

# Manual of the Basic Set of Environment Statistics of the FDES 2013



## Ecosystems and Biodiversity Statistics

(Topic 1.2.2: Ecosystems and biodiversity)

*Elaborated by the Environment Statistics Section  
of the United Nations Statistics Division,  
in collaboration with the  
Expert Group on Environment Statistics*

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Methodology sheet of the Basic Set of Environment Statistics of the FDES

[https://unstats.un.org/unsd/envstats/fdes/manual\\_bses.cshtml](https://unstats.un.org/unsd/envstats/fdes/manual_bses.cshtml)

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# 1. Statistics in Topic 1.2.2. Ecosystems and biodiversity

## Component 1: Environmental Conditions and Quality

### Sub-component 1.2: Land Cover, Ecosystems and Biodiversity

#### Topic 1.2.2: Ecosystems and biodiversity

Statistics and Related Information ( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )		Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a.	General ecosystem characteristics, extent and pattern		<ul style="list-style-type: none"> <li>▪ By location</li> <li>▪ By ecosystem (e.g., forest, cultivated, dryland, coastal, marine, urban, polar, inland water, island, mountain)<sup>(b)</sup></li> </ul>	<ul style="list-style-type: none"> <li>▪ Millennium Ecosystem Assessment</li> <li>▪ Convention on Biological Diversity (CBD)</li> <li>▪ UN Economic Commission for Europe (UNECE) Standard Statistical Classification of Flora, Fauna and Biotopes (1996)</li> <li>▪ Convention on Wetlands of International Importance, especially as Waterfowl Habitat (the Ramsar Convention)</li> </ul>
	1. <b>Area of ecosystems</b>	Area		
	2. <i>Proximity of ecosystem to urban areas and cropland</i>	Distance		
b.	Ecosystems' chemical and physical characteristics		<ul style="list-style-type: none"> <li>▪ By ecosystem (e.g., forest, cultivated, dryland, coastal, marine, urban, polar, inland water, island, mountain)<sup>(b)</sup></li> <li>▪ By status category (e.g., extinct, extinct in the wild, threatened, near threatened, least concern)</li> <li>▪ By class (e.g., mammals, fishes, birds, reptiles)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Millennium Ecosystem Assessment</li> <li>▪ CBD</li> <li>▪ International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species</li> <li>▪ UNECE Standard Statistical Classification of Flora, Fauna and Biotopes (1996)</li> <li>▪ FAO FISHSTAT (Species population and number of invasive alien species)</li> </ul>
	1. <i>Nutrients</i>	Concentration		
	2. <i>Carbon</i>	Concentration		
	3. <i>Pollutants</i>	Concentration		
c.	Biodiversity		<ul style="list-style-type: none"> <li>▪ By ecosystem (e.g., forest, cultivated, dryland, coastal, marine, urban, polar, inland water, island, mountain)<sup>(b)</sup></li> <li>▪ By status category (e.g., extinct, extinct in the wild, threatened, near threatened, least concern)</li> <li>▪ By class (e.g., mammals, fishes, birds, reptiles)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Millennium Ecosystem Assessment</li> <li>▪ CBD</li> <li>▪ International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species</li> <li>▪ UNECE Standard Statistical Classification of Flora, Fauna and Biotopes (1996)</li> <li>▪ FAO FISHSTAT (Species population and number of invasive alien species)</li> </ul>
	1. <b>Known flora and fauna species</b>	Number		
	2. Endemic flora and fauna species	Number		
	3. Invasive alien flora and fauna species	Number		
	4. Species population	Number		
	5. <i>Habitat fragmentation</i>	Area, Description, Location, Number		

			<ul style="list-style-type: none"> <li>▪ National</li> <li>▪ Sub-national</li> </ul>	
d.	Protected areas and species		<ul style="list-style-type: none"> <li>▪ By location</li> <li>▪ By management category<sup>(c)</sup></li> <li>▪ By ecosystem (e.g., forest, cultivated, dryland, coastal, marine, urban, polar, inland water, island, mountain)<sup>(b)</sup></li> <li>▪ National</li> <li>▪ Sub-national</li> </ul>	<ul style="list-style-type: none"> <li>▪ IUCN Protected Area Management Categories</li> <li>▪ UNSD: Millennium Development Goal (MDG) Indicator 7.6 Metadata</li> </ul>
	1. <b>Protected terrestrial and marine area</b> (also in 1.2.3.a)	Number, Area	<ul style="list-style-type: none"> <li>▪ By species</li> <li>▪ By ecosystem (e.g., forest, cultivated, dryland, coastal, marine, urban, polar, inland water, island, mountain)<sup>(b)</sup></li> <li>▪ By status category</li> <li>▪ National</li> <li>▪ Sub-national</li> </ul>	<ul style="list-style-type: none"> <li>▪ IUCN Red List of Threatened Species</li> <li>▪ UNSD: MDG Indicator 7.7 Metadata</li> </ul>
	2. Protected flora and fauna species	Number	<ul style="list-style-type: none"> <li>▪ By species</li> <li>▪ By ecosystem (e.g., forest, cultivated, dryland, coastal, marine, urban, polar, inland water, island, mountain)<sup>(b)</sup></li> <li>▪ By status category</li> <li>▪ National</li> <li>▪ Sub-national</li> </ul>	<ul style="list-style-type: none"> <li>▪ IUCN Red List of Threatened Species</li> <li>▪ UNSD: MDG Indicator 7.7 Metadata</li> </ul>
<p>(a) SEEA land cover categories, based on FAO Land Cover Classification System (<a href="http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA_CF_Final_en.pdf">http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA_CF_Final_en.pdf</a>)</p> <p>(b) Reporting categories used in the Millennium Ecosystem Assessment (<a href="http://www.millenniumassessment.org/documents/document_356.aspx.pdf">http://www.millenniumassessment.org/documents/document_356.aspx.pdf</a>)</p> <p>(c) IUCN reporting categories: Strict nature reserves; Wilderness areas; National parks, Natural monuments or features; Habitat/species management areas; Protected landscapes/seascapes; and Protected areas with sustainable use of natural resources (<a href="http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/">http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/</a>)</p>				

## 2. Introduction/Relevance

Ecosystems are essential for life. Ecosystems provide provisioning services, regulatory services, habitat and supporting services and cultural services. Natural ecosystems are currently under threat from climate change, pollution, land use change, human settlement encroachment, over-exploitation and invasive species. Natural ecosystems are defined by their location, their extent, their quality and their components.

The 1992 Earth Summit in Rio De Janeiro, Brazil was credited with a transformational shift toward global recognition of the linkage between ecosystems, the environment and development, with its plan of action to promote sustainable development outlined in Agenda 21.<sup>1</sup> The Earth Summit also resulted in the multilateral agreement of the Convention of Biological Diversity (CBD) as the first treaty in international law focusing on biodiversity. The CBD provides a mechanism to realize sustainable development and the principles of Agenda 21. Further recognition of the importance of ecosystems and biodiversity resulted in subsequent multilateral environmental agreements aimed at protecting ecosystems and biodiversity, including the Convention on International Trade in Endangered Species (CITES),<sup>2</sup> the Convention on the Conservation of Migratory Species of Wild Animals (CMS),<sup>3</sup> and the Ramsar Convention on Wetlands.<sup>4</sup> These remain key multilateral agreements for the preservation of ecosystems and biodiversity with the International Union for Conservation of Nature (IUCN) as a key international organisation in the area of environmental protection and management.

There has been global recognition of the importance of ecosystems and biodiversity and the linkages between ecosystems and the economic and social aspects of development. However, holistic measurement of ecosystems remains a challenge. Valuable examples of the type of data needed for protection and conservation of ecosystems and biodiversity are the IUCN's Red List of Threatened Species<sup>5</sup> (which is a key tool in tracking progress on the CBD) and data on the designation of protected areas<sup>6</sup> which are recognized worldwide as the main sources of global data on the conservation of species and ecosystems.

Development of national policy to protect ecosystems and biodiversity requires time series data on the presence, abundance and condition of biodiversity; measurement of the interactions between organisms; capture of the drivers of biodiversity changes; and statistics on terrestrial, freshwater and marine areas. This provides information on genetic variation of and within species, species assemblages, and the health of the ecosystem itself, which is needed for monitoring endangered populations, evaluating conservation priorities of an area, and bioprospecting. However, due to the complex nature of ecosystems and biodiversity there is often a lack of statistics and information.

Ecosystem extent is directly linked to land use. Every country has a finite area of land and all land use decisions are interconnected. Agricultural land or land for human settlements cannot increase without a decrease in another land type,

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<sup>1</sup> United Nations Conference on Environment and Development (1992) *Rio Declaration on Environment and Development 1992*, A/CONF.151/26 (Vol.I), <http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm> (accessed 08 January 2018)

<sup>2</sup> United Nations (1973) *Convention on International Trade in Endangered Species of Wild Fauna and Flora*, Vol.993, I-14537, <https://www.cites.org/eng/disc/text.php> (accessed 08 January 2018)

<sup>3</sup> United Nations (1979) *Convention on the Conservation of Migratory Species of Wild Animals*. Bonn Convention. CMS, webpage CMS Convention on the Conservation of Migratory Species of Wild Animals, <http://www.cms.int/> (accessed 08 January 2018)

<sup>4</sup> United Nations (1971) *Convention on Wetlands of International Importance especially as Waterfowl Habitat. Ramsar (Iran)*, 2 February 1971. UN Treaty Series No. 14583. As amended by the Paris Protocol, 3 December 1982, and Regina Amendments, 28 May 1987, webpage Ramsar Convention on Wetlands, [www.ramsar.org](http://www.ramsar.org) (accessed 07 January 2018)

<sup>5</sup> International Union for Conservation of Nature, *IUCN Red List of Threatened Species* webpage <https://www.iucnredlist.org/> (accessed 08 January 2018)

<sup>6</sup> Protected Planet *Protected Planet world database on protected areas*, webpage <https://www.protectedplanet.net/> (accessed 08 January 2018)

typically a decrease in natural ecosystems. Increases in the volume of land used for agriculture, industry and human settlements are typically coupled with an increase in chemical and waste residuals flowing into natural ecosystems. As natural ecosystems decrease and pressure on ecosystems increases, these ecosystems may no longer be able to meet the regulatory service demands of a country in terms of water purification, climate regulation and soil nutrient stabilization. Residuals which exceed the regulatory ability of natural ecosystems have direct impacts on water, air and soil quality. Therefore, statistics describing the goods and services provided by ecosystems, included in Component 2: Environmental resources and their use and Component 3: Residuals, are needed to provide the comprehensive picture required for environmental decision making.

Topic 1.2.2 Ecosystems and Biodiversity covers the extent, the chemical and physical characteristics and the biological components (biodiversity) of the ecosystems:<sup>7</sup>

- Extent (location and size) and pattern describe the spatial area of ecosystems and how they intermingle across the landscape (e.g., area of wetlands, rivers and streams, the proximity of croplands to residences and habitat fragmentation).
- The chemical and physical characteristics report on nutrients, carbon, oxygen, contaminants and key physical trends (e.g., the amount of nitrogen that major rivers deliver to the nation's coastal waters, soil nutrient depletion and cropland erosion).
- Biological components (biodiversity) provide information on the diversity and conditions of plants, animals and living habitats (e.g., number of known species or species at risk of extinction). Ecosystem goods and services describe the flows that humanity derives from ecosystems (e.g., amount of timber harvested).<sup>8</sup>

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<sup>7</sup> United Nations Statistics Division (2017) *Framework for the Development of Environment Statistics (FDES 2013)*, <https://unstats.un.org/unsd/environment/fdes/FDES-2015-supporting-tools/FDES.pdf> (accessed 08 January 2018)

<sup>8</sup> H. John Heinz III Center for Science, Economics, and the Environment (2008) *The State of the Nation's Ecosystems: Measuring the Lands, Waters, and Living Resources of the United States*, Island Press: Washington, D.C.: Island Press

# 3. Definitions and description of the statistics

## Ecosystem

An **ecosystem** is defined as a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.<sup>9</sup>

The operation of ecosystems involves processes such as the capture of light, energy and carbon through photosynthesis, the transfer of carbon and energy through food webs, and the release of nutrients and carbon through decomposition. Biodiversity affects ecosystem functioning, as do the changes arising from disturbances and succession. The principles of ecosystem science suggest that natural resources management should be conducted at the level of the ecosystem rather than at the level of the individual species.<sup>10</sup> However, a standard and internationally-agreed definition for ecosystem types does not exist.<sup>11</sup>

For monitoring ecosystem extent and quality, individual countries may wish to develop and tailor ecosystem definitions to meet their needs. Ecosystem monitoring may occur at the national level or by biogeographical regions, river basins/sub-basins. Ecosystem boundaries and ecosystem extent should be defined by areas which are relatively homogenous in terms of providing ecosystem services (further detail is provided under the definition of area of ecosystem - FDES 1.2.2.a.1). Within different ecosystem areas, the chemical and physical characteristics of the ecosystem and the biodiversity are often also monitored.

## Biodiversity

**Biodiversity** is “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.”<sup>12</sup>

Statistics on biodiversity include statistics on the diversity of endemic and naturally occurring flora and fauna species, as well as information on invasive species. Endemic species refer to those native to, and restricted to, a geographical region<sup>13</sup> such as an island, or country, or specific ecosystem. Therefore, organisms that are indigenous to a place are not endemic to it if they are also found elsewhere. Invasive species are defined as a subset of introduced species or non-native species that are rapidly expanding outside of their native range.<sup>14</sup>

Typically, these statistics include the diversity of flora and fauna species (the plant and animal life of a particular region or time, generally regarded as that which is naturally occurring and indigenous). Typical themes include the number and

<sup>9</sup> United Nations (1992) *Convention on Biological Diversity*, <https://www.cbd.int/doc/legal/cbd-en.pdf> (accessed 08 January 2018)

<sup>10</sup> United Nations, European Commission, Organisation for Economic Co-operation and Development and World Bank (2014) *System of Environmental-Economic Accounting 2012-Experimental Ecosystem Accounting*. Sales No. .13.XVII.13., [https://unstats.un.org/unsd/envaccounting/seeaRev/eea\\_final\\_en.pdf](https://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf) (accessed 31 January 2018)

<sup>11</sup> United Nations Statistics Division (2017) *Framework for the Development of Environment Statistics (FDES 2013)*, <https://unstats.un.org/unsd/environment/fdes/FDES-2015-supporting-tools/FDES.pdf> (accessed 17 January 2018)

<sup>12</sup> United Nations (1992) *Convention on Biological Diversity*, <https://www.cbd.int/doc/legal/cbd-en.pdf> (accessed 08 January 2018)

<sup>13</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

<sup>14</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

population trends of known species of flora and fauna (terrestrial, freshwater and marine) and their vulnerability status category.<sup>15</sup> In this context, species are defined as “a group of interbreeding individuals with common characteristics that produce fertile (capable of reproducing) offspring and which are not able to interbreed with other such groups, that is, a population that is reproductively isolated from others; related species are grouped into genera.”<sup>16</sup> The IUCN states that those endemic species located in restricted natural areas are more vulnerable to extinction if their natural environment is modified in a significant manner, thus measuring endemic species is linked to measuring threatened species.

### Protected area

A **protected area** is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.<sup>17</sup>

## 3A. General ecosystem characteristics, extent and pattern (FDES 1.2.2.a)

### Area of ecosystem (FDES 1.2.2.a.1)

The area covered by an individual ecosystem.

#### Remarks:

- The main input determining the primary productivity of terrestrial ecosystems is land and the area of land available. In the absence of an international classification of ecosystem types, land cover classes have often been used as proxies to define ecosystems in practice.<sup>18</sup> A relevant international land cover classification is that used by the System of Environmental-Economic Accounting.<sup>19</sup> However, it should be noted that in addition to land cover, other factors can be used to differentiate one ecosystem from another such as water resources, climate, altitude and soil type, although in practice these may be more difficult to operationalize than use of land cover.<sup>20</sup>
- Various global land cover classifications and global land cover datasets, including the FAO Land Cover Classification System (LCCS)<sup>21</sup> which may provide a starting point for identification of ecosystem type can be found in the Methodology Sheet on Land Cover and Land Use Statistics.<sup>22</sup> Further guidance related to use of land cover for ecosystem assessment, including a mapping among relevant land cover types, can be found in the United Nations Convention to Combat Desertification (UNCCD), Good Practice Guidance: Sustainable

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<sup>15</sup> United Nations Statistics Division (2017) *Framework for the Development of Environment Statistics (FDES 2013)*, <https://unstats.un.org/unsd/environment/fdes/FDES-2015-supporting-tools/FDES.pdf> (accessed 17 January 2018)

<sup>16</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

<sup>17</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

<sup>18</sup> United Nations, European Commission, Organisation for Economic Co-operation and Development and World Bank (2014) *System of Environmental-Economic Accounting 2012-Experimental Ecosystem Accounting*. Sales No. 13.XVII.13., [https://unstats.un.org/unsd/envaccounting/seeaRev/eea\\_final\\_en.pdf](https://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf) (accessed 31 January 2018)

<sup>19</sup> United Nations, European Commission, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank (2014) *System of Environmental-Economic Accounting 2012: Central Framework*. Studies in Methods, Series F, No. 109. Sales No. E.12.XVII.12., [https://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\\_CF\\_Final\\_en.pdf](https://unstats.un.org/unsd/envaccounting/seeaRev/SEEA_CF_Final_en.pdf) (accessed 31 January 2018)

<sup>20</sup> United Nations, European Commission, Organisation for Economic Co-operation and Development and World Bank (2014) *System of Environmental-Economic Accounting 2012-Experimental Ecosystem Accounting*. Sales No. 13.XVII.13., [https://unstats.un.org/unsd/envaccounting/seeaRev/eea\\_final\\_en.pdf](https://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf) (accessed 31 January 2018)

<sup>21</sup> FAO (2016) *Land Cover Classification System: Classification concepts Software Version 3*, FAO: Rome, [www.fao.org/3/a-i5232e.pdf](http://www.fao.org/3/a-i5232e.pdf) (accessed 17 January 2018)

<sup>22</sup> United Nations Statistics Division (2018) *Methodology Sheet on Land Cover and Land Use Statistics of the Manual on the Basic Set of Environment Statistics*, [https://unstats.un.org/unsd/envstats/fdes/manual\\_bses.cshtml](https://unstats.un.org/unsd/envstats/fdes/manual_bses.cshtml) (accessed 18 January 2018)



Development Goal Indicator 15.3.1.<sup>23</sup> The Millennium Ecosystem Assessment (MEA)<sup>24</sup> set of ecosystems categories, can also be referred to as a classification used internationally, the categories are, at the highest level, forest, cultivated, coastal, marine, drylands, urban, polar, inland water, island and mountain. For mountain area ecosystems, the Global Mountain Biodiversity Assessment (GMBA) includes a more precise definition of mountain ecosystems, based on ruggedness, as opposed to one strictly based on elevation.<sup>25</sup>

- Ecosystems may be defined and studied at different geographical scales, and what is included in an ecosystem type may differ among countries; in addition, types of ecosystems within a country may overlap. For example, a country may be interested in measuring wetlands and has defined wetlands to include: swamp forests, mangroves, marshes and other flooded grasslands. That same country may later be interested in measuring forest extent and may therefore include swamp forest in the scope of forest. Thus, an individual area on a map may be part of more than one ecosystem, depending on the type of analysis conducted.
- In practice, measurement of ecosystem extent requires mapping of the ecosystem. An ecosystem type may change due to seasonal variation and may also change over time. Therefore, the collection of data should be planned to meet users' demands for monitoring the ecosystem. For example, in monitoring wetlands, the objective of monitoring may include understanding seasonal variability and thus the monitoring of ecosystem extent would need to be planned to correspond with the timing of the seasons. If the purpose of monitoring is to identify annual changes, then seasonal changes would still need to be considered when planning the geospatial mapping of ecosystem boundaries so as not to conflate seasonal changes with longer term changes. Ideally, any ecosystem mapping should happen at multiple times during the year to minimize the impact of seasonality. One method of reflecting the ecosystem over the entire year is to map the ecosystem type that occurs in the majority of the data collection points.

#### **Proximity of ecosystem to urban areas and cropland (FDES 1.2.2.a.2)**

The distance from the urban or cropland ecosystems to other types of ecosystem within a geographical area.

##### *Remarks:*

- The distance will vary depending on the location within the ecosystem the measure is taken from (i.e., centre, location on border) to the location within the urban or cropland ecosystem (i.e., centre, location on border). Often the border of each ecosystem or land cover type has been used; the rationale being that this is the point closest to the source of contamination or conflict from the urban area or cropland. However, the decision will ultimately depend on the purpose of the analysis.
- The proximity measure can be analysed with other statistics, e.g., correlation with extent of the ecosystem, its degradation status, threatened species and distance to the pressures of urban and cropland ecosystems, to provide more detailed evaluation of conflicts and competition for resources between ecosystems.

### **3B. Ecosystems' chemical and physical characteristics (FDES 1.2.2.b)**

#### **Nutrients (FDES 1.2.2.b.1)**

Amount of nutrient found in soil, freshwater and marine water.

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<sup>23</sup> UNCCD (2017) *Good Practice Guidance: SDG Indicator 15.3.1: Proportion of land that is degraded over total land area*, [http://www2.unccd.int/sites/default/files/relevant-links/2017-10/Good%20Practice%20Guidance\\_SDG%20Indicator%2015.3.1\\_Version%201.0.pdf](http://www2.unccd.int/sites/default/files/relevant-links/2017-10/Good%20Practice%20Guidance_SDG%20Indicator%2015.3.1_Version%201.0.pdf) (accessed 08 January 2018)

<sup>24</sup> Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-Being: Synthesis*, <https://www.millenniumassessment.org/documents/document.356.aspx.pdf> (accessed 08 January 2018)

<sup>25</sup> Körner C., Jetz W., Paulsen J., Payne D., Rudmann-Maurer K., Spehn E.M. (2017) A global inventory of mountains for bio-geographical applications, *Alpine Botany*, 127(1), pgs. 1-15

*Remarks:*

- Nutrients relevant to monitoring the health of freshwater and marine systems include phosphorous and nitrogen which can cause eutrophication and high levels of nitrate in drinking water. Deposits of sulphur also threaten ecosystems.<sup>26</sup>
- Soil nutrients and other characteristics relevant to healthy ecosystems can be found in the FAO guidance on soil and plant nutrient analysis. This covers soil nutrients, chemical balance and other physical characteristics necessary for healthy soils.<sup>27</sup>

**Carbon (FDES 1.2.2.b.2)**

Amount of soil organic carbon stock. Soil organic carbon is the amount of organic carbon stored in the soil.<sup>28 29</sup>  
Soil organic carbon is referred to as it is particularly important to ecosystem health.

**Pollutants (FDES 1.2.2.b.3)**

Amount of pollutants found in soil, freshwater and marine water.

*Remarks:*

- There is no consensus on measuring pollution. Pollution includes chemicals and excess nutrients from fertilizers, industry waste, wastewater and pollutants from other sources such as human settlements.
- Persistent Organic Pollutants (POPs) are of importance. These are “organic compounds that are resistant to environmental degradation through chemical, biological, and photolytic processes”.<sup>30</sup> The POPs defined in the Stockholm Convention are: (1) Pesticides: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene; (2) Industrial chemicals: hexachlorobenzene, polychlorinated biphenyls (PCBs); and (3) By-products: hexachlorobenzene; polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF), and PCBs.<sup>31</sup>

## 3C. Biodiversity (FDES 1.2.2.c)

**Known flora and fauna species (FDES 1.2.2.c.1)**

Number of known flora and fauna species present in the specific ecosystem.

*Remarks:*

- The statistics can be presented by ecosystem, by major taxonomic group (class, order for animals and class, family for plants) and by IUCN status category.

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<sup>26</sup> Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-Being: Synthesis*, <https://www.millenniumassessment.org/documents/document.356.aspx.pdf> (accessed 08 January 2018)

<sup>27</sup> FAO (2017) *Voluntary Guidelines for Sustainable Soil Management*, <http://www.fao.org/3/a-bl813e.pdf> (accessed 08 January 2018)

<sup>28</sup> FAO (2017) *Soil Organic Carbon: the hidden potential*, <http://www.fao.org/3/a-bl813e.pdf> (accessed 18 January 2018), Rome: FAO, <http://www.fao.org/3/a-i6937e.pdf> (accessed 08 January 2018)

<sup>29</sup> IPCC (1997) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Reference Manual (Vol 3)*, <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html> (accessed 07 January 2018)

<sup>30</sup> The Stockholm Convention on POPs is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on human health or on the environment. Its objective is to protect human health and the environment from persistent organic pollutants. It was adopted in 2001 and entered into force in 2004, and requires its parties to take measures to eliminate or reduce the release of POPs into the environment, <http://chm.pops.int/TheConvention/Overview/tabid/3351/Default.aspx> (accessed 08 January 2018)

<sup>31</sup> Stockholm Convention (2001) *Stockholm Convention on Persistent Organic Pollutants*, <http://chm.pops.int/TheConvention/ThePOPs/The12InitialPOPs/tabid/296/Default.aspx> (accessed 08 January 2018)

- For IUCN status category, the IUCN Red List of Threatened Species categories and criteria<sup>32</sup> can be used, which is based on the threat level. The main categories are extinct, extinct in the wild, threatened (critically endangered, endangered and vulnerable), near threatened and least concern.
- The IUCN summary statistics can be referred to for relevant taxonomies and appropriate taxonomic rank for statistics on species, for purpose of conservation (i.e., statistically speaking relevant classifications and appropriate levels of the classification).<sup>33</sup>

### **Endemic flora and fauna species (FDES 1.2.2.c.2)**

Population of a species that is native to the region, and which area of distribution is restricted to a small place<sup>34</sup> such as an island, or country, or specific ecosystem.

#### *Remarks:*

- An indigenous or native species is assumed be intrinsically part of the ecosystem, owing to having developed there, having arrived in the area long before record of such matters was kept, having arrived by natural means (unaided by human action), etc.<sup>35</sup>
- Organisms that are indigenous to a place are not endemic to it if they are also found elsewhere.
- The statistics can be presented by ecosystem, by major taxonomic group (class, order for animals and class, family for plants) and by IUCN status.
- For status category, the IUCN Red List of Threatened Species categories and criteria<sup>36</sup> can be used, which is based on the threat level. The main categories are extinct, extinct in the wild, threatened (critically endangered, endangered and vulnerable), near threatened and least concern.
- The IUCN summary statistics can be referred to for relevant taxonomies and appropriate taxonomic rank for statistics on species, for purpose of conservation (i.e., statistically speaking relevant classifications and appropriate levels of the classification).<sup>37</sup>

### **Invasive alien flora and fauna species (FDES 1.2.2.c.3)**

A subset of introduced species or non-native species that are rapidly expanding outside of their native range.<sup>38</sup>

#### *Remarks:*

- An exotic species is an introduced species not native or endemic to the area in question. Likewise, an alien species is not native to the ecosystem in which it is introduced. Non-native species are species, subspecies or lower taxon introduced outside its normal past or present distribution; includes any parts, gametes, seeds, eggs or propagules of such species that might survive and subsequently reproduce.<sup>39</sup>

<sup>32</sup> International Union for Conservation of Nature, Species Survival Commission (2010) *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels (Version 4.)*, [http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg\\_guidelines\\_en.pdf](http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg_guidelines_en.pdf) (accessed 08 January 2018)

<sup>33</sup> International Union for Conservation of Nature and Natural Resources metadata, *IUCN Red List website summary statistics*: <http://www.iucnredlist.org/about/summary-statistics> (accessed 09 January 2018)

<sup>34</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

<sup>35</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

<sup>36</sup> International Union for Conservation of Nature, Species Survival Commission (2010) *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels (Version 4.)*, [http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg\\_guidelines\\_en.pdf](http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg_guidelines_en.pdf) (accessed 08 January 2018)

<sup>37</sup> International Union for Conservation of Nature and Natural Resources metadata, *IUCN Red List website summary statistics*: <http://www.iucnredlist.org/about/summary-statistics> (accessed 09 January 2018)

<sup>38</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

<sup>39</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

- The statistics can be presented by ecosystem, by major taxonomic group (class, order for animals and class, family for plants) and by IUCN status.
- For status category, the IUCN Red List of Threatened Species categories and criteria<sup>40</sup> can be used, which is based on the threat level. The main categories are extinct, extinct in the wild, threatened (critically endangered, endangered and vulnerable), near threatened and least concern.
- The IUCN summary statistics can be referred to for relevant taxonomies and appropriate taxonomic rank for statistics on species, for purpose of conservation (i.e., statistically speaking relevant classifications and appropriate levels of the classification).<sup>41</sup>

#### **Species population (FDES 1.2.2.c.4)**

Number of individuals from the same wild species that share the same habitat. It is considered as the basic management unit of wild species living in freedom.<sup>42</sup>

#### *Remarks:*

- Note the IUCN Red List Criteria<sup>43</sup> defines population as the total number of individuals of the taxon, where a taxon is defined as a species or infraspecific entity whose extinction risk is being assessed. This is different to its common biological usage defined above.
- For functional reasons, primarily owing to differences between life forms, population size is measured as numbers of mature individuals only.
- The IUCN summary statistics can be referred to for relevant taxonomies and appropriate taxonomic rank for statistics on species, for purpose of conservation (i.e., statistically speaking relevant classifications and appropriate levels of the classification).<sup>44</sup>

#### **Habitat fragmentation (FDES 1.2.2.c.5)**

The process and result of breaking an area of contiguous habitat into distinct patches.<sup>45</sup>

#### *Remark:*

- There is currently not an internationally accepted methodology for measuring this statistic. Landscape ecology metrics have traditionally been used to measure patterns of habitat fragmentation and connectivity.

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<sup>40</sup> International Union for Conservation of Nature, Species Survival Commission (2010) *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels (Version 4.)*, [http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg\\_guidelines\\_en.pdf](http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg_guidelines_en.pdf) (accessed 08 January 2018)

<sup>41</sup> International Union for Conservation of Nature and Natural Resources metadata, *IUCN Red List* website summary statistics: <http://www.iucnredlist.org/about/summary-statistics> (accessed 09 January 2018)

<sup>42</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

<sup>43</sup> International Union for Conservation of Nature, Species Survival Commission (2010) *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels (Version 4.)*, [http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg\\_guidelines\\_en.pdf](http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg_guidelines_en.pdf) (accessed 08 January 2018)

<sup>44</sup> International Union for Conservation of Nature and Natural Resources metadata, *IUCN Red List* website summary statistics: <http://www.iucnredlist.org/about/summary-statistics> (accessed 09 January 2018)

<sup>45</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

### 3D. Protected areas and species (FDES 1.2.2.d)

#### Protected terrestrial and marine area (FDES 1.2.2.d.1)

An area of land and/or sea especially dedicated to the protection of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.<sup>46</sup>

#### Remark:

- Comparing the designation of protected areas with the mapping of ecosystems is useful to understand which areas need protecting, and whether protected areas are effectively protecting them.

#### Protected flora and fauna species (FDES 1.2.2.d.2)

Number of protected flora and fauna species designated in the country.

#### Remarks:

- Most countries have a list of designated protected species containing both flora and fauna species that are particularly important to the country. Many nations have laws that protect conservation-reliant species: for example, prohibiting hunting or flora harvest, felling or use, or restricting conditions leading to their exploitation. Protection status is given to certain species based on a combination of endemism and level or category of threat. The designation of protected species occurs at the national level based on national definitions.
- The statistics can be presented by ecosystem, by major taxonomic group (class, order for animals and class, family for plants) and by status.
- For status category, the IUCN Red List of Threatened Species categories and criteria<sup>47</sup> can be used, which is based on the threat level. The main categories are extinct, extinct in the wild, threatened (critically endangered, endangered and vulnerable), near threatened and least concern.
- The IUCN summary statistics can be referred to for relevant taxonomies and appropriate taxonomic rank for statistics on species, for purpose of conservation (i.e., statistically speaking relevant classifications and appropriate levels of the classification).<sup>48</sup>

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<sup>46</sup> International Union for Conservation of Nature (2014) *IUCN Definitions*, [http://cmsdata.iucn.org/downloads/en\\_iucn\\_glossary\\_definitions.pdf](http://cmsdata.iucn.org/downloads/en_iucn_glossary_definitions.pdf) (accessed 08 January 2018)

<sup>47</sup> International Union for Conservation of Nature, Species Survival Commission (2010) *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels (Version 4.)*, [http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg\\_guidelines\\_en.pdf](http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3101/reg_guidelines_en.pdf) (accessed 08 January 2018)

<sup>48</sup> International Union for Conservation of Nature and Natural Resources metadata, *IUCN Red List website summary statistics*: <http://www.iucnredlist.org/about/summary-statistics> (accessed 09 January 2018)

# 4. International sources and recommendations

## 4A. Classifications and groupings

### 4A1. General ecosystem characteristics

Various global land cover classifications and global land cover datasets, including the FAO Land Cover Classification System (LCCS),<sup>49</sup> which may provide a starting point for identification of ecosystem types, can be found in the Methodology Sheet on Land Cover and Land Use Statistics.<sup>50</sup>

Further guidance related to use of land cover for ecosystem assessment, including a mapping among relevant land cover types, can be found in UNCCD, Good Practice Guidance for Assessing UN Sustainable Development Goal Indicator 15.3.1.<sup>51</sup> The Millennium Ecosystem Assessment (MEA)<sup>52</sup> set of ecosystems categories, can also be referred to as a classification used internationally, the categories are, at the highest level, forest, cultivated, coastal, marine, drylands, urban, polar, inland water, island and mountain.

For mountain area ecosystems, the Global Mountain Biodiversity Assessment (GMBA) includes a more precise definition of mountain ecosystems, based on ruggedness, as opposed to a definition based strictly on elevation.<sup>53</sup>

The SEEA-EEA provides a classification of ecosystem goods and services,<sup>54</sup> based on the Common International Classification of Ecosystem Services (CICES)<sup>55</sup> and the U.S. Environmental Protection Agency's Final Ecosystem Goods and Services Classification System (FEGS-CS).<sup>56</sup>

### 4A2. Biodiversity

#### Plant and animal species

The taxonomy/classification of plant and animal species and the allocation of species to these groups, is a discipline in itself. The methodology sheet does not attempt to cover the multitude of biological taxonomies in existence.

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<sup>49</sup> FAO (2016) *Land Cover Classification System: Classification concepts Software Version 3*, FAO: Rome, [www.fao.org/3/a-i5232e.pdf](http://www.fao.org/3/a-i5232e.pdf) (accessed 08 January 2018)

<sup>50</sup> United Nations Statistics Division (2018) *Methodology Sheet on Land Cover and Land Use Statistics of the Manual on the Basic Set of Environment Statistics*, [https://unstats.un.org/unsd/envstats/fdes/manual\\_bses.cshtml](https://unstats.un.org/unsd/envstats/fdes/manual_bses.cshtml) (accessed 08 January 2018)

<sup>51</sup> UNCCD (2017) *Good Practice Guidance: SDG Indicator 15.3.1: Proportion of land that is degraded over total land area*, [http://www2.unccd.int/sites/default/files/relevant-links/2017-10/Good%20Practice%20Guidance\\_SDG%20Indicator%2015.3.1\\_Version%201.0.pdf](http://www2.unccd.int/sites/default/files/relevant-links/2017-10/Good%20Practice%20Guidance_SDG%20Indicator%2015.3.1_Version%201.0.pdf) (accessed 08 January 2018)

<sup>52</sup> Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-Being: Synthesis*, <https://www.millenniumassessment.org/documents/document.356.aspx.pdf> (accessed 08 January 2018)

<sup>53</sup> Körner C., Jetz W., Paulsen J., Payne D., Rudmann-Maurer K., Spehn E.M. (2017) A global inventory of mountains for bio-geographical applications, *Alpine Botany*, 127(1), pgs. 1-15

<sup>54</sup> United Nations, European Commission, Organisation for Economic Co-operation and Development and World Bank (2014) *System of Environmental-Economic Accounting 2012-Experimental Ecosystem Accounting*. Sales No. 13.XVII.13., [https://unstats.un.org/unsd/envaccounting/seeaRev/eea\\_final\\_en.pdf](https://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf) (accessed 31 January 2018)

<sup>55</sup> European Union, CICES webpage, <https://cices.eu/> (accessed 18 January 2018)

<sup>56</sup> US EPA, *Final Ecosystem Goods and Services Classification System* webpage, <https://www.epa.gov/eco-research/final-ecosystem-goods-and-services-classification-system> (accessed 18 January 2018)

The IUCN summary statistics uses taxonomic classes and major taxonomic groups for both plants and animals to group species. Countries may wish to use the IUCN major animal taxonomic group (Class, Order) and major plant taxonomic group (Class, Family) as a reference when using the statistics for conservation and preservation purposes.<sup>57</sup> This will also provide comparability of country level data with the international IUCN data. Groupings are provided for animal, plant, and fungi and protist species.

### Categories of protected areas

Through its World Commission on Protected Areas (WCPA), the IUCN has provided the international guidelines on the categorisation of protected areas.<sup>58</sup> These categories are internationally recognised and facilitate a global system for defining, recording and classifying protected areas and the wide variety of specific aims they might embody. Acknowledged on an international level and often incorporated into national legislation, the categories below are based upon the management objectives of a protected area.

The IUCN Protected Area Management Categories<sup>59</sup> are based on the strictness of protection and serve as the classification for protected areas, see Figure 3.1.

**Figure 4.1: IUCN classification of protected areas**

Category	Description
Ia: Strict Nature Reserve	Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.
Ib: Wilderness Area	Category Ib protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.
II: National Park	Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.
III: Natural Monument or Feature	Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.

<sup>57</sup> International Union for Conservation of Nature and Natural Resources metadata, *IUCN Red List* website summary statistics: <http://www.iucnredlist.org/about/summary-statistics> (accessed 09 January 2018)

<sup>58</sup> United Nations Environment Programme, World Conservation Monitoring Centre, *IUCN Management Categories*, [http://www.iucn.org/about/work/programmes/gpap\\_home/gpap\\_quality/gpap\\_pacategories/](http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/) (accessed 09 January 2018)

<sup>59</sup> International Union for Conservation of Nature and Natural Resources, *IUCN Protected Areas Categories System*, [http://www.iucn.org/about/work/programmes/gpap\\_home/gpap\\_quality/gpap\\_pacategories/](http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/) (accessed 09 January 2018)

IV: Habitat/Species Management Area	Category IV protected areas aim to protect particular species or habitats and management reflects this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.
V: Protected Landscape/Seascape	A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.
VI: Protected area with sustainable use of natural resources	Category VI protected areas conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.

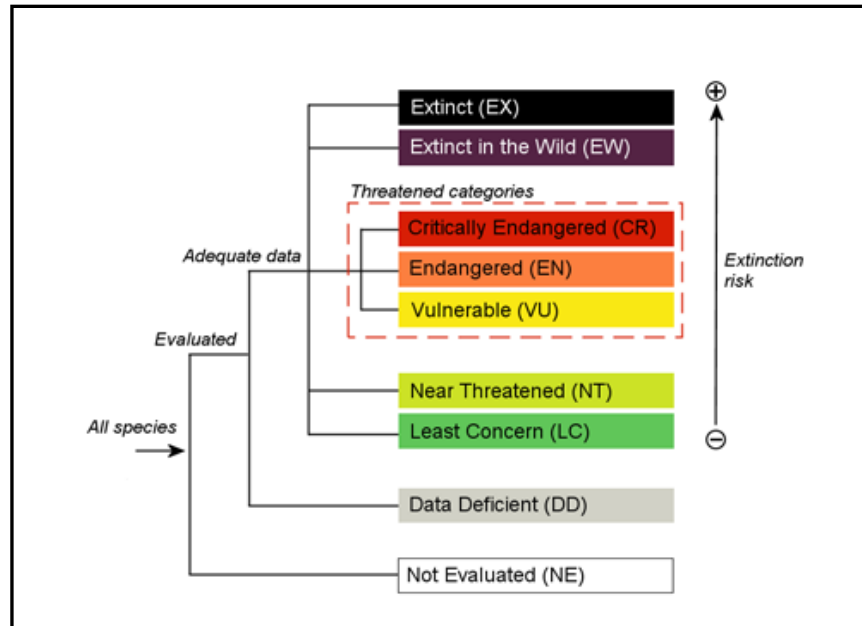
#### Categories of status/conservation of species

The IUCN Red List Categories and Criteria are intended to be an easily and widely understood system for classifying the global extinction risk of species. The general aim of the system is to provide an explicit, objective framework for the classification of extinction risk, and can be used to assess threat levels for any species.<sup>60</sup>

<sup>60</sup> IUCN Species Survival Commission (2014) *2001 IUCN Red List Categories and Criteria version 3.1*, <http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria> (accessed 08 January 2018)



Figure 4.2: Structure of the IUCN Red List Categories<sup>61</sup>



In practice, many countries also refer to the CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendices<sup>62</sup> in addition to the IUCN Red List to identify threatened species:

- Appendix I shall include all species threatened with extinction which are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances.
- Appendix II shall include:
  - (a) all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and
  - (b) other species which must be subject to regulation in order that trade in specimens of certain species referred to in sub-paragraph (a) of this paragraph may be brought under effective control.
- Appendix III shall include all species which any Party identifies as being subject to regulation within its jurisdiction for the purpose of preventing or restricting exploitation, and as needing the co-operation of other Parties in the control of trade.

The IUCN collaborates with CITES in reviewing proposed amendments to its Appendices.<sup>63</sup>

<sup>61</sup> IUCN Species Survival Commission (2014) *Guidelines for Using the IUCN Red List Categories and Criteria*, <http://ir.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed 08 January 2018)

<sup>62</sup> Convention on International Trade in Endangered Species of Wild Fauna and Flora, *text of the convention* webpage, <https://www.cites.org/eng/disc/text.php> (accessed 08 January 2018)

<sup>63</sup> IUCN CITES webpage, <https://www.iucn.org/theme/species/our-work/sustainable-use-and-trade/cites> (accessed 09 January 2018)

## 4B. Reference to international statistical recommendations, frameworks and standards

International organizations have produced guidance documents and have set guidelines for the collection of ecosystems and biodiversity data, e.g., improvement of relevant databases, including ecosystem goods and services (state of forests, agriculture and livestock, fisheries and aquaculture, soil biodiversity). A non-exhaustive list of references is provided below:

### 4B1. *Ecosystems characteristics*

- Millennium Ecosystem Assessment (MEA): an assessment of conditions and trends in the world's ecosystems and the services they provide, as well as information on their conservation and sustainable use. It was the first major global scientific ecosystem assessment, <http://www.millenniumassessment.org/en/Index-2.html>.
- System of Environmental-Economic Accounting 2012: Experimental Ecosystem Accounting: measurement framework for integrating biophysical data, tracking changes in ecosystems and linking those changes to economic and other human activity, [https://unstats.un.org/unsd/envaccounting/seeaRev/eea\\_final\\_en.pdf](https://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf).
- UN Environment World Conservation Monitoring Centre (WCMC): UN Environment portal for guidance and research on ecosystems, <http://www.unep-wcmc.org/>.

### 4B2. *Ecosystems' chemical and physical properties*

#### Soil Organic Carbon

- Guidance on measuring soil organic carbon can be found in FAO (2017) *Soil Organic Carbon: FAO Soil Organic Carbon: the hidden potential*, <http://www.fao.org/3/a-i6937e.pdf>, which is based on the IPCC Guidelines on measuring soil carbon, IPCC (1997) Revised 1996 *IPCC Guidelines for National Greenhouse Gas Inventories, Reference Manual (Vol 3)*, <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html>. Further technical guidance and software packages can be found in FAO (2017) *Soil Organic Carbon mapping cookbook*, 1<sup>st</sup> edition, Rome: FAO, <http://www.fao.org/3/a-bs901e.pdf>.

### 4B3. *Biodiversity*

- Convention on Biological Diversity (CBD): international agreement for protection of biological biodiversity, sustainable use of components of biodiversity and equitable use of benefits from use of genetic resources, <https://www.cbd.int/>.
- International Union for Conservation of Nature (IUCN): source for information on conservation and species protection, <http://www.iucn.org/en/>.
- UN Environment World Conservation Monitoring Centre (WCMC): UN Environment portal for guidance and research on biodiversity, <http://www.unep-wcmc.org/>.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): international agreement governing international trade in wild animals and plants, <http://checklist.cites.org/#/en>.

## 4C. Sources of global and regional environment statistics and indicators series

### 4C1. *Ecosystems characteristics*

- Millennium Ecosystem Assessment (MEA): data from the Millennium Ecosystem Assessment, <http://www.millenniumassessment.org/en/Index-2.html>.

- United Nations List of Protected Areas: created by UN Environment-WCMC and IUCN, data includes the name, IUCN protected area management category, location, size and year of establishment of protected areas. It includes only information from officially recognized national authorities, [http://www.unep-wcmc.org/protected\\_areas/UN\\_list/index.htm](http://www.unep-wcmc.org/protected_areas/UN_list/index.htm).
- Ramsar Convention: maintains for wetlands a data base of protected areas, <https://rsis.ramsar.org/>.
- Biodiversity Information System for Europe: information on biodiversity for Europe, <https://biodiversity.europa.eu/>.

#### **4C2. Ecosystems' chemical and physical properties**

- FAO Harmonized World Soil Database: which provides information on selected soil parameters <http://www.fao.org/soils-portal/soil-survey/soil-maps-and-databases/harmonized-world-soil-database-v12/en/> and detailed guidance on soil and plant nutrient analysis (<http://www.fao.org/3/a-i0131e.pdf>).
- FAO Global Soil Organic Carbon Map: <http://www.fao.org/global-soil-partnership/pillars-action/4-information-and-data/global-soil-organic-carbon-gsoc-map/en/>.
- Stockholm Convention: contains additional information on measuring POPs. <http://chm.pops.int/TheConvention/ThePOPs/The12InitialPOPs/tabid/296/Default.aspx>.

#### **4C3. Biodiversity**

- UN Environment, Protected Planet database: which is the most comprehensive platform includes a global map of nationally submitted protected areas <https://www.protectedplanet.net/>. It serves as the main platform for the CBD: <http://www.cbd.int/protected/>.
- Convention on Biological Diversity (CBD): contains country level data on status and trends of biodiversity. <https://www.cbd.int/>.
- International Union for Conservation of Nature (IUCN): database of Red List and World Database on Key Biodiversity Areas. <http://www.iucn.org/en/>.
- IUCN Red List of Threatened Species Website: Global Red List data, [www.iucnredlist.org](http://www.iucnredlist.org) and <http://www.iucn.org/themes/ssc/redlist.htm>.
- UN Environment World Conservation Monitoring Centre (WCMC): data on biodiversity <http://www.unep-wcmc.org/>.
- Global Invasive Species Biodiversity Indicators Partnership (BIP): with the Secretariat in UN Environment, it supports measurement of targets to the Convention on Biological Diversity (CBD) and the Aichi Biodiversity Targets of the Strategic Plan for Biodiversity 2011-2020: <https://www.bipindicators.net/>. Database (GISD): managed by the Invasive Species Specialist Group (ISSG) of the IUCN Species Survival Commission. ISSG is a global network of scientific and policy experts on invasive species, promotes and facilitates the exchange of information and knowledge on invasive species across the globe and ensures the linkage between knowledge, practice and policy so that decision making is informed. Manages the Aliens-L: a list server dedicated to those invasive species that threaten biodiversity and the Global Invasive Species Database contains profiles of invasive species ranging from plants, mammals, invertebrates, birds, reptiles, fish, and amphibians, to macro-fungi and micro-organisms, <http://www.issg.org/database/welcome>.

#### 4C4. General data sources

##### Earth Observation data for measuring ecosystems

- Various earth observation systems relevant to ecosystems can be found in the Methodology Sheet on Land Cover and Land Use Statistics, [https://unstats.un.org/unsd/envstats/fdes/manual\\_bses.cshtml](https://unstats.un.org/unsd/envstats/fdes/manual_bses.cshtml).<sup>64</sup>
- The European Environment Agency (EEA): <http://www.eea.europa.eu>, specifically the Climate Change Initiative land cover mapping: <https://www.esa-landcover-cci.org/?q=node/158>.
- NASA Moderate Resolution Imaging Spectroradiometer data: <https://modis.gsfc.nasa.gov/>.

##### Regional statistical databases

- OECD Environment Statistics database: contains statistics about threatened species, [http://www.oecd-ilibrary.org/environment/data/oecd-environment-statistics\\_env-data-en;jsessionid=3ev95il1ak69v.x-oecd-live-01](http://www.oecd-ilibrary.org/environment/data/oecd-environment-statistics_env-data-en;jsessionid=3ev95il1ak69v.x-oecd-live-01).
- European Commission: biodiversity statistics database, [http://ec.europa.eu/eurostat/statistics-explained/index.php/Biodiversity\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Biodiversity_statistics).

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<sup>64</sup> United Nations Statistics Division (2018) *Methodology Sheet on Land Cover and Land Use Statistics of the Manual on the Basic Set of Environment Statistics*, [https://unstats.un.org/unsd/envstats/fdes/manual\\_bses.cshtml](https://unstats.un.org/unsd/envstats/fdes/manual_bses.cshtml) (accessed 08 January 2018)

## 5. Data collection and sources of data

The methodologies to produce primary data sets on ecosystems, and biodiversity are varied and specific to the objectives of the different evaluation and monitoring needs of each country. As resources are limited, the studies are often ad hoc and focus on a wide variety of aspects across a range of years and periods, covering different spatial areas and ecological units.

The raw data needed to produce the indicators under this section are typically collected via: satellite imagery, field surveys, soil and plant sampling and other field studies. For example, each ecosystem can be monitored using satellite imagery or other national maps, followed by field surveys to map ecosystem boundaries and health. The surveys or monitoring programmes assess the status, condition, or extent of the ecosystem. The area covered may be a well-defined ecosystem or may be a larger area of importance for biodiversity, e.g., small lakes or wetlands, compared to stream networks, forests, or the volume of water in large lakes.<sup>65</sup>

For measuring species populations, countries typically rely on the known species and their taxonomies, as there are still new ones being discovered and described. Known species of flora and fauna usually serve as the basis of all biodiversity assessments and regulations. Data are needed about the existence, conditions and changes in species populations within different ecosystems, with a focus on key species such as keystone species, invasive and endemic species, in relation to their level of conservation or threatened status. However, proxy data are often used as direct data on all species are often not available; proxies include data on protected areas both terrestrial and marine, as well as protected species. Despite the importance of biodiversity research, there are no standard methodologies for producing such statistics. This is due to the heterogeneity of resources, time, areas to be monitored, organisms to be found, and a myriad of other factors that change from one measurement to another.

Data are often held by multiple agencies but an understanding of ecosystems and policies to manage and protect ecosystems requires cross-ministerial/organisational work. Nonetheless, the nature of ecosystems and biodiversity statistics most of the time goes far beyond conventional areas of established statistical operations and expertise. Biodiversity data are often produced by non-governmental organisations (NGOs) or scientific research bodies, therefore interagency cooperation and coordination is needed among NSOs, government and research institutes. NSOs also require an increase in statistical capacity and data availability to facilitate access to specific information with respect to ecosystems and biodiversity status in the country.

Due to the ad hoc nature of biodiversity data collection, data are often not produced according to national or international definitions, recommendations and guidelines in terms of data collection, analysis and dissemination. Data are disseminated at varying levels of detail, using a wide range of approaches which are targeted for a multitude of end uses: national policies and targets, international commitments, participation in MEAs or in regional initiatives or information systems, among other factors. Data on ecosystems and biodiversity are typically published in compendia containing

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<sup>65</sup> Marker, D. and Stevens, D (2009) Sampling and Inference in Environmental Surveys, in Pfefferman, D. and Rao, C. (Eds.) *Handbook of Statistics*. Vol.29A. *Sample surveys: Design, Methods and Applications*, Amsterdam: Elsevier, [http://hbanaszak.mjr.uw.edu.pl/TempTxt/Danny%20Pfeffermann,%20C.R.%20Rao-Handbook%20of%20Statistics%2029A%20Sample%20Surveys%20Design,%20Methods%20and%20Applications-North%20Holland%20\(2009\).pdf](http://hbanaszak.mjr.uw.edu.pl/TempTxt/Danny%20Pfeffermann,%20C.R.%20Rao-Handbook%20of%20Statistics%2029A%20Sample%20Surveys%20Design,%20Methods%20and%20Applications-North%20Holland%20(2009).pdf) (accessed 08 January 2018)

statistics and indicators such as time-series, computed averages, and aggregates, rather than dissemination of primary data which are rarely shared with end users. Thus, compendia focus on presenting a broad, holistic picture of the biodiversity and ecosystems' status in a country, region or zone, without detailed analysis of the characteristics or condition of ecosystems and biodiversity.

Other common data sets are databases of species, forming part of conservation or management projects in specific areas. These databases are necessary for the elaboration of inventories and catalogues of species, which in turn are supplemented with data from other collections or with material from other studies. Additionally, spatially referenced data have been integrated into the ecosystems and biodiversity information systems. It adds value to the analysis by enabling the geographical representation of such data sets.

### **Scope**

The scope of the statistics covers all ecosystems within a given geographical area of interest and all species of interest, e.g., the set of species in a given habitat; the set of individuals of a given species of a particular interest (e.g., commercial value, rarity, vulnerability, importance for an ecosystem function).

### **Statistical unit**

The statistical unit will vary depending on the objective of the study. For example, if certain characteristics of a species are to be measured, such as the average size of individuals, the statistical unit is an individual of the species. If characteristics of an ecosystem are to be determined, such as the average soil quality, the statistical unit is the ecosystem itself, or parts of it, if measurements are done at different points. If a national assessment of all ecosystems is being produced, the statistical unit will be each ecosystem.

### **Measurement units**

Depending on the focus of the study, the data can be expressed in different units:

- Spatial units: these are usually natural spatial units which generally do not correspond to administrative units and its boundaries, e.g., the geographical boundaries of an ecosystem, the area of habitat of a specific species, etc.
- Physical units: data related to characteristics of ecosystems, e.g., population (number of species, number of individuals of a given species, etc.), volume (the caudal of a river, etc.) and bio-chemical measurements (concentration of a given element, soil quality, etc.).

### **Sources**

The source types used to produce data on this topic are a combination of scientific research, monitoring systems, and remote sensing. Research studies and monitoring also incorporate sample surveys describing certain aspects of ecosystems and biodiversity.

In general, information related to biodiversity or ecosystems is produced through what is termed an "evaluation of biodiversity" (i.e., an assessment) which organizes and uses the information on biodiversity collected through monitoring, e.g., the number of species present, the population of a species, a habitat (usually meaning a vegetation community) or the sum of all such components within a given area or site.<sup>66</sup> The need for an evaluation may be triggered by conservation concerns, need to determine protected areas, identifying which of a site's features are of conservation interest, management planning and monitoring processes, or policy or economic interests, among others.

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<sup>66</sup> Marker, D. and Stevens, D (2009) Sampling and Inference in Environmental Surveys, in Pfefferman, D. and Rao, C. (Eds.) *Handbook of Statistics. Vol.29A. Sample surveys: Design, Methods and Applications*, Amsterdam: Elsevier, [http://hbanaszak.mjr.uw.edu.pl/TempTxt/Danny%20Pfeffermann,%20C.R.%20Rao-Handbook%20of%20Statistics%2029A%20Sample%20Surveys%20Design,%20Methods%20and%20Applications-North%20Holland%20\(2009\).pdf](http://hbanaszak.mjr.uw.edu.pl/TempTxt/Danny%20Pfeffermann,%20C.R.%20Rao-Handbook%20of%20Statistics%2029A%20Sample%20Surveys%20Design,%20Methods%20and%20Applications-North%20Holland%20(2009).pdf) (accessed 08 January 2018)

The most common sources of data about ecosystems and biodiversity (and those used for evaluations) are total counts or surveys, which can be conducted as regular monitoring or as ad hoc surveys. These are conducted as part of regional or national studies, case studies, baseline studies, targeted studies, observations, scientific studies, and expert judgment. The use of these approaches varies depending on existing resources and the purpose, scale, characteristics and components of the ecosystems and biodiversity to be described. Collecting biodiversity information to identify species, requires specialized knowledge and thus highly specialized personnel or volunteers, often trained biologists; however, gains are being made in using citizen science approaches to measuring species.

### **Institutions**

Most available biodiversity and ecosystem data come from organised monitoring initiatives coordinated at country level by regional or national environment agencies or statistical offices. A significant part of information now originates from monitoring schemes coordinated by non-governmental organisations (NGOs) working in biodiversity.

The institutional partners producing different aspects of ecosystems and biodiversity data vary according to the national institutional set-up and the organization of statistical production and dissemination in the country. However, the main partners usually include the following:

- Scientific and research institutions evaluating, assessing and monitoring ecosystems and biodiversity;
- National agencies such as biodiversity protection and environmental authorities and those responsible for the management of protected areas and national parks;
- Geographical institutes;
- Government departments in charge of national parks, wildlife, forests, seashore and seas;
- Sectoral experts, stakeholder organisations;
- National Statistical Offices;
- International organisations disseminating relevant studies, data and statistics.

### **Aggregation**

Statistics on ecosystems and biodiversity are aggregated or disaggregated to varying degrees depending on the objectives of the statistical operation, availability of primary data points, relevance, and financial resources, among others. Some of the information on ecosystems and biodiversity can be produced or aggregated according to certain dimensions: by ecosystem type, species, region and national level. In general, quantity measurements can be aggregated, e.g., size of the population of a given species in each area or measures of area; total area of lakes, forests, etc. Measurements collected at high frequency intervals, e.g., temperature and humidity, should be aggregated in time (average, median, etc.).

Other variables cannot be spatially aggregated, e.g., measurements on the quality of soils or air, caudal/tail of a river which is measured at two points, etc. Qualitative information of each species within an ecosystem is presented for each species, not aggregated to higher levels in the classification such as taxon, group, family, etc.

#### Temporal aggregation

Ecosystem and biodiversity statistics may be presented as collected or aggregated over time. However, data are often sparse, therefore the possibility of this also depends on the frequency of data collection and measurement points.

An important temporal consideration to note is that the calendar year often does not coincide with the events that occur in ecosystems and biodiversity, which may cover shorter or longer periods of time.

Seasonality also needs to be considered; some environmental variables behave in a markedly seasonal manner. For example, fluctuations in certain types of aquatic ecosystems, tropical ecosystem productivity, surface water levels, ice

cap surface and incidence of fires are heavily influenced by seasonality and weather (e.g., due to occurrence of El Niño or La Niña) and natural extreme events. In such cases, monitoring is focused more on some months than others, and therefore statistics should be produced for the most relevant time periods.

The appropriate frequency for updating the data will depend on the relevance and nature of change of a given variable. For example, in a slow growing natural forest that is not subject to logging, periodicity of monitoring and informing about its status may be greater than one year. Another example is that of soil nutrient and conditions for a defined ecosystem or territory, which is usually assessed only once or twice within decades, therefore is rarely updated but remains applicable.

#### Spatial aggregation

Statistics can be collected at different scales and can be aggregated to varying levels of scales related to units which reflect the ecosystem, such as homogeneous areas of land cover; smaller units below the ecosystem; or areas related to management purposes which contain overlapping boundaries or multiple ecosystems, such as river basins or environmental management areas.

#### **Validation**

In ecosystems and biodiversity statistics a programme of quality control may include measurement-related activities such as the calibration of monitoring equipment as well as ensuring its appropriate use, data management, field audits and the training of personnel involved in monitoring and, in certain cases, laboratory analysis.

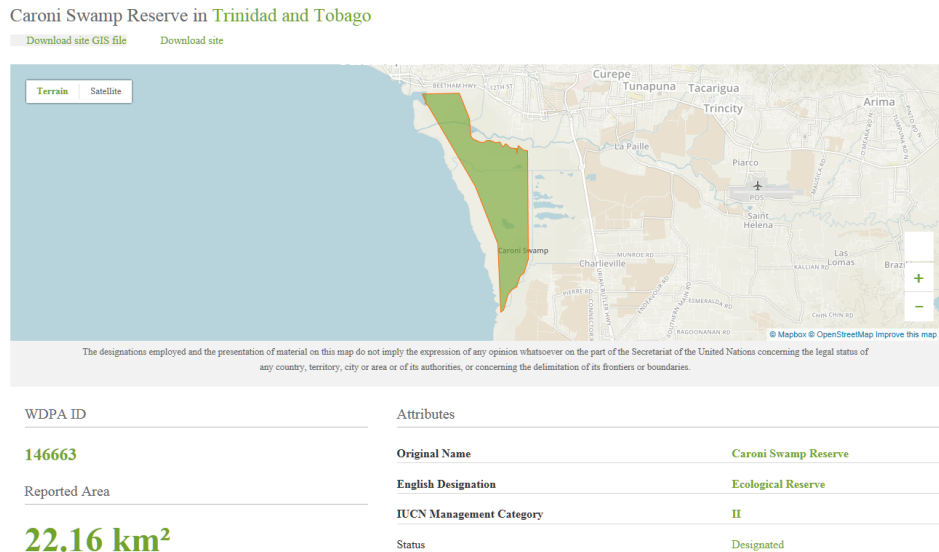
Data on ecosystems often originate from disparate data sources. Therefore, it should be ensured that, as far as possible, the information gathered aligns with appropriate concepts and measurement boundaries. Given the diversity of sources, it is important that experts review and validate the information generated, ensuring that it is consistent with the results generally found in other studies and in the literature. Data can also be validated and cross-checked against existing biodiversity information including global estimations, data provided by local experts, preliminary surveys, etc.



# 6. Uses and dissemination

## 6A. Potential presentation/dissemination formats

Figure 6.1: IUCN Protected Planet Database, Caroni Swamp Reserve Protected Area, Trinidad and Tobago



Source: IUCN Protected Planet database, <https://www.protectedplanet.net/caroni-swamp-reserve-ecological-reserve> (accessed 08 January 2018)

Protected Planet is a valuable source of information on protected areas, including qualitative information and incorporates some of the best mass media techniques, including photographs of species and protected areas to generate new components of interest and information for protected areas.

Figure 6.2: Great Lakes Dimensions, Canada

### The Great Lakes, dimensions

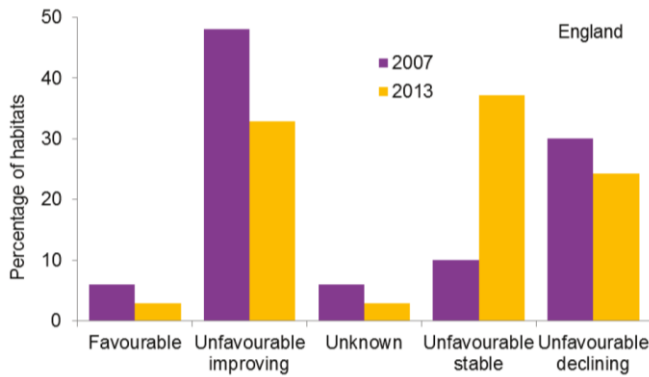
	Length	Maximum depth	Total area	Area on Canadian side of boundary
	km	m	km <sup>2</sup>	km <sup>2</sup>
Superior	563	406	82,100	28,700
Michigan	494	282	57,800	0
Huron	332	229	59,600	36,000
Erie	388	64	25,700	12,800
Ontario	311	244	18,960	10,000

Source: Natural Resources Canada, GeoAccess Division and Great Lakes Commission. Last modified: 2005-02-02.

Source: Statistics Canada, webpage summary tables on natural resources 2005, <http://www.statcan.gc.ca/tables-tableaux/sum-som/I01/cst01/phys04-eng.htm> (accessed 08 January 2018)

The table shows physical data for the Great Lakes of Canada.

**Figure 6.3: Habitat Conservation Status, England 2007-2013**



Notes: Graph based on 70 habitats listed on Annex I of the Habitats Directive that occur in England.

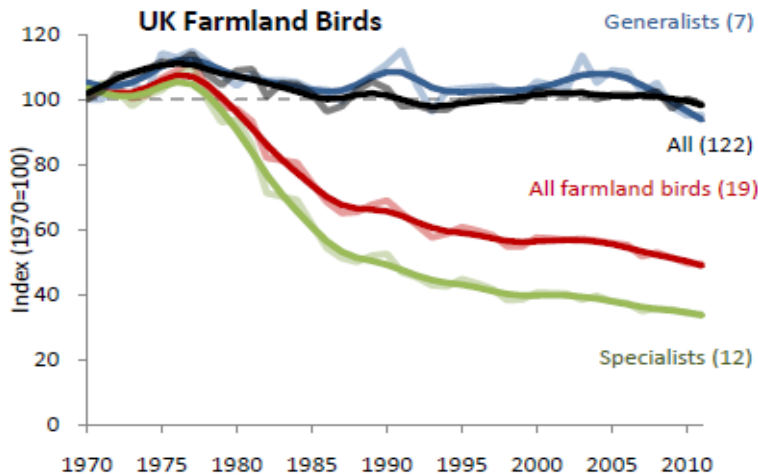
Source: UK Habitats Directive (Article 17) reports 2007 and 2013.

Source: DEFRA (2017) England Biodiversity Indicators,

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/635189/2b\\_Priority\\_habitats\\_2017.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/635189/2b_Priority_habitats_2017.pdf) (accessed 08 January 2018)

The figure shows progress in maintaining or restoring favourable conservation status for habitats in the UK.

**Figure 6.4 Trend in Farmland Birds, UK 1970-2010**



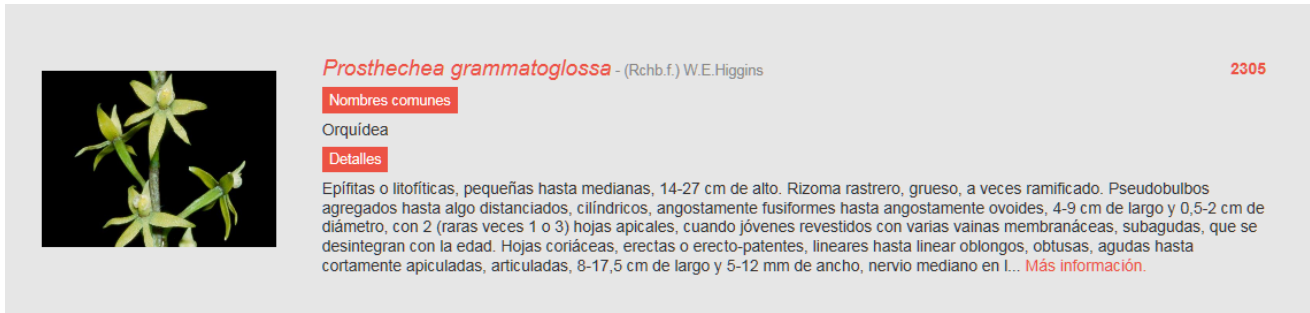
Source: [RSPB, BTO, JNCC, Defra](#)

Source: DEFRA (2013) World Environment Day Factsheet,

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/204914/wed-feactsheet-v4\\_1final.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/204914/wed-feactsheet-v4_1final.pdf) (accessed 08 January 2018)

The graph shows trend in farmland birds categorized by dependence on farmland as a habitat, i.e., specialists, or generalists, those not depending on farmland for habitat.

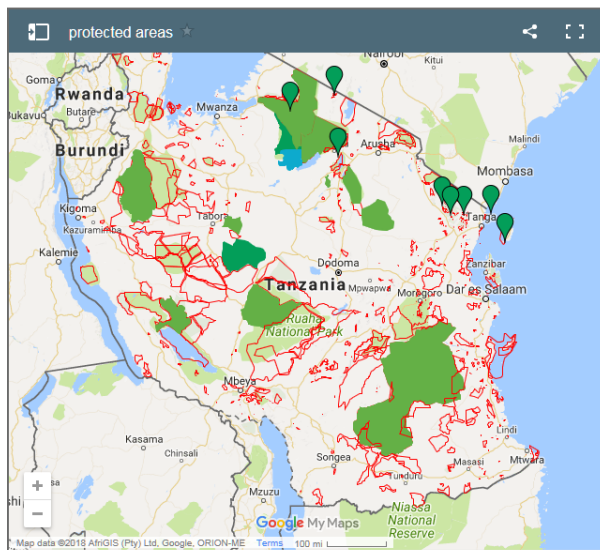
**Figure 6.5: Biodiversity Catalogue of Colombia**



Source: Sistema de Información sobre Biodiversidad de Colombia, web database of the biodiversity catalogue of Colombia maintained by Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, <http://catalogo.biodiversidad.co/> (accessed 07 January 2018)

It provides a catalogue of species in a country, contains information on biological taxonomy, common names, a map of the areas where species are found, counts of species, habitat, and conservation status.

**Figure 6.6: Tanzania Protected Areas Overlaid with Administrative Areas**



Source: Tanzania Commission for Science and Technology, [http://bimt.costech.or.tz/Home/protected\\_area](http://bimt.costech.or.tz/Home/protected_area) (accessed 08 January 2018)

Identifies geographic and taxonomic locations of data, species and protected areas. Also makes available citizen science data.

## 6B. SEEA accounts/tables that use these statistics

These environment statistics are integrated in the System of Environmental-Economic Accounting 2012 (SEEA 2012) – Experimental Ecosystem Accounting.<sup>67</sup>

Ecosystem accounting provides a picture of trends in ecosystems by integrating information on stocks, changes in stocks of ecosystem assets, and information on flows of ecosystem services. It aims to provide understanding of how economic and other human activity contribute to the degradation of ecosystems. Of key interest is the measurement of changes in ecosystem assets, particularly ecosystem degradation and ecosystem enhancement.

The SEEA contains tables on ecosystem assets and ecosystem services in both physical and monetary terms. It is the tables on ecosystem assets in physical terms which are most relevant. These are:

- Tables 2.3. and 4.3. Measures of Ecosystem Condition and Extent for an Ecosystem Accounting Unit (EAU) at end of Accounting Period. Provides information on ecosystem extent under indicators which cover the functioning, integrity and resilience of the ecosystems, for various characteristics of ecosystems, e.g., vegetation, biodiversity, soil, water, carbon.
- Table 4.4. Changes in Ecosystem Condition for a Land Cover/Ecosystem Functional Units (LCEU). Covers opening condition, improvements in condition due to natural regeneration and due to human activity, reductions in condition due to extraction and harvest of resources; human activity or catastrophic losses due to human activity; and closing condition for each ecosystem characteristic in the individual ecosystem (LCEU).
- Table 4.7. Biodiversity Account: species abundance by Kingdom for an EAU. Accounts are prepared for taxa or categories in a classification of species. Showing opening and closing population, net change, reference population, and opening and closing population as a percentage of reference population.
- Table A4.2.1. Accounts for Threatened species. For each threatened species or groups of species, provides for each IUCN Red List category of threatened status, the opening stock; closing stock; additions due to movement between categories, rediscoveries, reclassifications, updated assessments or new additions to the list; and reductions due to movement between categories, reclassifications, local extinction or updated assessments.

The following units of measurement referred to above are specific to the SEEA 2012 - Experimental Ecosystem Accounting. These are Basic Spatial Units (BSU), Land Cover/Ecosystem Functional Units (LCEU) and Ecosystem Accounting Units (EAU).<sup>68</sup> BSUs smaller units which together can be aggregated to form LCEUs. These are typically the grid or pixels of satellite images; the LCEUs correspond to what is defined here as ecosystems. EAUs correspond to administrative areas of interest such as river basins, and may contain several LCEUs.

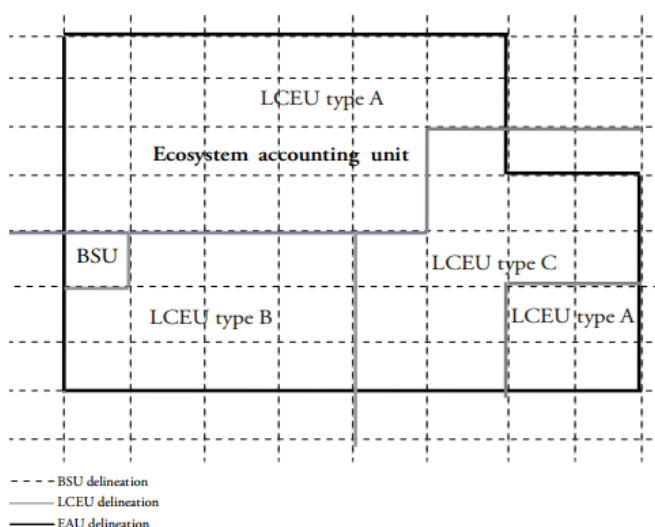
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<sup>67</sup> United Nations, European Commission, Organisation for Economic Co-operation and Development and World Bank (2014) *System of Environmental-Economic Accounting 2012-Experimental Ecosystem Accounting*. Sales No. E.13.XVII.13.  
[https://unstats.un.org/unsd/envaccounting/seeaRev/eea\\_final\\_en.pdf](https://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf) (accessed 08 January 2018)

<sup>68</sup> United Nations, European Commission, Organisation for Economic Co-operation and Development and World Bank (2014) *System of Environmental-Economic Accounting 2012-Experimental Ecosystem Accounting*. Sales No. E.13.XVII.13.  
[https://unstats.un.org/unsd/envaccounting/seeaRev/eea\\_final\\_en.pdf](https://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf) (accessed 08 January 2018)

**Figure 6B. Relationship between BSUs, LCEUs and EAUs**

Stylized depiction of relationships between BSUs, LCEUs and EAUs



## 6C. Commonly used indicators that incorporate these statistics

Biodiversity indicators can provide data at regional or national level, for different taxa (levels of a taxonomy/classification) or for different ecosystem functions.

**Convention on Biological Diversity (CBD) - COP 7 Decision VII/30 Provisional Indicators for Assessing Progress Towards the 2010 Biodiversity Target:** indicators are included in Annex I portraying trends in abundance and distribution of selected species, coverage of protected areas, change in status of threatened species, trends in invasive alien species, among other (<https://www.cbd.int/decision/cop/?id=7767>).

**Strategic Plan for Biodiversity 2011-2020:** The above indicators have since been replaced by the Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets, of the Convention on Biological Diversity, COP 10 Decision X/2, (<https://www.cbd.int/sp/>). Relevant to the statistics of the methodology sheet are:

- **Target 5:** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.
- **Target 8:** By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.
- **Target 9:** 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.
- **Target 11:** By 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.
- **Target 12:** By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

- **Target 13:** By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.
- **Target 14:** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.
- **Target 15:** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

**United Nations Sustainable Development Indicators:**<sup>69</sup> for more information, consult indicators of sustainable development, guidelines and methodologies at <http://www.un.org/esa/sustdev/natlinfo/indicators/guidelines.pdf>.

#### Indicators on Oceans and coasts

- Proportion of marine area protected total and by ecological region.

*Marine area protected = protected marine area (1.2.2.d.1)/Total marine area or total ecological region area (1.2.2.a.1)*

#### Biodiversity

- Proportion of terrestrial area protected, total and by ecological region.

*Terrestrial area protected = protected terrestrial area (1.2.2.d.1)/Total terrestrial area or total ecological region area (1.2.2.a.1)*

- Area of selected key ecosystems.

*Area of ecosystems (1.2.2.a.1)*

- Fragmentation of habitats: trends in the fragmentation of identified key habitats to assess the relative effectiveness of measures for conserving biodiversity, and as a tool to estimate the need for specific conservation measures to maintain the biological diversity in a country or region.

*Habitat fragmentation (1.2.2.c.5) years t to t+n*

- Abundance of invasive alien species - The indicator measures the number of invasive alien species in a given country or region.

*Invasive alien flora and fauna species (1.2.2.c.3) years t to t+n*

- Change in threat status of species: it shows overall changes in threat status of representative sets of species at the global level. It is also applicable at the national level for any country which has a national Red List, and which has fully assessed its species more than once over time.

*Known flora and fauna species by threat level (1.2.2.c.1) year t+n minus Known flora and fauna species by threat level (1.2.2.c.1) year t*

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<sup>69</sup> United Nations (2007) Indicators of Sustainable Development: Guidelines and Methodologies, 3<sup>rd</sup> edition, New York: United Nations, <http://www.un.org/esa/sustdev/natlinfo/indicators/guidelines.pdf> (accessed 10 January 2018)

- Abundance of selected key species: population trends in selected species to show changes in biodiversity, and the relative effectiveness of measures to maintain biodiversity. This indicator can be applied to individual groups of species or can be aggregated to incorporate a number of taxa. The unit of measurement is the number of mature individuals or other relevant indicator of abundance within a given area or population.

*Known flora and fauna species (1.2.2.c.1) years t to t+n*

## OECD Biodiversity Indicators

- The number of threatened species compared to the number of known or assessed species. “Threatened” refers to the “endangered”, “critically endangered” and “vulnerable” species.

*Known flora and fauna species (with IUCN Red List status endangered, critically endangered or vulnerable) (1.2.2.c.1) / Known flora and fauna species (1.2.2.c.1)*

- Streamlining European Biodiversity Indicators (SEBI): <https://biodiversity.europa.eu/topics/sebi-indicators>
  - Abundance and distribution of selected species, 1.2.2.c.4 *Species population*
  - Red List Index for European species, 1.2.2.c.1 *Known flora and fauna species*
  - Ecosystem coverage, 1.2.2.a.1 *Area of ecosystems*
  - Nationally designated protected areas, 1.2.2.d.1 *Protected terrestrial and marine area*
  - Critical load exceedance for nitrogen, 1.2.2.b.1 *Ecosystems’ chemical and physical characteristics: Nutrients*
  - Invasive alien species in Europe, 1.2.2.c.3 *Invasive alien flora and fauna species*
  - Fragmentation of natural and semi-natural areas, 1.2.2.c.5 *Habitat fragmentation*
  - Nutrients in transitional, coastal and marine waters, 1.2.2.b.1 *Ecosystems’ chemical and physical characteristics: 1. Nutrients, 3. Pollutants*

## 6D. SDG indicators that incorporate these statistics

### Indicator 6.6.1 Change in the extent of water-related ecosystems over time

The indicator looks at ecosystem categories: wetlands (swamps, marshes and peatlands), open water (rivers and estuaries, lakes, coastal waters and reservoirs), and groundwater aquifers. The relevant statistic is 1.2.2.a.1 Area of ecosystems.

### Indicator 14.1.1 Index of coastal eutrophication and floating plastic debris density

The index includes concentrations of Chlorophyll-a as an indicator of phytoplankton biomass; inputs of nutrients (nitrogen, phosphorous and silica, in different forms) from rivers; and quantities of floating plastics distribution and beach litter. Relevant statistics would fall under 1.2.2.b Ecosystems’ chemical and physical characteristics, and 1.2.2.b.1, 1.2.2.b.2, and 1.2.2.b.3 concentrations of nutrients, carbon and pollutants.

### Indicator 14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations

The indicator is defined as mean (monthly or annual) surface seawater pH and aragonite saturation state, based on ocean acidification observations. These observations must include: two parameters of the carbonate system (Dissolved Inorganic Carbon, total pH, pCO<sub>2</sub>, total alkalinity), in situ seawater temperature, salinity, as well as relevant meta data. Relevant statistics would fall under 1.2.2.b Ecosystems’ chemical and physical characteristics, and 1.2.2.b.1, 1.2.2.b.2, and 1.2.2.b.3 concentrations of nutrients, carbon and pollutants.

### Indicator 14.5.1 Coverage of protected areas in relation to marine areas

The indicator shows temporal trends in the mean percentage of each important site for marine biodiversity (i.e., those that contribute significantly to the global persistence of biodiversity) that is covered by designated protected areas. The relevant statistics are 1.2.2.a.1 Area of ecosystems and 1.2.2.d Protected areas and species.

**Indicator 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type**

The indicator shows important sites for terrestrial and freshwater biodiversity that are covered by protected areas. It 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. The relevant statistics are 1.2.2.a.1 Area of ecosystems and 1.2.2.d Protected areas and species.

**Indicator 15.3.1 Proportion of land that is degraded over total land area**

Measures land degradation by sub-indicators showing trends in land cover, land productivity and carbon stocks. The FDES statistic 1.2.2.b.2 Carbon, which measures soil organic carbon, is relevant to the third sub-indicator.

**Indicator 15.4.1 Coverage by protected areas of important sites for mountain biodiversity**

The indicator 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. The relevant statistics are 1.2.2.a.1 Area of ecosystems and 1.2.2.d Protected areas and species.

**Indicator 15.5.1 Red List Index**

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) and is expressed as changes in an index ranging from 0 to 1. Related statistic at country level is FDES 1.2.2.c.4 Species population by IUCN status category for total species and threatened species.

**Indicator 15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020 (Tier III).**

The indicator is Tier III and methodology is in development. Related to FDES statistic 1.2.2.c.3 Invasive alien flora and fauna species.

The following indicators do not directly use the FDES statistics of Topic 1.2.2 but are related to the health of ecosystems and biodiversity, and are therefore of interest to the topic.

- Indicator 14.2.1 Proportion of national exclusive economic zones managed using ecosystem-based approaches.
- Indicator 15.7.1 and 15.C.1 Proportion of traded wildlife that was poached or illicitly trafficked.
- Indicator 15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species.
- Indicator 15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020. The target reads “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”. It is thus related to Component 6: Environmental Protection, Management and Engagement.







**F D E S**

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