15.a: Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems  
  
  
  
Indicator: 15.a.1/15.b.1 (a) Official development assistance on conservation and sustainable use of biodiversity; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
Organisation for Economic Cooperation and Development (OECD)  
  
  
  
Contact person(s):  
  
Yasmin Ahmad, Development Cooperation Directorate, OECD  
  
Katia Karousakis, Environment Directorate, OECD  
  
  
  
Email address (for internal use only)  
  
Yasmin.AHMAD@oecd.org  
  
Katia.KAROUSAKIS@oecd.org  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
  
  
This is a twin indicator consisting of:  
  
  
  
a) Official development assistance on conservation and sustainable use of biodiversity, defined as gross disbursements of total Official Development Assistance (ODA) from all donors for biodiversity.   
  
b) revenue generated and finance mobilised from biodiversity-relevant economic instruments, defined as revenue generated and finance mobilised from biodiversity-relevant economic instruments, covering biodiversity-relevant taxes, fees and charges, and positive subsidies. (New on-going work is underway to collect data on payments for ecosystem services and biodiversity offsets -- including the finance they mobilise for biodiversity).  
  
  
  
Rationale:  
  
a) Total ODA flows to developing countries quantify the public effort that donors provide to developing countries for biodiversity.  
  
  
  
b) Economic policy instruments can either generate revenue (e.g. biodiversity-relevant taxes) or mobilise finance directly for biodiversity conservation and sustainable use (e.g. biodiversity-relevant fees and charges; positive subsidies; PES and offsets) which is finance mobilised at domestic level.   
  
The data are collected in a consistent and comparable way across countries.  
  
  
  
Concepts:  
  
  
  
a) The Development Assistance Committee (DAC) defines ODA as those flows to countries and territories on the DAC list of ODA recipients and multilateral institutions which are:  
  
Provided by official agencies, including state and local governments, or by their executive agencies; and  
  
Each transaction of which:  
  
 is administered with the promotion of the economic development and welfare of developing countries as its main objective; and  
  
is concessional in character.  
  
 (See http://www.oecd.org/dac/stats/officialdevelopmentassistancedefinitionandcoverage.htm).  
  
  
  
  
  
b) The Environmental Policy Committee (EPOC) collects data on Policy Instruments for the Environment (to the OECD PINE database), including biodiversity-relevant economic instruments. Currently more than 110 countries are contributing data. For 2020 data, see Tracking Economic Instruments and Finance for Biodiversity -2020.   
  
  
  
Comments and limitations:  
  
  
  
a) OECD CRS data are available since 1973. However, the data coverage at an activity level is considered complete from 1995 for commitments and 2002 for disbursements. The Rio biodiversity marker was introduced in 2002.  
  
  
  
b) The OECD PINE database tracks the biodiversity-relevant economic instruments that countries have put in place, and countries are encouraged to also provide information on the revenue and finance channelled via each of the instruments. The comprehensiveness of data provided currently varies across the biodiversity-relevant economic instruments. The data on revenue generated by biodiversity-relevant taxes is currently the most comprehensive. For the data on biodiversity-relevant fees and charges, for example, of the total number of these instruments currently reported to the PINE database, 42% also include data on the finance they generate.   
  
  
  
Like all data provided by a diffuse set of respondents, the data is subject to missing values, human error, and differences in interpretation of the provided definitions. However, all possible efforts have been made to ensure that the data is complete, accurate, and comparable across countries.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
a) This indicator is calculated as the sum of all ODA flows from all donors to developing countries that have biodiversity as a principal or significant objective, thus marked with the Rio marker for biodiversity.  
  
  
  
b) Countries are requested to report on when the policy instrument was introduced, what it applies to, the geographical coverage, the environmental domain, the industries concerned; the revenues, costs or rates; whether the revenue is earmarked; and exemptions.  
  
  
  
Disaggregation:  
  
  
  
a) This indicator can be disaggregated by donor, by recipient country (or region), by type of finance, by type of aid, by sub-sector, by policy marker (e.g. gender), etc.  
  
  
  
b) Information is available by country at the individual policy instrument level.  
  
  
  
Treatment of missing values:  
  
  
  
At country level  
  
a) and b) No attempt is made to estimate missing values.  
  
At regional and global levels  
  
a) and b) No attempt is made to estimate missing values.  
  
  
  
Regional aggregates:  
  
  
  
a) Data are reported at a country level.   
  
  
  
b) Data are reported at national and sub-national level, depending on the scope of the policy instrument.  
  
  
  
Sources of discrepancies:  
  
   
  
a) DAC statistics are standardized on a calendar year basis for all donors and may differ from fiscal year data available in budget documents for some countries. Some countries provide more comprehensive information than others.  
  
  
  
b) Some countries provide more comprehensive information than others.  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
  
  
a) The DAC statistical Reporting Directives govern the reporting of DAC statistics, and are reviewed and agreed by the DAC Working Party of Development Finance Statistics, see: https://one.oecd.org/document/DCD/DAC/STAT(2018)9/FINAL/en/pdf  
  
  
  
b) The OECD provides instructions and a formatted questionnaire for countries to provide data.  
  
  
  
Quality assurance  
  
  
  
a) The data collected by the OECD/DAC Secretariat are official data provided by national statistical reporters in each providing country/agency. The OECD/DAC Secretariat is responsible for checking, validating and publishing these data.   
  
  
  
b) Data are provided by competent national authorities. The OECD Secretariat conducts regular checks to identify errors or missing data.  
  
  
  
  
  
Data Sources  
  
  
  
Description:  
  
  
  
a) The OECD/DAC has been collecting data on official and private resource flows from 1960 at an aggregate level and 1973 at an activity level through the CRS (CRS data are considered complete from 1995 for commitments at an activity level and 2002 for disbursements). The Rio marker for biodiversity was introduced in 2002. The data are provided by DAC donors, other bilateral providers of development cooperation and multilateral organizations.   
  
  
  
b) Information for the OECD PINE database is collected via a network of 200 country experts, including in government agencies (Ministries of Finance and Environment, statistical institutes) as well as research institutes and international organisations. Data is collected systematically for 37 OECD members as well as the active accession countries. A growing number of non-member countries also provide information. Currently, more than 110 countries are contributing data. Registered experts are asked to update data at least once a year, typically in January or February, through a password-protected interface. The data collection method may result in some reporting bias, as OECD members and active accession countries are likely to report more data on a regular basis, and all figures should be interpreted in this context.  
  
  
  
Collection process:  
  
  
  
a) Via and annual questionnaire reported by national statistical reporters in aid agencies, ministries of foreign affairs, etc.  
  
  
  
b) Via questionnaire and directly via the network of contacts.  
  
  
  
  
  
Data Availability  
  
  
  
Description:  
  
  
  
a) The Rio biodiversity marker was introduced in 2002 and data are available since then for most DAC members, with improvements in reporting over time. Not all other providers report their data at an activity level though.  
  
  
  
Provisional data classification: Tier I  
  
  
  
b) Currently more than 110 countries are contributing data to the PINE database. As of March 2020, the database contained more than 3 500 policy instruments for the environment, of which 3 100 were in force. The environmental domains covered by the database include biodiversity, climate, air pollution, among others.  
  
  
  
Time series:  
  
a) The data are available since 1996 on an annual basis, with time series since 1950.  
  
  
  
b) The data series is annual and data is available from before 1980.   
  
The PINE database exists since 1996, with the added feature of tagging biodiversity-relevant instruments introduced in 2017. The biodiversity-relevant information in the PINE database is being used to monitor progress towards Aichi Target 3 on positive incentives, under the Convention on Biological Diversity. For more information on this, see Aichi Target 3 under the website of the Biodiversity Indicators Partnership (BIP).  
  
  
  
Calendar  
  
  
  
Data collection:  
  
 a) On an annual basis.   
  
b) On an on-going basis.   
  
   
  
Data release:  
  
  
  
 a) The data are published at the end of each year for year -1.  
  
  
  
b) An updated and expanded brochure on “Tracking Economic Instruments and Finance for Biodiversity” is planned to be released in mid-2020.   
  
 The 2020 version is available here: OECD (2020), Tracking Economic Instruments and Finance for Biodiversity -2020.  
  
   
  
  
  
Data providers  
  
a) A statistical reporter is responsible for the collection of DAC statistics in each providing country/agency. This reporter is usually located in the national aid agency, Ministry of Foreign Affairs or Finance etc.  
  
  
  
b) Information for the PINE database is collected via a network of 200 country experts, including in government agencies (Ministries of Finance and Environment, statistical institutes) as well as research institutes and international organisations. Data is collected systematically for 37 OECD members as well as the active accession countries. A growing number of non-member countries also provide information. Registered experts are asked to update data at least once a year, typically in January or February, through a password-protected interface. The data collection method may result in some reporting bias, as OECD members and active accession countries are likely to report more data on a regular basis, and all figures should be interpreted in this context.   
  
  
  
The OECD Secretariat, in consultation with countries, validates the data before they are published online. The management of PINE is overseen by OECD Committees and Working Parties.  
  
  
  
Data compilers  
  
  
  
a) OECD, Development Cooperation Directorate. The OECD is the only International Organisation collecting this data.  
  
  
  
b) OECD, Environment Directorate. The OECD is the only International Organisation collecting this data.  
  
  
  
References  
  
  
  
URL:  
  
  
  
a) See all links here: http://www.oecd.org/dac/stats/methodology.htm  
  
  
  
References:   
  
  
  
a) See all links here: http://www.oecd.org/dac/stats/methodology.htm  
  
b) OECD (2020), Tracking Economic Instruments and Finance for Biodiversity - 2020.   
  
The brochure also highlights on-going work to scale up the policy instruments to include Payments for Ecosystem Services, and Biodiversity Offsets, and the finance these two policy instruments mobilise. The PINE data is available at https://oe.cd/pine  
  
   
  
Additional information extracted from the PINE database is reported in OECD (2019) Biodiversity: Finance and the Economic and Business Case for Action  
  
  
  
  
  
  
  
Related indicators  
  
  
  
A related indicator is that on public expenditure on biodiversity. Public expenditure on biodiversity is currently a Tier III indicator and is to be improved. For expenditure the methodology is agreed upon, i.e. SEEA Environmental Expenditure Accounts and National accounts COFOG.   
  
  
  
  
  
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Last updated: 19 July 2016  
  
  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.7: Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products  
  
Indicator 15.7.1: Proportion of traded wildlife that was poached or illicitly trafficked  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
  
  
United Nations Office on Drugs and Crime (UNODC)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
  
  
The share of all trade in wildlife detected as being illegal  
  
  
  
Rationale:  
  
  
  
There are over 35,000 species under international protection, so it is impossible to monitor all poaching. Illegal trade, however, is an indirect indicator of poaching. Wildlife seizures represent concrete instances of illegal trade, but the share of overall wildlife crime they represent is unknown and variable. In addition, the number of species under international protection continues to grow. Legal international trade in protected species, by definition, is 100% captured in the CITES Trade Database, which now contains over 16 million records of trade in CITES-listed species. To ground the illegal trade data in a complete indicator, the ratio of aggregated seizures to total trade is estimated. An increase in the share of total wildlife trade that is illegal would be interpreted as a negative indicator, and a decrease as a positive one.  
  
  
  
Because the illegal wildlife trade represents thousands of distinct products, a means of aggregation is necessary. The legal trade value does not represent the true black market value of the items seized, nor the true value of the legal shipments, because it is derived from a single market source (US LEMIS). It does, however, present a logical and consistent means of aggregating unlike products.  
  
  
  
Concepts:  
  
  
  
“All trade in wildlife” is the sum of the values of legal and illegal trade  
  
  
  
“Legal trade” is the sum of the value of all shipments made in compliance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), using valid CITES permits and certificates.  
  
  
  
“Illegal trade” is the sum of the value of all CITES/listed specimens seized.  
  
  
  
Comments and limitations:  
  
  
  
Seizures are an incomplete indicator of trafficking, and subject to considerable volatility. Universal coverage is not presently available, although 120 countries are represented in the present database. Since the indicator looks at the relationship between two values, changes in the relationship could be due to changes in either value.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
The value of a species-product unit is derived from the weighted average of prices declared for legal imports of analogous species product units, as acquired from United States Law Enforcement Monitoring and Information System of the Fish and Wildlife Service.  
  
  
  
The value of legal trade is the sum of all species-product units documented in CITES export permits as reported in the CITES Annual Reports times the species-product unit prices as specified above.  
  
  
  
The value of illegal trade is the sum of all species-product units documented in the World WISE seizure database times the species-product unit prices as specified above.  
  
  
  
The indicator is value of illegal trade/(value of legal trade + value of illegal trade)  
  
  
  
Disaggregation:  
  
  
  
Where source data are available, the data could be disaggregated to the national level. As a form of trade data, issues of gender, age, and disability status are not applicable.  
  
  
  
Treatment of missing values:  
  
  
  
At country level  
  
  
  
Given the number of products and volatility of these markets, there is presently no mechanism for imputing missing data.  
  
  
  
At regional and global levels  
  
  
  
As above  
  
  
  
Regional aggregates:  
  
  
  
National data are added.  
  
  
  
Sources of discrepancies:  
  
  
  
The global figure is the aggregate of national figures provided by countries.  
  
  
  
Data Sources  
  
  
  
Description:  
  
  
  
The legal trade data are reported annually by Parties to CITES and stored in the CITES Trade Database, managed by the UNEP World Conservation Monitoring Centre in Cambridge.  
  
  
  
The detected illegal trade data have been gathered from a number of sources and combined in a UNODC database called “World WISE”. This database will be filled, from 2017, with data from the new annual CITES Illegal Trade reporting requirement.  
  
  
  
The US LEMIS price data for CITES-listed species are also provided to UNEP-WCMC within the U.S. annual report to CITES.  
  
  
  
Collection process:  
  
  
  
Some adjustment/validation is necessary between countries, but standardized codes for the legal wildlife trade have been developing since 1975. The basic fields necessary for the global indicator (species, product, and unit) are well established and present in every seizure. Some unit conversions (e.g. logs to MT to m3 for timber) are necessary for some products. For many commodities, for instance trade in live animals and trophies, it is possible to aggregate based on “whole individuals”. To do regional or national breakdowns, however, data on the source of the shipment are necessary (as the impact of poaching pertains to the source country, not the seizure country), and these data are not available for every seizure.  
  
  
  
Data Availability  
  
  
  
60  
  
  
  
Calendar  
  
  
  
Data collection:  
  
  
  
The first tranche of data from the Illicit Trade Report should be available in November 2017.   
  
  
  
Data release:  
  
  
  
To be determined  
  
  
  
Data providers  
  
  
  
The CITES Management Authority of each country  
  
  
  
Data compilers  
  
  
  
UNODC and UNEP-WCMC  
  
  
  
References  
  
  
  
URL:  
  
  
  
www.unodc.org  
  
  
  
References:  
  
  
  
http://www.unodc.org/documents/data-and-analysis/wildlife/Methodological\_Annex\_final.pdf  
  
  
  
http://trade.cites.org/cites\_trade\_guidelines/en-CITES\_Trade\_Database\_Guide.pdf

Last updated: 31 May 2018  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.6: Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed  
  
Indicator 15.6.1: Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits  
  
  
  
Institutional information  
  
Organization(s):  
  
Secretariat of the Convention on Biological Diversity (CBD)  
  
  
  
Concepts and definitions  
  
Definition  
  
The indicator is defined as the number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits. It refers to the efforts by countries to implement the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (2010) and the International Treaty on Plant Genetic Resources for Food and Agriculture (2001).  
  
  
  
The Nagoya Protocol covers genetic resources and traditional knowledge associated with genetic resources, as well as the benefits arising from their utilization by setting out core obligations for its contracting Parties to take measures in relation to access, benefit-sharing and compliance. The objectives of the International Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity.   
  
  
  
The Protocol provides greater legal certainty and transparency for both providers and users of genetic resources and associated traditional knowledge, and therefore, encourages the advancement of research on genetic resources which could lead to new discoveries for the benefit of all.   
  
The Nagoya Protocol also creates incentives to conserve and sustainably use genetic resources, and thereby enhances the contribution of biodiversity to development and human well-being. In addition, Parties to the Protocol are to encourage users and providers to direct benefits arising from the utilization of genetic resources towards the conservation of biological diversity and the sustainable use of its components.  
  
  
  
The International Treaty has established the Multilateral System of Access and Benefit-sharing, which facilitates exchanges of plant genetic resources for purposes of agricultural research and breeding, by providing a transparent and reliable framework for the exchange of crop genetic resources. The Multilateral System is instrumental to achieving the conservation and sustainable use of plant genetic resources as well as the fair and equitable sharing of benefits arising from their use.   
  
  
  
Rationale and interpretation  
  
The Nagoya Protocol, to be operational, requires that certain enabling conditions are met at the national level for its effective implementation. In particular, countries will need, depending on their specific circumstances, to revise legislative, administrative or policy measures already in place or develop new measures in order to meet the obligations set out under the Protocol.   
  
  
  
In particular, the Nagoya Protocol provides that Parties are to take legislative, administrative or policy measures, as appropriate, to ensure the fair and equitable sharing of the benefits arising from the utilization of genetic resources, including for genetic resources that are held by indigenous communities, and benefits arising from the utilization of traditional knowledge associated with genetic resources.   
  
The ABS Clearing-House is a platform for exchanging information on access and benefit-sharing established by Article 14 of the Protocol, The ABS Clearing-House is a key tool for facilitating the implementation of the Nagoya Protocol, by enhancing legal certainty and transparency on procedures for access, and for monitoring the utilization of genetic resources along the value chain. The Protocol requires Parties to make information on legislative, administrative and policy measures available to the ABS Clearing-House. Non-Parties are also encouraged to make this information available in the same manner. The goal is to allow users of genetic resources and associated traditional knowledge to easily find information on the ABS Clearing-House on how to access these resources and knowledge in an organized manner, and all in one convenient location.  
  
  
  
The International Treaty stipulates that Contracting Parties ensure the conformity of its laws, regulations and procedures with their obligations under the International Treaty (Article 4). Under the Multilateral System of Access and Benefit-sharing (Articles 10-13), countries grant each other facilitated access to their plant genetic resources, while users of plant genetic material from the Multilateral System are encouraged to share their benefits with the Multilateral System. Such benefits should primarily flow to farmers in developing countries who promote the conservation and sustainable use of plant genetic resources.   
  
  
  
Pursuant to Article 21, the Governing Body adopted the Procedures and operational mechanism to promote compliance and address issues of non-compliance. Under the monitoring and reporting in the Procedures, each Contracting Party is requested to submit a report on the measures it has taken to implement its obligations under the International Treaty, including the access and benefit-sharing measures. Contracting Parties report using an agreed standard format and through the Online Reporting System on Compliance. Additionally, information on the number of Standard Material Transfer Agreements is gathered from the Data Store of the International Treaty through Easy-SMTA. SMTA is a mandatory contract that Contracting Parties of the International Treaty have agreed to use whenever plant genetic resources falling under the Multilateral System are made available.   
  
  
  
Indicator 15.6.1 directly measures progress made by countries in establishing legislative, administrative or policy frameworks on access and benefit-sharing (ABS). By developing their ABS frameworks, countries are contributing to the achievement of SDG Target 15.6 and to the conservation and sustainable use of biological and genetic diversity. Progress in this indicator is assessed through measuring the increase in the number of countries that have adopted ABS legislative, administrative and policy measures and that have made available this information in the ABS Clearing-House and through the Online Reporting System on Compliance of the International Treaty in relation to plant genetic resources for food and agriculture.   
  
  
  
Comments and limitations  
  
This indicator can be used to measure progress in adopting ABS legislative, administrative and policy frameworks over time.  
  
  
  
This indicator does not assess the scope or effectiveness of ABS legislative, administrative and policy frameworks.   
  
  
  
The notion of framework suggests that there is a complete set of rules established on access and benefit-sharing. However, it is difficult to have a predefined idea of what constitutes an ABS framework. In the context of this indicator, the publication by a country of one or more ABS legislative, administrative and policy measure in the ABS Clearing-House would be considered progress by that country on having an ABS legislative, administrative and policy framework, and through the Online Reporting System on Compliance of the International Treaty in relation to plant genetic resources for food and agriculture.  
  
  
  
Methodology  
  
Computation Method  
  
Summation of information made available by each Party to the Convention on Biological Diversity and to the International Treaty related to:  
  
ABS legislative, administrative or policy measures made available to the ABS Clearing-House and to the Online Reporting System on Compliance of the International Treaty in relation to plant genetic resources for food and agriculture (y/n);   
  
  
  
Disaggregation  
  
Data are provided by countries (or regional integration entities), and can be displayed by country, regional group, membership to a specific regional organization, and/or by their status as Parties or non-Parties to the Protocol and to the International Treaty.  
  
  
  
Sources of discrepancies  
  
Reliability of the indicator is dependent on countries making information available to the ABS Clearing-House of the Nagoya Protocol and to the Online Reporting System on Compliance of the International Treaty on ABS legislative, administrative or policy measures.  
  
  
  
In addition to the information made available by countries to the ABS Clearing-House, the CBD Secretariat collects information from other sources: national biodiversity strategies and actions plans, national reports submitted under the CBD, the interim national reports on the implementation of the Nagoya Protocol (due in 2017) and official communications to the SCBD (responses to notifications, email communications, etc.). The information collected from these sources inform the Secretariat’s inputs to other processes under the Protocol, in particular the consideration by the Conference of the Parties serving as the meeting of the Parties to the Protocol (COP-MOP) of national reports (Article 29) and assessment and review (Article 31). The resulting information on the number of countries with ABS legislative, administrative or and policy measures may differ from the number of countries that have made available this information in the ABS Clearing-House.   
  
   
  
In addition to the information made available by countries to the Online Reporting System on Compliance of the International Treaty, FAO collects information from countries, submitted through their national reports, on conservation and use of PGRFA and their efforts in this regard for the preparation of the State of the World’s Plant Genetic Resources for Food and Agriculture.   
  
  
  
Data Sources  
  
The Access and Benefit-sharing Clearing-House home page: http://absch.cbd.int  
  
  
  
The Online Reporting System on Compliance of the International Treaty on PGRFA, http://faoitpgrfa.ort-production.linode.unep-wcmc.org  
  
  
  
Easy-SMTA, https://mls.planttreaty.org  
  
  
  
Data Availability  
  
For 196 Parties to the Convention on Biological Diversity.  
  
  
  
Availability of data is dependent on countries making the information on ABS legislative, administrative or and policy measures available to the ABS Clearing-  
  
  
  
For 144 countries that have ratified, accepted, approved or acceded to the International Treaty on Plant Genetic Resources for Food and Agriculture (as of 1 February 2018)  
  
Calendar  
  
Data collection  
  
Ongoing.  
  
  
  
Data release  
  
First data set can be made available by the SCBD in 2016.  
  
For the data related to the International Treaty, the updated data was provided as of 1 February 2018.   
  
   
  
Data providers  
  
  
  
Publishing authorities for the ABS Clearing-House as designated by the CBD national focal points or the ABS focal points. Publishing authorities for the Online Reporting System on compliance of the International Treaty on PGRFA are the officially nominated national focal points or nominated reporting authorities.  
  
  
  
Data compilers  
  
CBD and International Treaty Secretariats.  
  
  
  
References  
  
Text of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity: https://www.cbd.int/abs/text/default.shtml   
  
  
  
The Access and Benefit-sharing Clearing-House: http://absch.cbd.int   
  
  
  
International Treaty on Plant Genetic Resources for Food and Agriculture, http://www.fao.org/3/a-i0510e.pdf  
  
  
  
Data Store of the International Treaty on PGRFA, Easy-SMTA, https://mls.planttreaty.org  
  
  
  
Related indicators as of February 2020  
  
N/A  
  
An indicator on numbers of permits and numbers of Material Transfer Agreements issued would provide complementary information.  
  
  
  
In relation to the International Treaty, the total number of Standard Material Transfer Agreements (SMTAs) transfering plant genetic resources for food and agriculture to the country is as of 1 February 2018. (Cumulative figures).

Last updated: 23 January 2018  
  
  
  
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss  
  
Target 15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world  
  
Indicator 15.3.1: Proportion of land that is degraded over total land area  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
United Nations Convention to Combat Desertification (UNCCD) and partners, including the Food and Agriculture Organization of the United Nations (FAO), United Nations Statistics Division (UNSD), United Nations Environment (UNEP), United Nations Framework Convention on Climate Change (UNFCCC) and Convention on Biological Diversity (CBD).  
  
  
  
Concepts and definitions  
  
  
  
Definitions:  
  
Land degradation is defined as the reduction or loss of the biological or economic productivity and complexity of rain fed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from a combination of pressures, including land use and management practices. This definition was adopted by and is used by the 196 countries that are Party to the UNCCD. (see also Figure 1)  
  
Land Degradation Neutrality (LDN) is defined as a state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems (decision 3/COP12).  
  
Total land area is the total surface area of a country excluding the area covered by inland waters, like major rivers and lakes.  
  
The measurement unit for this indicator is the spatial extent (hectares or km2) expressed as the proportion (percentage or %) of land that is degraded over total land area.  
  
SDG indicator 15.3.1 is a binary - degraded/not degraded - quantification based on the analysis of available data for three sub-indicators to be validated and reported by national authorities. The sub-indicators (Trends in Land Cover, Land Productivity and Carbon Stocks) were adopted by the UNCCD’s governing body in 2013 as part of its monitoring and evaluation approach.   
  
The method of computation for this indicator follows the “One Out, All Out” statistical principle and is based on the baseline assessment and evaluation of change in the sub-indicators to determine the extent of land that is degraded over total land area.  
  
The One Out, All Out (1OAO) principle is applied taking into account changes in the sub-indicators which are depicted as (i) positive or improving, (ii) negative or declining, or (iii) stable or unchanging. If one of the sub-indicators is negative (or stable when degraded in the baseline or previous monitoring year) for a particular land unit, then it would be considered as degraded subject to validation by national authorities.  
  
Concepts:  
  
The assessment and quantification of land degradation is generally regarded as context-specific, making it difficult for a single indicator to fully capture the state or condition of the land. While necessary but not sufficient, the sub-indicators address changes in different yet highly relevant ways: for example, land cover or productivity trends can capture relatively fast changes while changes in carbon stocks reflect slower changes that suggest a trajectory or proximity to thresholds.   
  
As proxies to monitor the key factors and driving variables that reflect the capacity to deliver land-based ecosystem services, the sub-indicators are globally agreed upon in definition and methodology of calculation, and deemed both technically and economically feasible for systematic observation under both the Global Climate Observation System (GCOS) and the integrated measurement framework of the System of Environmental-Economic Accounting (SEEA). The ultimate determination of the extent of degraded land made by national authorities should be contextualized with other indicators, data and ground-based information.  
  
An operational definition of land degradation along with a description of the linkages among the sub-indicators is given in Figure 1.  
  
  
Figure 1: Operational definition of land degradation and linkage with the sub-indicators.  
  
  
  
Land cover refers to the observed physical cover of the Earth’s surface which describes the distribution of vegetation types, water bodies and human-made infrastructure. It also reflects the use of land resources (i.e., soil, water and biodiversity) for agriculture, forestry, human settlements and other purposes. This sub-indicator serves two functions for SDG indicator 15.3.1: (1) changes in land cover may point to land degradation when there is a loss of ecosystem services that are considered desirable in a local or national context; and (2) a land cover classification system can be used to disaggregate the other two sub-indicators, thus increasing the indicator’s policy relevance. This sub-indicator is also expected to be used for reporting on SDG indicators 6.6.1, 11.3.1 and 15.1.1.  
  
There is an international standard for the sub-indicator on land cover which includes the Land Cover Meta Language (LCML), a common reference structure (statistical standard) for the comparison and integration of data for any generic land cover classification system. LCML is also used for defining land cover and ecosystem functional units used in the SEEA, and closely linked to the Intergovernmental Panel on Climate Change (IPCC) classification on land cover/land use.  
  
Land productivity refers to the total above-ground net primary production (NPP) defined as the energy fixed by plants minus their respiration which translates into the rate of biomass accumulation that delivers a suite of ecosystem services. This sub-indicator points to changes in the health and productive capacity of the land and reflects the net effects of changes in ecosystem functioning on plant and biomass growth, where declining trends are often a defining characteristic of land degradation.  
  
The international standard for calculating NPP (gC/m²/day) from remotely-sensed, multi-temporal surface reflectance data, accounting for the global range of climate and vegetation types, was established in 1999 by the U.S. National Aeronautics and Space Administration (NASA) in anticipation of the launch of the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor. The Land Productivity Dynamics (LPD) methodology and dataset, developed by the Joint Research Centre of the European Commission and used in the UNCCD pilot programme, employs this international standard to calculate NPP time series trends and change analyses.   
  
Carbon stock is the quantity of carbon in a “pool”: a reservoir which has the capacity to accumulate or release carbon and is comprised of above- and below-ground biomass, dead organic matter, and soil organic carbon. In UNCCD decision 22/COP.11, soil organic carbon (SOC) stock was adopted as the metric to be used with the understanding that this metric will be replaced by total terrestrial system carbon stocks, once operational. SOC is an indicator of overall soil quality associated with nutrient cycling and its aggregate stability and structure with direct implications for water infiltration, soil biodiversity, vulnerability to erosion, and ultimately the productivity of vegetation, and in agricultural contexts, yields. SOC stocks reflect the balance between organic matter gains, dependent on plant productivity and management practices, and losses due to decomposition through the action of soil organisms and physical export through leaching and erosion.  
  
For carbon stocks, IPCC (2006) contains the most relevant definitions and standards, especially with regard to reference values applicable for Tier 2 and 3 GHG reporting. In this regard, the technical soil infrastructure, data transfer and provision of national reporting data is also standards-based.  
  
  
  
Rationale:  
  
In the last decade, there have been a number of global/regional targets and initiatives to halt and reverse land degradation and restore degraded land. Starting in 2010, these include the Aichi Biodiversity Targets, one of which aims to restore at least 15% of degraded ecosystems; the Bonn Challenge and its regional initiatives to restore more than 150 million hectares; and most recently the Sustainable Development Goals (SDGs), in particular SDG target 15.3.   
  
For each of the sub-indicators, countries can access a wide range of data sources, including Earth observation and geospatial information, while at the same time ensuring national ownership. The use of the existing national reporting templates of the UNCCD, which include the indicator and sub-indicators, provides a practical and harmonized approach to reporting on this indicator beginning in 2018 and every four years thereafter. The quantitative assessments and corresponding mapping at the national level, as required by this indicator, would help countries to set policy and planning priorities among diverse land resource areas, in particular:  
  
to identify hotspots and plan actions of redress, including through the conservation, rehabilitation, restoration and sustainable management of land resources; and  
  
to address emerging pressures to help avoid future land degradation.  
  
Comments and limitations:  
  
SDG indicator 15.3.1 is a binary -- degraded/not degraded -- quantification based on the analysis of available data that is validated and reported by national authorities. Reporting on the sub-indicators should be based primarily, and to the largest extent possible, on comparable and standardized national official data sources. To a certain extent, national data on the three sub-indicators is and can be collected through existing sources (e.g., databases, maps, reports), including participatory inventories on land management systems as well as remote sensing data collected at the national level.   
  
  
  
Regional and global datasets derived from Earth observation and geospatial information can play an important role in the absence of, to complement, or to enhance national official data sources. These datasets can help validate and improve national statistics for greater accuracy by ensuring that the data are spatially-explicit. Recognizing that the sub-indicators cannot fully capture the complexity of land degradation (i.e., its degree and drivers), countries are strongly encouraged to use other relevant national or sub-national indicators, data and information to strengthen their interpretation.   
  
As regards slow changing variables, such as soil organic carbon stocks, reporting every four years may not be practical or offer reliable change detection for many countries. Nevertheless, this sub-indicator captures important data and information that will become more available in the future via improved measurements at the national level, such as those being facilitated by the FAO’s Global Soil Partnership and others.  
  
While access to remote sensing imagery has improved dramatically in recent years, there is still a need for essential historical time series that is currently only available at coarse to medium resolution. The expectation is that the availability of high-resolution, locally-calibrated datasets will increase rapidly in the near future. National capacities to process, interpret and validate geospatial data still need to be enhanced in many countries; good practice guidance for the monitoring and the reporting of the sub-indicators in other processes will assist in this regard.   
  
Methodology  
  
  
  
Computation Method:  
  
By analysing changes in the sub-indicators in the context of local assessments of climate, soil, land use and any other factors influencing land conditions, national authorities can determine which land units are to be classified as degraded, sum the total, and report on the indicator. A conceptual framework, endorsed by the UNCCD’s governing body in September 2017, underpins a universal methodology for deriving the indicator. The methodology helps countries to select the most appropriate datasets for the sub-indicators and determine national methods for estimating the indicator. In order to assist countries with monitoring and reporting, Good Practice Guidance for SDG Indicator 15.3.1 has been developed by the UNCCD and its partners.   
  
The indicator is derived from a binary classification of land condition (i.e., degraded or not degraded) based primarily, and to the largest extent possible, on comparable and standardized national official data sources. However, due to the nature of the indicator, Earth observation and geospatial information from regional and global data sources can play an important role in its derivation, subject to validation by national authorities.   
  
Quantifying the indicator is based on the evaluation of changes in the sub-indicators in order to determine the extent of land that is degraded over total land area. The sub-indicators are few in number, complementary and non-additive components of land-based natural capital and sensitive to different degradation factors. As a result, the 1OAO principle is applied in the method of computation where changes in the sub-indicators are depicted as (i) positive or improving, (ii) negative or declining, or (iii) stable or unchanging. If one of the sub-indicators is negative (or stable when degraded in the baseline or previous monitoring year) for a particular land unit, then normally it would be considered as degraded subject to validation by national authorities.   
  
The baseline year for the indicator is 2015 and its value (t0) is derived from an initial quantification and assessment of time series data for the sub-indicators for each land unit during the period 2000-2015. Subsequent values for the indicator during each monitoring period (t1-n) are derived from the quantification and assessment of changes in the sub-indicators as to whether there are has been positive, negative or no change for each land unit relative to the baseline value. Although the indicator will be reported as a single figure quantifying the area of land that is degraded as a proportion of land area, it can be spatially disaggregated by land cover class or other policy‐relevant units.  
  
As detailed in the Good Practice Guidance for SDG indicator 15.3.1, deriving the indicator for the baseline and subsequent monitoring years is done by summing all those areas where any changes in the sub-indicators are considered negative (or stable when degraded in the baseline or previous monitoring year) by national authorities. This involves the:  
  
(1) assessment and evaluation of land cover and land cover changes;  
(2) analysis of land productivity status and trends based on net primary production; and   
(3) determination of carbon stock values and changes, with an initial assessment of soil organic carbon as the proxy.  
  
It is good practice to assess change for interim and final reporting years in relation to the baseline year for each sub-indicator and then the indicator. This facilitates the spatial aggregation of the results from the sub-indicators for each land unit to determine the proportion of land that is degraded for the baseline and each monitoring year. Furthermore, it ensures that land classified as degraded will retain that status unless it has improved relative to the baseline or previous monitoring year.   
  
Land degradation (or improvement) as compared to the baseline may be identified with reference to parameters describing the slope and confidence limits around the trends in the sub-indicators, or to the level or distribution of conditions in space and/or time as shown during the baseline period. The evaluation of changes in the sub-indicators may be determined using statistical significance tests or by interpretation of results in the context of local indicators, data and information. The method of computation for SDG indicator 15.3.1 is illustrated in Figure 2.  
  
Figure 2: Steps to derive the indicator from the sub-indicators, where ND is not degraded and D is degraded.  
  
  
  
The area degraded in the monitoring period tn within land cover class i is estimated by summing all the area units within the land cover class determined to be degraded plus all area units that had previously been defined as degraded and that remain degraded:  
  
 (1)  
  
  
  
Where:   
  
 is the total area degraded in the land cover class i in the year of monitoring n (ha);  
  
 is the area defined as degraded in the current monitoring year following 1OAO assessment of the sub-indicators (ha);  
  
 is the area previously defined as degraded which remains degraded in the monitoring year following the 1OAO assessment of the sub-indicators (ha).  
  
  
  
The proportion of land cover type i that is degraded is then given by:  
  
 (2)  
  
Where  
  
is the proportion of degraded land in that land cover type i in the monitoring period n;   
  
 is the total area degraded in the land cover type i in the year of monitoring n (ha);  
  
 is the total area of land cover type i within the national boundary (ha).   
  
  
  
The total area of land that is degraded over total land area is the accumulation across the m land cover classes within the monitoring period n is given by:  
  
 (3)  
  
 Where  
  
 is the total area degraded in the year of monitoring n (ha);  
  
 is the total area degraded in the land cover type i in the year of monitoring n.  
  
  
  
The total proportion of land that is degraded over total land area is given by:  
  
 (4)  
  
 Where  
  
 is the proportion of land that is degraded over total land area;  
  
 is the total area degraded in the year of monitoring n (ha);  
  
 is the total area within the national boundary (ha).  
  
   
The proportion is converted to a percentage value by multiplying by 100.   
  
  
Disaggregation:  
  
The indicator can be disaggregated by land cover class or other spatially explicit land unit.  
  
Treatment of missing values:  
  
At country level  
  
For countries where no data or information is available, the UNCCD and its partners can provide default estimates from regional or global data sources that would then be validated by national authorities.  
  
At regional and global levels  
  
The land area of countries with missing values (i.e., there is no default data) would be excluded from regional and global aggregation.  
  
Regional and global aggregates:  
  
The indicator can be aggregated to the regional and global level by summing the spatial extent of land that is degraded over total land area for all countries reporting in a specific region or globally.  
  
Sources of discrepancies:  
  
Data reported by the countries themselves will follow a standardized format for UNCCD national reporting that will include the indicator and sub-indicators as well as their data sources and explanatory notes. Differences between global and national figures may arise due to differences in spatial resolution of datasets, classification approaches (i.e. definition of land cover classes) and/or contextualization with other indicators, data and information.   
  
The UNCCD reporting format helps to ensure that countries provide references for national data sources as well as associated definitions and terminology. In addition, the reporting format can accommodate more detailed analysis of the data, including any assumptions made and the methods used for estimating the indicator and sub-indicators.  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
All data are provided to UNCCD by countries in the form of a national report following a standard reporting template, which includes the quantitative data for the indicator and sub-indicators as well as a qualitative assessment of indicator trends. The reporting template ensures that countries provide the full reference for original data sources as well as national definitions and methodology.  
  
Detailed guidance on how to prepare the country reports and how to compute the indicator and sub-indicators is contained in the UNCCD reporting manual and in the Good Practice Guidance for SDG indicator 15.3.1, respectively.   
  
Quality assurance  
  
The UNCCD reporting templates has built-in quality check functionalities (e.g., range checks). Once received, national reports will undergo a review process by the UNCCD and its partners to ensure data integrity, correctness and completeness, the correct use of definitions and methodology as well as internal consistency.   
  
A help-desk system has been set up as a single point of contact for countries to get answers to questions and gain assistance on reporting issues.  
  
Data Sources  
  
  
  
Description:  
  
National data on the three sub-indicators is and can be collected through existing sources (e.g., databases, maps, reports), including participatory inventories on land management systems as well as remote sensing data collected at the national level. Datasets that complement and support existing national indicators, data and information are likely to come from multiple sources, including statistics and estimated data for administrative or national boundaries, ground measurements, Earth observation and geospatial information. A comprehensive inventory of all data sources available for each sub-indicator is contained in the Good Practice Guidance for SDG Indicator 15.3.1.   
  
The most accessible and widely used regional and global data sources for each of the sub-indicators are briefly described here.  
  
1) Land cover and land cover change data are available in the:   
  
(1) ESA-CCI-LC, containing annual land cover area data for the period 1992-2015, produced by the Catholic University of Louvain Geomatics as part of the Climate Change Initiative of the European Space Agency (ESA); or   
  
(2) SEEA-MODIS, containing annual land cover area data for the period 2001-2012, derived from the International Geosphere-Biosphere Programme (IGBP) type of the MODIS land cover dataset (MCD12Q1).  
  
2) Land productivity data represented as vegetation indices (i.e., direct observations), and their derived products are considered the most independent and robust option for the analyses of land productivity, offering the longest consolidated time series and a broad range of operational data sets at different spatial scales. The most accurate and reliable datasets are available in the:   
  
(1) MODIS data products, averaged at 1 km pixel resolution, integrated over each calendar year since 2000; and   
  
(2) Copernicus Global Land Service products, averaged at 1 km pixel resolution and integrated over each calendar year since 1998.  
  
3) Soil organic carbon stock data are available in the:   
  
(1) Harmonized World Soil Database (HWSD), Version 1.2, the latest update being the current de facto standard soil grid with a spatial resolution of about 1 km;   
  
(2) SoilGrids250m, a global 3D soil information system at 250m resolution containing spatial predictions for a selection of soil properties (at six standard depths) including SOC stock (t ha-1);  
  
(3) Global SOC Map, Version 1.0, which consists of national SOC maps, developed as 1 km soil grids, covering a depth of 0-30 cm.  
  
In the absence of, to enhance, or as a complement to national data sources, good practice suggests that the data and information derived from global and regional data sets should be interpreted and validated by national authorities. The most common validation approach involves the use of national, sub-national or site-based indicators, data and information to assess the accuracy of the sub-indicators derived from these regional and global data sources. This could include a mixed-methods approach which makes use of multiple sources of information or combines quantitative and qualitative data, including the ground-truthing of remotely sensed data using Google Earth images, field surveys or a combination of both.  
  
Collection process:  
  
Data on the indicator and sub-indicators will be provided by national authorities (“main reporting entity”) to the UNCCD in their national reports following a standard format every four years beginning in 2018 or through other national data platforms and mechanisms endorsed by the UN Statistical Commission. This will include the original data and reference sources, and descriptions of how these have been used to derive the indicator and sub-indicators. Eligible (i.e. developing) countries will receive financial and technical assistance in preparing their national reports from the UNCCD and its partners.  
  
Once received, national reports will undergo a review process by the UNCCD and its partners to ensure the correct use of definitions and methodology as well as internal consistency. A comparison can be made with past assessments and other existing data sources. Regular contacts between the main reporting entity and UNCCD secretariat via a help desk system, and through regional, sub-regional, and national workshops, will form part of this review process, enable data adjustments when needed, and contribute to building national capacities. The data will then be aggregated at sub-regional, regional and global levels by the UNCCD and its partners.  
  
Data Availability  
  
  
  
Description:  
  
In many countries, national data for one or more of the sub-indicators are available. Regional and global data are available for all three sub-indicators and can be disaggregated at the national level for interpretation and validation by national authorities. Communication and coordination with national statistical systems, NSO representatives and UNCCD national focal points in a transparent manner will include an assessment of data needs and capacity building for monitoring and reporting on the indicator when necessary.  
  
Time series:  
  
Annual since the year 2000.  
  
Calendar  
  
  
  
Data collection:  
  
The data collection process for UNCCD reporting has begun with the first reporting period scheduled for 2018 and subsequent reporting every four years.  
  
Data release:  
  
Data from the 2018 reporting period will be released by February 2019 in national, sub-regional, regional and global formats.   
  
Data providers  
  
  
  
The ministries or agencies (“main reporting entity”) that host the UNCCD National Focal Points, in conjunction with National Statistical Offices and specialized agencies, will prepare UNCCD national reports that include indicator 15.3.1 and the sub-indicators. Otherwise national data will be procured through national data platforms and mechanisms endorsed by the UN Statistical Commission.  
  
  
  
Data compilers  
  
  
  
UNCCD   
  
  
  
References  
  
  
  
All references for this indicator are provided in the footnotes  
  
  
  
Related indicators as of February 2020  
  
  
  
2.4.1; 6.6.1; 11.3.1; 15.1.1; 15.2.1  
  
5

**Ecosystem**



Left: [Coral reef](https://en.wikipedia.org/wiki/Coral_reef) ecosystems are highly [productive](https://en.wikipedia.org/wiki/Productivity_(ecology)) marine systems.,[[1]](#page7) right: [Temperate rainforest](https://en.wikipedia.org/wiki/Temperate_rainforest) on the [Olympic Peninsula](https://en.wikipedia.org/wiki/Olympic_Peninsula) in [Washington state.](https://en.wikipedia.org/wiki/Washington_(state))

An **ecosystem** is a [community](https://en.wikipedia.org/wiki/Community_(ecology)) of living organisms in conjunction with the [nonliving components](https://en.wikipedia.org/wiki/Abiotic_component) of their environment, interacting as a system.[[2]](#page7) These



[biotic](https://en.wikipedia.org/wiki/Biotic_component) and [abiotic components](https://en.wikipedia.org/wiki/Abiotic_component) are linked together through nutrient cycles and energy flows.[[3]](#page7) Energy enters the system through [photosynthesis](https://en.wikipedia.org/wiki/Photosynthesis) and is incorporated into plant tissue. By feeding on plants and on one-another, [animals](https://en.wikipedia.org/wiki/Animal) play an important role in the movement of matter and energy through the system. They also influence the quantity of plant and [microbial](https://en.wikipedia.org/wiki/Microbe) [biomass](https://en.wikipedia.org/wiki/Biomass_(ecology)) present. By breaking down dead organic matter, [decomposers](https://en.wikipedia.org/wiki/Decomposer) release carbon back to the atmosphere and facilitate [nutrient cycling](https://en.wikipedia.org/wiki/Nutrient_cycling) by converting nutrients stored in dead biomass back to a form that can be readily used by plants and other microbes.[[4]](#page7)



Ecosystems are controlled by external and internal factors. External factors such as [climate,](https://en.wikipedia.org/wiki/Climate) [parent material](https://en.wikipedia.org/wiki/Parent_material) which forms the soil and [topography,](https://en.wikipedia.org/wiki/Topography) control



the overall structure of an ecosystem but are not themselves influenced by the ecosystem.[[5]](#page7) Unlike external factors, internal factors are controlled, for example, decomposition, root competition, shading, disturbance, succession, and the types of species present.

Ecosystems are dynamic entities—they are subject to periodic disturbances and are in the process of recovering from some past disturbance.[[6]](#page7) Ecosystems in similar environments that are located in different parts of the world can end up doing things very differently simply because they have different pools of species present.[[5]](#page7) Internal factors not only control ecosystem processes but are also controlled by them and are often subject to [feedback loops.](https://en.wikipedia.org/wiki/Feedback)[[5]](#page7)



Resource inputs are generally controlled by external processes like climate and parent material. Resource availability within the ecosystem is controlled by internal factors like decomposition, root competition or shading.[[5]](#page7) Although humans operate within ecosystems, their cumulative effects are large enough to influence external factors like climate.[[5]](#page7)

[Biodiversity](https://en.wikipedia.org/wiki/Biodiversity) affects ecosystem functioning, as do the processes of [disturbance](https://en.wikipedia.org/wiki/Disturbance_(ecology)) and [succession.](https://en.wikipedia.org/wiki/Ecological_succession) Ecosystems provide a variety of [goods and services](https://en.wikipedia.org/wiki/Ecosystem_services) upon which people depend.



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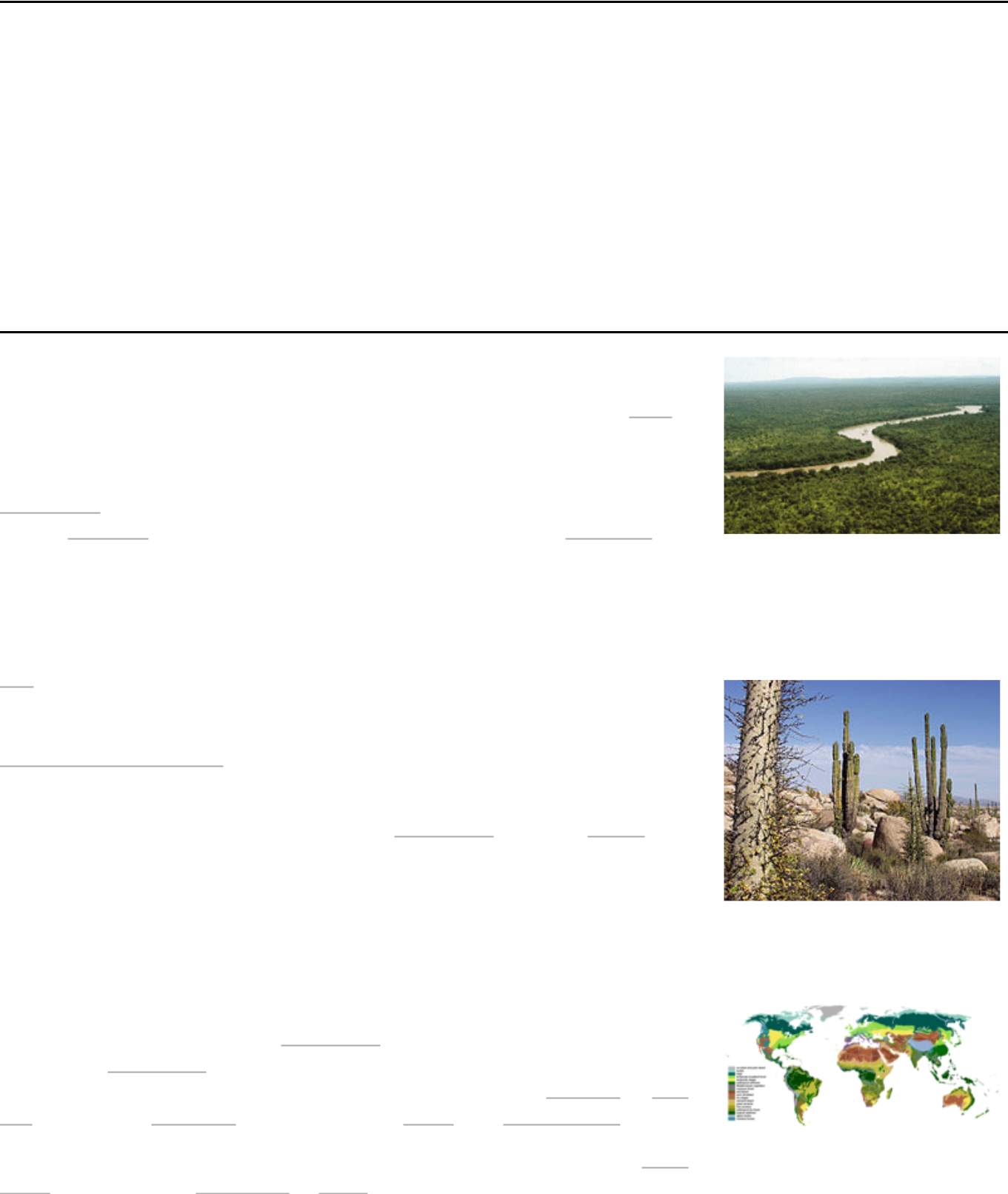
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[**Rainforest**](https://en.wikipedia.org/wiki/Rainforest) **ecosystems are rich in** [**biodiversity.**](https://en.wikipedia.org/wiki/Biodiversity) **This is the** [**Gambia River**](https://en.wikipedia.org/wiki/Gambia_River)[**in Senegal's Niokolo-Koba National**](https://en.wikipedia.org/wiki/Niokolo-Koba_National_Park)[**Park.**](https://en.wikipedia.org/wiki/Niokolo-Koba_National_Park)

[**G. Evelyn Hutchinson,**](https://en.wikipedia.org/wiki/G._Evelyn_Hutchinson) **a** [**limnologist**](https://en.wikipedia.org/wiki/Limnologist) **who was a contemporary of Tansley's, combined** [**Charles Elton's**](https://en.wikipedia.org/wiki/Charles_Sutherland_Elton) **ideas about** [**trophic**](https://en.wikipedia.org/wiki/Trophic_level) **ecology with those of Russian geochemist** [**Vladimir Vernadsky.**](https://en.wikipedia.org/wiki/Vladimir_Vernadsky) **As a result, he suggested that mineral nutrient availability in a lake limited** [**algal production.**](https://en.wikipedia.org/wiki/Algal_bloom) **This would, in turn, limit the abundance of animals that feed on algae.** [**Raymond Lindeman**](https://en.wikipedia.org/wiki/Raymond_Lindeman) **took these ideas further to suggest that the flow of energy through a lake was the primary driver of the ecosystem. Hutchinson's students, brothers** [**Howard T. Odum**](https://en.wikipedia.org/wiki/Howard_T._Odum) **and** [**Eugene P. Odum,**](https://en.wikipedia.org/wiki/Eugene_P._Odum) **further developed a "systems approach" to the study of ecosystems. This allowed them to study the flow of energy and material through ecological systems.**[**[8]**](#page7)

**including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment".**[**[9]**](#page7) **Tansley regarded ecosystems not simply as natural units, but as "mental isolates".**[**[9]**](#page7) **Tansley later defined the spatial extent of ecosystems using the term** [**ecotope.**](https://en.wikipedia.org/wiki/Ecotope)[**[10]**](#page7)

**The term ecosystem was first used in 1935 in a publication by British ecologist** [**Arthur Tansley.**](https://en.wikipedia.org/wiki/Arthur_Tansley)[**[fn**](#page7) **1][7] Tansley devised the concept to draw attention to the importance of transfers of materials between organisms and their environment.**[**[8]**](#page7) **He later refined the term, describing it as "The whole system, ...**

**History**

[**See also**](#page7)[**Notes**](#page7)[**References**](#page7)[**Literature cited**](#page8)[**External links**](#page9)

[**Threats caused by humans**](#page6)

[**Parent material**](https://en.wikipedia.org/wiki/Parent_material) **determines the nature of the soil in an ecosystem, and influences the supply of mineral nutrients.** [**Topography**](https://en.wikipedia.org/wiki/Topography) **also controls ecosystem processes by affecting things like** [**microclimate,**](https://en.wikipedia.org/wiki/Microclimate) **soil development and the movement of water through a system. For example, ecosystems can be quite different if situated in a small depression on the landscape, versus one present on an adjacent steep hillside.**[**[5]**](#page7)

**Ecosystems are controlled both by external and internal factors. External factors, also called state factors, control the overall structure of an ecosystem and the way things work within it, but are not themselves influenced by the ecosystem. The most important of these is** [**climate.**](https://en.wikipedia.org/wiki/Climate)[**[5]**](#page7) **Climate determines the** [**biome**](https://en.wikipedia.org/wiki/Biome) **in which the ecosystem is embedded. Rainfall patterns and seasonal temperatures influence photosynthesis and thereby determine the amount of water and energy available to the ecosystem.**[**[5]**](#page7)

**in an ecosystem is called the gross primary production (GPP).**[**[12]**](#page7) **About half of the GPP is consumed in plant respiration.**[**[13]**](#page7) **The remainder, that portion**

**Processes**

**Unlike external factors, internal factors in ecosystems not only control ecosystem processes but are also controlled by them. Consequently, they are often subject to** [**feedback loops.**](https://en.wikipedia.org/wiki/Feedback)[**[5]**](#page7) **While the** [**resource**](https://en.wikipedia.org/wiki/Resource_(biology)) **inputs are generally controlled by external processes like climate and parent material, the availability of these resources within the ecosystem is controlled by internal factors like decomposition, root competition or shading.**[**[5]**](#page7) **Other factors like disturbance, succession or the types of species present are also internal**

**Other external factors that play an important role in ecosystem functioning include time and potential** [**biota.**](https://en.wikipedia.org/wiki/Biota_(ecology)) **Similarly, the set of organisms that can potentially be present in an area can also significantly affect ecosystems. Ecosystems in similar environments that are located in different parts of the world can end up doing things very differently simply because they have different pools of species present.**[**[5]**](#page7) **The** [**introduction of non-native species**](https://en.wikipedia.org/wiki/Introduced_species) **can cause substantial shifts in ecosystem function.**[**[11]**](#page7)

[**Flora**](https://en.wikipedia.org/wiki/Flora) **of** [**Baja California Desert,**](https://en.wikipedia.org/wiki/Baja_California_Desert)[**Cataviña**](https://en.wikipedia.org/wiki/Cataviña) **region,** [**Mexico**](https://en.wikipedia.org/wiki/Mexico)

**factors.**

[**Through the process of photosynthesis, plants capture energy from light and use it to combine carbon**](https://en.wikipedia.org/wiki/Carbon_dioxide)[**dioxide and water to produce**](https://en.wikipedia.org/wiki/Carbon_dioxide) [**carbohydrates**](https://en.wikipedia.org/wiki/Carbohydrate) [**and**](https://en.wikipedia.org/wiki/Carbon_dioxide) [**oxygen.**](https://en.wikipedia.org/wiki/Oxygen) [**The photosynthesis carried out by all the plants**](https://en.wikipedia.org/wiki/Carbon_dioxide)

**Biomes of the world**

**Primary production is the production of** [**organic matter**](https://en.wikipedia.org/wiki/Organic_matter) **from inorganic carbon sources. This mainly occurs through** [**photosynthesis.**](https://en.wikipedia.org/wiki/Photosynthesis) **The energy incorporated through this process supports life on earth,** [**while the carbon makes up much of the organic matter in living and dead biomass, soil carbon and fossil**](https://en.wikipedia.org/wiki/Fossil_fuel)[**fuels. It also drives the**](https://en.wikipedia.org/wiki/Fossil_fuel) [**carbon cycle,**](https://en.wikipedia.org/wiki/Carbon_cycle) [**which influences global**](https://en.wikipedia.org/wiki/Fossil_fuel) [**climate**](https://en.wikipedia.org/wiki/Climate) [**via the**](https://en.wikipedia.org/wiki/Fossil_fuel) [**greenhouse effect.**](https://en.wikipedia.org/wiki/Greenhouse_effect)

**Primary production**

[of GPP that is not used up by respiration, is known as the net primary](https://en.wikipedia.org/wiki/Net_primary_production)



[production (NPP).](https://en.wikipedia.org/wiki/Net_primary_production)[[14]](#page7) [Total photosynthesis is limited by a range of](https://en.wikipedia.org/wiki/Net_primary_production) environmental factors. These include the amount of light available, the amount of [leaf](https://en.wikipedia.org/wiki/Leaf) area a plant has to capture light (shading by other plants is a major limitation of photosynthesis), rate at which carbon dioxide can be supplied to the [chloroplasts](https://en.wikipedia.org/wiki/Chloroplast) to support photosynthesis, the availability of water, and the availability of suitable temperatures for carrying out [photosynthesis.](https://en.wikipedia.org/wiki/Photosynthesis)[[12]](#page7)



**Energy flow**

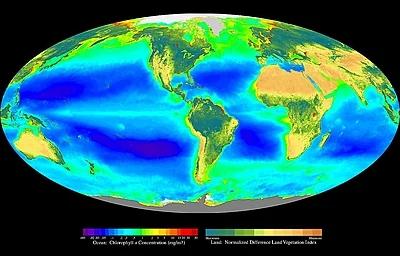
[Energy](https://en.wikipedia.org/wiki/Energy) and [carbon](https://en.wikipedia.org/wiki/Carbon) enter ecosystems through [photosynthesis,](https://en.wikipedia.org/wiki/Photosynthesis) are incorporated into living tissue, transferred to other organisms that feed on the living and dead plant matter, and eventually released through respiration.[[14]](#page7)



The carbon and energy incorporated into plant tissues (net primary production) is either consumed by animals while the plant is alive, or it remains uneaten when the plant tissue dies and becomes [detritus.](https://en.wikipedia.org/wiki/Detritus) In



Global oceanic and terrestrial [phototroph](https://en.wikipedia.org/wiki/Phototroph) abundance, from September 1997 to August 2000. As an estimate of [autotroph](https://en.wikipedia.org/wiki/Autotroph) biomass, it is only a rough indicator of primary production potential and not an actual estimate of it.



[terrestrial ecosystems,](https://en.wikipedia.org/wiki/Terrestrial_ecosystem) roughly 90% of the net primary production ends up being broken down by [decomposers.](https://en.wikipedia.org/wiki/Decomposition) The remainder is either consumed by animals while still alive and enters the plant-based trophic system, or it is consumed after it has died, and enters the detritus-based trophic system.



In [aquatic systems,](https://en.wikipedia.org/wiki/Aquatic_ecosystem) the proportion of plant biomass that gets consumed by [herbivores](https://en.wikipedia.org/wiki/Herbivore) is much higher.[[15]](#page7) In trophic systems photosynthetic organisms are the primary producers. The organisms that consume their tissues are called primary consumers or [secondary](https://en.wikipedia.org/wiki/Secondary_production) [producers—herbivores.](https://en.wikipedia.org/wiki/Herbivores) Organisms which feed on [microbes](https://en.wikipedia.org/wiki/Microbe) [(bacteria](https://en.wikipedia.org/wiki/Bacteria) and [fungi)](https://en.wikipedia.org/wiki/Fungi) are termed [microbivores.](https://en.wikipedia.org/wiki/Microbivore) Animals that feed on primary [consumers—carnivores—are](https://en.wikipedia.org/wiki/Carnivore) secondary consumers. Each of



these constitutes a [trophic level.](https://en.wikipedia.org/wiki/Trophic_level)[[15]](#page7)



The sequence of consumption—from plant to herbivore, to carnivore—forms a [food chain.](https://en.wikipedia.org/wiki/Food_chain) Real systems are much more complex than this—organisms will generally feed on more than one form of food, and may feed at more than one trophic level. Carnivores may capture some prey which are part of a plant-based trophic system and others that are part of a detritus-based trophic system (a bird that feeds both on herbivorous grasshoppers and earthworms, which consume detritus). Real systems, with all these complexities, form [food webs](https://en.wikipedia.org/wiki/Food_web) rather than food chains.[[15]](#page7) The food chain usually consist of four level of consumption which are producers, primary consumers, secondary consumers, and tertiary consumers.



**Decomposition**

The carbon and nutrients in [dead organic matter](https://en.wikipedia.org/wiki/Soil_organic_matter) are broken down by a group of processes known as [decomposition.](https://en.wikipedia.org/wiki/Decomposition) This releases nutrients that can then be re-used for plant and microbial production and returns carbon dioxide to the atmosphere (or water) where it can be used for [photosynthesis.](https://en.wikipedia.org/wiki/Photosynthesis) In the absence of decomposition, the dead organic matter would accumulate in an ecosystem, and nutrients and atmospheric carbon dioxide would be depleted.[[16]](#page7) Approximately 90% of terrestrial net primary production goes directly from plant to decomposer.[[15]](#page7)



Decomposition processes can be separated into three [categories—leaching,](https://en.wikipedia.org/wiki/Leaching_(agriculture)) fragmentation and chemical alteration of dead material. As water moves through dead organic matter, it dissolves and carries with it the water-soluble components. These are then taken up by organisms in the soil, react with mineral soil, or are transported beyond the confines of the ecosystem (and are considered lost to it).[[16]](#page7) Newly shed leaves and newly dead animals have high concentrations of water-soluble components and include [sugars,](https://en.wikipedia.org/wiki/Sugar) [amino acids](https://en.wikipedia.org/wiki/Amino_acid) and mineral nutrients. Leaching is more important in wet environments and much less important in dry ones.[[16]](#page7)



Fragmentation processes break organic material into smaller pieces, exposing new surfaces for colonization by microbes. Freshly shed [leaf litter](https://en.wikipedia.org/wiki/Leaf_litter) may be inaccessible due to an outer layer of [cuticle](https://en.wikipedia.org/wiki/Plant_cuticle) or [bark,](https://en.wikipedia.org/wiki/Bark_(botany)) and [cell contents](https://en.wikipedia.org/wiki/Protoplasm) are protected by a [cell wall.](https://en.wikipedia.org/wiki/Cell_wall) Newly dead animals may be covered by an [exoskeleton.](https://en.wikipedia.org/wiki/Exoskeleton)



Fragmentation processes, which break through these protective layers, accelerate the rate of microbial decomposition.[[16]](#page7) Animals fragment detritus as they hunt for food, as does passage through the gut. [Freeze-thaw cycles](https://en.wikipedia.org/wiki/Freeze-thaw_cycle) and cycles of wetting and drying also fragment dead material.[[16]](#page7)



The chemical alteration of the dead organic matter is primarily achieved through bacterial and fungal action. Fungal [hyphae](https://en.wikipedia.org/wiki/Hypha) produce enzymes which can break through the tough outer structures surrounding dead plant material. They also produce enzymes which break down [lignin,](https://en.wikipedia.org/wiki/Lignin) which allows them access to both cell contents and to the nitrogen in the lignin. Fungi can transfer carbon and nitrogen through their hyphal networks and thus, unlike bacteria, are not dependent solely on locally available resources.[[16]](#page7)



Decomposition rates vary among ecosystems.[[17]](#page7) The rate of decomposition is governed by three sets of factors—the physical environment (temperature, moisture, and soil properties), the quantity and quality of the dead material available to decomposers, and the nature of the microbial community itself.[[18]](#page7) Temperature controls the rate of microbial respiration; the higher the temperature, the faster microbial decomposition occurs. It also affects soil moisture, which slows microbial growth and reduces leaching. Freeze-thaw cycles also affect decomposition—freezing temperatures kill soil microorganisms, which allows leaching to play a more important role in moving nutrients around. This can be especially important as the soil thaws in the spring, creating a pulse of nutrients which become available.[[18]](#page7)

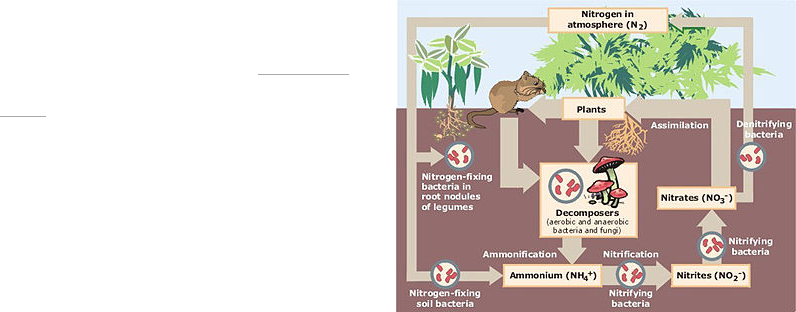
Decomposition rates are low under very wet or very dry conditions. Decomposition rates are highest in wet, moist conditions with adequate levels of oxygen. Wet soils tend to become deficient in oxygen (this is especially true in [wetlands),](https://en.wikipedia.org/wiki/Wetland) which slows microbial growth. In dry soils, decomposition



slows as well, but bacteria continue to grow (albeit at a slower rate) even after soils become too dry to support plant growth.[[18]](#page7)

**Nutrient cycling**

Ecosystems continually exchange energy and carbon with the wider [environment.](https://en.wikipedia.org/wiki/Environment_(systems)) Mineral nutrients, on the other hand, are mostly cycled back and forth between plants, animals, microbes and the soil. Most nitrogen enters ecosystems through biological [nitrogen fixation,](https://en.wikipedia.org/wiki/Nitrogen_fixation) is deposited through precipitation, dust, gases or is applied as [fertilizer.](https://en.wikipedia.org/wiki/Fertilizer)[[19]](#page7)



[Since most terrestrial ecosystems are nitrogen-limited, nitrogen](https://en.wikipedia.org/wiki/Nitrogen_cycle) [cycling is an important control on ecosystem production.](https://en.wikipedia.org/wiki/Nitrogen_cycle)[[19]](#page7)



Until modern times, nitrogen fixation was the major source of nitrogen for ecosystems. Nitrogen-fixing bacteria either live [symbiotically](https://en.wikipedia.org/wiki/Symbiosis) with plants or live freely in the soil. The energetic cost is high for plants which support nitrogen-fixing symbionts—as much as 25% of gross primary production when measured in controlled conditions. Many members of the [legume](https://en.wikipedia.org/wiki/Legume) plant family support nitrogen-fixing symbionts. Some [cyanobacteria](https://en.wikipedia.org/wiki/Cyanobacteria) are also capable of nitrogen fixation. These are [phototrophs,](https://en.wikipedia.org/wiki/Phototroph) which carry out photosynthesis. Like other nitrogen-fixing bacteria, they can either be



Biological nitrogen cycling

[free-living or have symbiotic relationships with plants.](https://en.wikipedia.org/wiki/Fossil_fuel)[[19]](#page7) [Other sources of nitrogen include acid deposition produced through the combustion of fossil](https://en.wikipedia.org/wiki/Fossil_fuel)



[fuels,](https://en.wikipedia.org/wiki/Fossil_fuel) [ammonia](https://en.wikipedia.org/wiki/Ammonia) [gas which evaporates from agricultural fields which have had fertilizers applied to them, and dust.](https://en.wikipedia.org/wiki/Fossil_fuel)[[19]](#page7) [Anthropogenic nitrogen inputs](https://en.wikipedia.org/wiki/Fossil_fuel)



account for about 80% of all nitrogen fluxes in ecosystems.[[19]](#page7)

When plant tissues are shed or are eaten, the nitrogen in those tissues becomes available to animals and microbes. Microbial decomposition releases nitrogen compounds from dead organic matter in the soil, where plants, fungi, and bacteria compete for it. Some soil bacteria use organic nitrogen-containing compounds as a source of carbon, and release [ammonium](https://en.wikipedia.org/wiki/Ammonium) ions into the soil. This process is known as [nitrogen mineralization.](https://en.wikipedia.org/wiki/Ammonification) Others convert



ammonium to [nitrite](https://en.wikipedia.org/wiki/Nitrite) and [nitrate](https://en.wikipedia.org/wiki/Nitrate) ions, a process known as [nitrification.](https://en.wikipedia.org/wiki/Nitrification) [Nitric oxide](https://en.wikipedia.org/wiki/Nitric_oxide) and [nitrous oxide](https://en.wikipedia.org/wiki/Nitrous_oxide) are also produced during nitrification.[[19]](#page7) Under nitrogen-rich and oxygen-poor conditions, nitrates and nitrites are converted to [nitrogen gas,](https://en.wikipedia.org/wiki/Nitrogen) a process known as [denitrification.](https://en.wikipedia.org/wiki/Denitrification)[[19]](#page7)



Other important nutrients include [phosphorus,](https://en.wikipedia.org/wiki/Phosphorus) [sulfur,](https://en.wikipedia.org/wiki/Sulfur) [calcium,](https://en.wikipedia.org/wiki/Calcium) [potassium,](https://en.wikipedia.org/wiki/Potassium) [magnesium](https://en.wikipedia.org/wiki/Magnesium) and [manganese.](https://en.wikipedia.org/wiki/Manganese)[[20][17]](#page7) Phosphorus enters ecosystems through



[weathering.](https://en.wikipedia.org/wiki/Weathering) As ecosystems age this supply diminishes, making phosphorus-limitation more common in older landscapes (especially in the tropics).[[20]](#page8) Calcium and sulfur are also produced by weathering, but acid deposition is an important source of sulfur in many ecosystems. Although magnesium and manganese are produced by weathering, exchanges between soil organic matter and living cells account for a significant portion of ecosystem fluxes. Potassium is primarily cycled between living cells and soil organic matter.[[20]](#page8)



**Function and biodiversity**

[Biodiversity](https://en.wikipedia.org/wiki/Biodiversity) plays an important role in ecosystem functioning.[[22]](#page8) The reason for this is that ecosystem processes are driven by the number of species in



an ecosystem, the exact nature of each individual species, and the relative abundance organisms within these species.[[23]](#page8) Ecosystem processes are broad generalizations that actually take place through the actions of individual organisms. The nature of the organisms—the species, [functional groups](https://en.wikipedia.org/wiki/Functional_group_(ecology)) and trophic levels to which they belong—dictates the sorts of actions these individuals are capable of carrying out and the relative efficiency with which they do so.



Ecological theory suggests that in order to coexist, species must have some level of [limiting similarity—](https://en.wikipedia.org/wiki/Limiting_similarity) they must be different from one another in some fundamental way, otherwise one species would [competitively exclude](https://en.wikipedia.org/wiki/Competitive_exclusion) the other.[[24]](#page8) Despite this, the cumulative effect of additional species in an ecosystem is not linear—additional species may enhance nitrogen retention, for example, but beyond some level of species richness, additional species may have little additive effect.[[23]](#page8)



The addition (or loss) of species which are ecologically similar to those already present in an ecosystem tends to only have a small effect on ecosystem function. Ecologically distinct species, on the other hand, have a much larger effect. Similarly, dominant species have a large effect on ecosystem function, while rare species tend to have a small effect. [Keystone species](https://en.wikipedia.org/wiki/Keystone_species) tend to have an effect on ecosystem function



that is disproportionate to their abundance in an ecosystem.[[23]](#page8) Similarly, an [ecosystem engineer](https://en.wikipedia.org/wiki/Ecosystem_engineer) is any [organism](https://en.wikipedia.org/wiki/Organism) that creates, significantly modifies, maintains or destroys a [habitat.](https://en.wikipedia.org/wiki/Habitat_(ecology))



**Dynamics**

Ecosystems are dynamic entities. They are subject to periodic disturbances and are in the process of recovering from some past disturbance.[[6]](#page7) When a [perturbation](https://en.wikipedia.org/wiki/Perturbation_(biology)) occurs, an ecosystem responds by moving away from its initial state. The tendency of an ecosystem to remain close to its equilibrium state, despite that disturbance, is termed its [resistance.](https://en.wikipedia.org/wiki/Resistance_(ecology)) On the other hand, the speed with which it returns to its



initial state after disturbance is called its [resilience.](https://en.wikipedia.org/wiki/Resilience_(ecology))[[6]](#page7) Time plays a role in the development of soil from bare rock and the [recovery of a community from disturbance.](https://en.wikipedia.org/wiki/Ecological_succession)[[5]](#page7)



From one year to another, ecosystems experience variation in their biotic and abiotic environments. A drought, a colder than usual winter, and a pest outbreak all are short-term variability in environmental conditions. Animal populations vary from year to year, building up during resource-rich periods and [crashing as they overshoot their food supply. These changes play out in changes in net primary](https://en.wikipedia.org/wiki/Net_primary_production)



[production](https://en.wikipedia.org/wiki/Net_primary_production) [decomposition](https://en.wikipedia.org/wiki/Decomposition) [rates, and other ecosystem processes.](https://en.wikipedia.org/wiki/Net_primary_production)[[6]](#page7) [Longer-term changes also shape](https://en.wikipedia.org/wiki/Net_primary_production) ecosystem processes—the forests of eastern North America still show legacies of cultivation which ceased 200 years ago, while [methane](https://en.wikipedia.org/wiki/Methane) production in eastern [Siberian](https://en.wikipedia.org/wiki/Siberia) lakes is controlled by organic matter



which accumulated during the [Pleistocene.](https://en.wikipedia.org/wiki/Pleistocene)[[6]](#page7)



[Loch Lomond](https://en.wikipedia.org/wiki/Loch_Lomond) in [Scotland](https://en.wikipedia.org/wiki/Scotland) forms a relatively isolated ecosystem. The fish community of this lake has remained stable over a long period until a number of [introductions](https://en.wikipedia.org/wiki/Introduced_species) in the 1970s restructured its [food web.](https://en.wikipedia.org/wiki/Food_web)[[21]](#page8)



Spiny forest at Ifaty, [Madagascar,](https://en.wikipedia.org/wiki/Madagascar) featuring various [*Adansonia*](https://en.wikipedia.org/wiki/Adansonia) (baobab) species, [*Alluaudia procera*](https://en.wikipedia.org/wiki/Alluaudia_procera) (Madagascar ocotillo) and other vegetation.

[Disturbance](https://en.wikipedia.org/wiki/Disturbance_(ecology)) also plays an important role in ecological processes. [F. Stuart Chapin](https://en.wikipedia.org/wiki/F._Stuart_Chapin_III) and coauthors define disturbance as "a relatively discrete event in time and space that alters the structure of populations, communities, and ecosystems and causes changes in resources availability or the physical environment".[[25]](#page8) This can range from tree falls and insect outbreaks to hurricanes and wildfires to volcanic eruptions. Such disturbances can cause large changes in plant, animal and microbe populations, as well soil organic matter content.[[6]](#page7) Disturbance is followed by [succession,](https://en.wikipedia.org/wiki/Ecological_succession) a "directional change in ecosystem structure and functioning resulting from biotically driven changes in resources supply."[[25]](#page8)



The frequency and severity of disturbance determine the way it affects ecosystem function. A major disturbance like a volcanic eruption or [glacial](https://en.wikipedia.org/wiki/Glacier) [advance and retreat leave behind soils that lack plants, animals or organic matter. Ecosystems that experience such disturbances undergo primary](https://en.wikipedia.org/wiki/Primary_succession)



[succession. A less severe disturbance like forest fires, hurricanes or cultivation result in](https://en.wikipedia.org/wiki/Primary_succession) [secondary succession](https://en.wikipedia.org/wiki/Secondary_succession) [and a faster recovery.](https://en.wikipedia.org/wiki/Primary_succession)[[6]](#page7) [More severe](https://en.wikipedia.org/wiki/Primary_succession) disturbance and more frequent disturbance result in longer recovery times.[[6]](#page7)



A [freshwater](https://en.wikipedia.org/wiki/Freshwater) lake in [Gran Canaria,](https://en.wikipedia.org/wiki/Gran_Canaria) an [island](https://en.wikipedia.org/wiki/Island) of the [Canary Islands.](https://en.wikipedia.org/wiki/Canary_Islands) Clear boundaries make lakes convenient to study using an ecosystem approach.

**Ecosystem ecology**



Ecosystem ecology studies the processes and dynamics of ecosystems, and the way the flow of matter and energy through them structures natural systems. The study of ecosystems can cover 10 [orders of magnitude,](https://en.wikipedia.org/wiki/Order_of_magnitude) from the surface layers of rocks to the surface of the planet.[[26]](#page8)





[degradation, and](https://en.wikipedia.org/wiki/Soil_retrogression_and_degradation) [deforestation.](https://en.wikipedia.org/wiki/Deforestation) [For](https://en.wikipedia.org/wiki/Soil_retrogression_and_degradation) [aquatic ecosystems](https://en.wikipedia.org/wiki/Aquatic_ecosystems) [threats include also unsustainable exploitation of marine resources (for example](https://en.wikipedia.org/wiki/Soil_retrogression_and_degradation) [overfishing](https://en.wikipedia.org/wiki/Overfishing) [of](https://en.wikipedia.org/wiki/Soil_retrogression_and_degradation) certain species), [marine pollution,](https://en.wikipedia.org/wiki/Marine_pollution) [microplastics](https://en.wikipedia.org/wiki/Microplastics) pollution, [water pollution,](https://en.wikipedia.org/wiki/Water_pollution) the warming of oceans, and building on coastal areas.[[39]](#page8)



[**Ecosystem services,**](https://en.wikipedia.org/wiki/Ecosystem_services) **on the other hand, are generally "improvements in the condition or location of things of value".**[**[36]**](#page8) **These include things like the maintenance of hydrological cycles, cleaning air and water, the maintenance of oxygen in the atmosphere, crop** [**pollination**](https://en.wikipedia.org/wiki/Pollination) **and even things like beauty, inspiration and opportunities for research.**[**[35]**](#page8) **While material from the ecosystem had traditionally been recognized as being the basis for things of economic value, ecosystem services tend to be taken for**

**Ecosystem management**

**When** [**natural resource management**](https://en.wikipedia.org/wiki/Natural_resource_management) **is applied to whole ecosystems, rather than single species, it is termed** [**ecosystem management.**](https://en.wikipedia.org/wiki/Ecosystem_management)[**[37]**](#page8) **Although definitions of ecosystem management abound, there is a common set of principles which underlie these definitions.**[**[38]**](#page8) **A fundamental principle is the long-term** [**sustainability**](https://en.wikipedia.org/wiki/Sustainability) **of the production of goods and services by the ecosystem;**[**[38]**](#page8) **"intergenerational sustainability [is] a precondition for management, not an afterthought".**[**[35]**](#page8)

**While ecosystem management can be used as part of a plan for** [**wilderness**](https://en.wikipedia.org/wiki/Wilderness) **conservation, it can also be used in intensively managed ecosystems**[**[35]**](#page8) **(see, for example,** [**agroecosystem**](https://en.wikipedia.org/wiki/Agroecosystem) **and** [**close to nature forestry)**](https://en.wikipedia.org/wiki/Close_to_nature_forestry)**.**

**Threats caused by humans**

[**As human population and per capita consumption grow, so do the resource demands imposed on ecosystems and the effects of the human ecological**](https://en.wikipedia.org/wiki/Ecological_footprint)[**footprint. Natural resources are vulnerable and limited. The environmental impacts of**](https://en.wikipedia.org/wiki/Ecological_footprint) [**anthropogenic**](https://en.wikipedia.org/wiki/Human_impact_on_the_environment) [**actions are becoming more apparent. Problems for**](https://en.wikipedia.org/wiki/Ecological_footprint)[**all ecosystems include: environmental pollution, climate change and biodiversity loss. For terrestrial ecosystems further threats include air pollution, soil**](https://en.wikipedia.org/wiki/Soil_retrogression_and_degradation)

**granted.**[**[36]**](#page8)

**The** [**High Peaks Wilderness Area**](https://en.wikipedia.org/wiki/High_Peaks_Wilderness_Area) **in the 6,000,000-acre (2,400,000 ha)** [**Adirondack Park**](https://en.wikipedia.org/wiki/Adirondack_Park) **is an example of a diverse ecosystem.**

**There is no single definition of what constitutes an ecosystem.**[**[27]**](#page8) **German ecologist Ernst-Detlef Schulze and coauthors defined an ecosystem as an area which is "uniform regarding the biological turnover, and contains all the fluxes above and below the ground area under consideration." They explicitly reject** [**Gene Likens'**](https://en.wikipedia.org/wiki/Gene_Likens) **use of entire** [**river catchments**](https://en.wikipedia.org/wiki/Drainage_basin) **as "too wide a demarcation" to be a single ecosystem, given the level of heterogeneity within such an area.**[**[28]**](#page8) **Other authors have suggested that an ecosystem can encompass a much larger area, even the whole planet.**[**[29]**](#page8) **Schulze and coauthors also rejected the idea that a single rotting log could be studied as an ecosystem because the size of the flows between the log and its surroundings are too large, relative to the proportion cycles within the log.**[**[28]**](#page8) **Philosopher of science Mark Sagoff considers the failure to define "the kind of object it studies" to be an obstacle to the development of theory in** [**ecosystem ecology.**](https://en.wikipedia.org/wiki/Ecosystem_ecology)[**[27]**](#page8)

**Ecosystems provide a variety of goods and services upon which people depend.**[**[35]**](#page8) **Ecosystem goods include the "tangible, material products" of ecosystem processes such as food, construction material, medicinal plants.**[**[36]**](#page8) **They also include less tangible items like** [**tourism**](https://en.wikipedia.org/wiki/Tourism) **and recreation, and genes from wild plants and animals that can be used to improve domestic species.**[**[35]**](#page8)

**Ecosystems can be studied through a variety of approaches—theoretical studies, studies monitoring specific ecosystems over long periods of time, those that look at differences between ecosystems to**

**elucidate how they work and direct manipulative experimentation.**[**[30]**](#page8) **Studies can be carried out at a variety of scales, ranging from whole-ecosystem studies to studying** [**microcosms**](https://en.wikipedia.org/wiki/Microcosm:_Model_/_experimental_ecosystem) **or** [**mesocosms**](https://en.wikipedia.org/wiki/Mesocosm) **(simplified representations of ecosystems).**[**[31]**](#page8) **American ecologist** [**Stephen R. Carpenter**](https://en.wikipedia.org/wiki/Stephen_R._Carpenter) **has argued that microcosm experiments can be "irrelevant and diversionary" if they are not carried out in conjunction with field studies done at the ecosystem scale. Microcosm experiments often fail to accurately predict ecosystem-level dynamics.**[**[32]**](#page8)

**The** [**Hubbard Brook Ecosystem Study**](https://en.wikipedia.org/wiki/Hubbard_Brook_Ecosystem_Study) **started in 1963 to study the** [**White Mountains in New Hampshire.**](https://en.wikipedia.org/wiki/White_Mountains_(New_Hampshire)) **It was the first successful attempt to study an entire** [**watershed**](https://en.wikipedia.org/wiki/Watershed_management) **as an ecosystem. The study used stream** [**chemistry**](https://en.wikipedia.org/wiki/Chemistry) **as a means of monitoring ecosystem properties, and developed a detailed** [**biogeochemical model**](https://en.wikipedia.org/wiki/Biogeochemistry) **of the ecosystem.**[**[33]**](#page8) [**Long-term research**](https://en.wikipedia.org/wiki/Long_Term_Ecological_Research_Network) **at the site led to the discovery of** [**acid rain**](https://en.wikipedia.org/wiki/Acid_rain) **in North America in 1972. Researchers documented the depletion of soil** [**cations**](https://en.wikipedia.org/wiki/Cations) **(especially calcium) over the next several decades.**[**[34]**](#page8)

**Human activities**

**Human activities are important in almost all ecosystems. Although humans exist and operate within ecosystems, their cumulative effects are large enough to influence external factors like climate.**[**[5]**](#page7)

**A** [**hydrothermal vent**](https://en.wikipedia.org/wiki/Hydrothermal_vent) **is an ecosystem on the ocean floor. (The scale bar is 1 m.)**

**Ecosystem goods and services**

Society is increasingly becoming aware that [ecosystem services](https://en.wikipedia.org/wiki/Ecosystem_services) are not only limited but also that they are threatened by human activities. The need to



better consider long-term [ecosystem health](https://en.wikipedia.org/wiki/Ecosystem_health) and its role in enabling human habitation and economic activity is urgent. To help inform decision-makers, many ecosystem services are being assigned economic values, often based on the cost of replacement with anthropogenic alternatives. The ongoing challenge of prescribing economic value to nature, for example through [biodiversity banking,](https://en.wikipedia.org/wiki/Biodiversity_banking) is prompting transdisciplinary shifts in how we recognize and manage the environment, [social responsibility,](https://en.wikipedia.org/wiki/Social_responsibility) business opportunities, and our future as a species.



**See also**



[Biosphere](https://en.wikipedia.org/wiki/Biosphere)



[Climate change](https://en.wikipedia.org/wiki/Climate_change)



[Complex system](https://en.wikipedia.org/wiki/Complex_system)



[Earth science](https://en.wikipedia.org/wiki/Earth_science)



[Ecocide](https://en.wikipedia.org/wiki/Ecocide)



[Ecosystem services](https://en.wikipedia.org/wiki/Ecosystem_services)



[Forest ecology](https://en.wikipedia.org/wiki/Forest_ecology)



[Human ecology](https://en.wikipedia.org/wiki/Human_ecology)



[Nature-based solutions](https://en.wikipedia.org/wiki/Nature-based_solutions)



[Novel ecosystem](https://en.wikipedia.org/wiki/Novel_ecosystem)



**Notes**



1. The term ecosystem was actually coined by [Arthur Roy Clapham](https://en.wikipedia.org/wiki/Arthur_Roy_Clapham), who came up with the word at Tansley's request (Willis 1997).

