

An inventory of biodiversity indicators in Europe, 2002



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Executive summary and conclusions

This review of biodiversity-related indicators was performed to support the development of a core set of environmental indicators to be established by the European Environment Agency (EEA). The overall objective of the EEA core set initiative is to identify a coherent indicator set covering the main environmental issues — including biodiversity — and economic sectors to support the policy-making processes across many levels in the EU and elsewhere.

Prior to the definition of the EEA core set of biodiversity indicators, there was a need to review current initiatives that aim at developing operational indicators, at various geographical levels, for specific fields of interest (such as sustainable development, agriculture, landscapes and biodiversity). The information includes international indicators as well as the first survey of national indicators carried out in the framework of the Convention on Biological Diversity (CBD) but does not cover the more recent CBD initiatives. A summary table presented in Chapter 6 lists 655 biodiversity-related indicators found during the study period (August 2001 to January 2002). Many of the indicators use the same data pool for various purposes. The list is distributed over 12 classes (sectors/themes) as presented in the table below:

Biodiversity-related indicators		
Sectors/themes	Indicators listed	(%)
Nature protection	387	58
Forestry	78	12
Energy	1	0
Recreation/tourism	4	1
Climate change	12	2
Urban development	4	1
Rural development	0	0
Water	43	7
Infrastructure/transport	11	2
Trade	2	0
Fisheries	22	3
Agriculture	91	14

The following main conclusions can be derived from the survey:

1. There is an enormous variety of indicators that have been developed to assess aspects of biodiversity at the national, international or global scale.
2. Many indicators have been proposed or developed, but only a limited number of them are actually in use on a regular basis.
3. The DPSIR assessment framework proves to be a good way of structuring thoughts on indicators but has its limitations in terms of interpretation.
4. Given the complexity of biodiversity and the need for further scientific research and testing, a two-way approach is recommended: select some indicators that can be used in the short term (even when imperfect) and meanwhile continue developing or fine-tuning other indicators for long-term use.
5. Main, current policy questions will define the objectives for using indicators. Cross-referencing a selected set of indicators to agreed policy questions will reveal existing gaps. The EEA core set of environmental indicators must be seen in the light of European assessments of the effectiveness of biodiversity-related policies as well as in the light of global concerns for biodiversity mainly expressed in the Convention of Biological Diversity.

1. Introduction

There are three basic functions of indicators: simplification, quantification and communication. Indicators generally simplify in order to make complex phenomena quantifiable so that information can be communicated (DOE, 1996). Indicators are commonly understood to serve as a communication tool about selected topics. Hence, biodiversity indicators support communication about the state and trend of biodiversity and of the causal relationships for changes. The geographical region concerned in the current report covers the European Environment Agency member countries⁽¹⁾.

As part of its mandate, the European Environment Agency (EEA) reports on environmental trends at European level on a regular basis. For this purpose, a core set of environmental indicators is being defined. It will include a limited number of indicators that are necessary to monitor and to guide policies, such as sectoral integration, thematic strategies, and important policy processes. The target groups for these indicators are thus: the European Commission (especially the Directorates-General for Environment, Agriculture, Energy and Transport, Fisheries, Regional Policy and Research and the Joint Research Centre), the European Council of Environment Ministers, the European Parliament and national governments. The European topic centres are international consortia brought together to support EEA to deliver information to policy-makers. Mainly, the European Topic Centre on Nature Protection and Biodiversity (ETC/NPB) develops the biodiversity-related indicators for the core set of environmental indicators. Prior to the definition of the core set of biodiversity indicators, there is a need to review main international initiatives under way that aim

at developing operational indicators. This review needs to cover various geographical levels and specific fields such as sustainable development, agriculture, landscapes, and biodiversity.

The current report defines criteria for selecting policy-relevant biodiversity indicators (Chapter 2), it presents the major policy requirements (Chapter 3), it provides an overview of existing main indicator development initiatives and biodiversity indicators developed to date (Chapters 4 and 5). The main content of this report is the summary table of 655 indicators presented in Chapter 6. Comparing the requirements and the existing indicators will feed into the discussion on developing the EEA core set of biodiversity indicators. Some conclusions are listed in the 'Executive summary and conclusions'.

The information in this report is based on consultations with various experts and stakeholders (Section 4.2) and numerous publications and other information sources (Chapter 8). The information includes the first survey of national indicators carried out in the framework of the Convention on Biological Diversity (CBD, see UNEP, 2001) but does not cover the more recent CBD initiatives.

The study has been performed by Ben Delbaere, European Centre for Nature Conversation as partner of the ETC/NPB. Valuable input to this study has been given by experts in response to the targeted enquiries (see Section 4.2), the participants of the indicator workshop held at the ETC/NPB in Paris on 17–18 October 2001 and the Eionet national representatives that participated in the Eionet meeting in Budapest on 29–30 October 2001. A special thanks also goes to Melanie Heath and Dominique Richard.

1) Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Turkey, United Kingdom.

2. Criteria for selection of biodiversity indicators

Criteria for selecting biodiversity indicators to be incorporated in this study can be derived from various studies (Reid *et al.*, 1993; Bosch & Söderbäck, 1997; Cannell *et al.*, 1999; UNEP, 1999, 2001; Ten Brink, 2000; European Commission, 2001a). The list below is a compilation of such criteria that fit best for the purposes of this report.

The indicators should meet the following criteria:

- be easy to understand and policy-relevant;
- provide factual, quantitative information;
- be normative (possibility to compare to a baseline situation);
- be scientifically sound and statistically valid;
- be responsive to change in time/space;
- be technically feasible and cost-efficient to use within acceptable limits (in terms of data collection);
- be useable for scenarios for future projections;
- allow comparison between member states;
- allow aggregation at national and multinational level;
- take into account country-specific biodiversity;
- be user-driven.

Meeting all of these criteria has not been a requirement for each of the indicators listed in the current report (otherwise, the list would be slimmed down considerably). The criteria could actually be applied more fully in a following step towards defining the biodiversity indicators to be included in a core set of environmental indicators, see Chapter 1.

3. Inventory of policy objectives for biodiversity

3.1. Policy instruments and their objectives

When developing a monitoring programme and indicators that feed into it, it is from the very start of primary importance to define objectives against which future results can be compared (Hellawell, 1991). These objectives should be possible to translate into generic policy questions. Each indicator should provide (part of) the answer to such policy questions.

An analysis of 12 selected international instruments (conventions, directives, agreements, etc.) by the UK Joint Nature Conservation Committee (JNCC) and the UNEP World Conservation Monitoring Centre (UNEP-WCMC) in the framework of developing the reporting obligations database (ROD) ⁽²⁾ identified 1 752 questions that countries need to answer as part of their reporting obligations (JNCC & UNEP-WCMC, 2000). However, most of these questions concern reporting on activities rather than on state and trends in biodiversity or the effectiveness of policy.

For the purpose of the current study, the major policy questions to be answered and for which indicators can provide useful tools are derived from the main objectives of 12 biodiversity-related global and European policy instruments:

- Ramsar Convention (1971)
- Bern Convention (1979)
- Bonn Convention (1979)
- EC birds directive (1979)
- EC habitats directive (1992)
- Convention on Biological Diversity (1992)
- Pan-European biological and landscape diversity strategy (1995)
- Ministerial Conference on the Protection of Forests in Europe (1990, 1993, 1998)
- EC water framework directive (2000)
- EC biodiversity strategy (1998) and its four sectoral biodiversity action plans (2001)

- EU sustainable development strategy (2001)
- Sixth EU environment action programme (2001)

Ramsar Convention

Since 1996, the Ramsar Convention's aims and objectives are concentrated into a mission statement, as included in the Ramsar strategic plan 1997–2002 ⁽³⁾. The convention's mission is the conservation and wise use of wetlands by national action and international cooperation as a means to achieving sustainable development throughout the world. Amongst other means, this mission is supported by objectives covering raising awareness of wetland values, capacity building, designation of wetlands as Ramsar sites and ensuring conservation of all sites listed.

Bern Convention

The aims of this Convention are formulated in its Article 1 and are '[...] to conserve wild flora and fauna and their natural habitats, especially those species and habitats whose conservation requires the cooperation of several States, and to promote such cooperation. Particular emphasis is given to endangered and vulnerable species, including endangered and vulnerable migratory species' (Council of Europe, 1979).

Bonn Convention

The Convention on Migratory Species (CMS, Bonn Convention) ⁽⁴⁾ spells in its CMS guide out the aims as follows: the CMS aims to conserve migratory (avian, marine and terrestrial) species over the whole of their range. The convention provides a framework within which parties may act to conserve migratory species and their habitats by:

- adopting strict protection measures for migratory species that have been categorised as being in danger of extinction throughout all or a significant proportion of their range

2) <http://rod.eionet.eu.int>.

3) http://ramsar.org/key_strat_plan_e.htm.

4) <http://www.wcmc.org.uk/cms/>.

- (listed in Appendix I to the convention);
- concluding agreements for the conservation and management of migratory species that have an unfavourable conservation status or would benefit significantly from international cooperation (listed in Appendix II to the convention);
- undertaking joint research and monitoring activities.

EC birds directive

The primary objective of the birds directive is laid down in its Article 2 and is '[...] to maintain the population of the species [...] at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level' (European Community, 1979). To achieve this objective the birds directive formulates specific measures to be taken by the Member States in the field of area protection (establishment of special protection areas, SPAs) and species protection. Species concerned are listed in the Annexes I–V to the directive.

EC habitats directive

Article 2 of the habitats directive formulates the aim '[...] to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the Treaty applies' (European Community, 1992). It specifies measures in support of this aim, being '[...] to maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of Community interest'. The measures '[...] shall take account of economic, social and cultural requirements and regional and local characteristics'.

In order to achieve its objective, the habitats directive calls for the establishment of a European ecological network, called Natura 2000, which consists of special areas for conservation (SACs), to be designated under the habitats directive, and the SPAs as designated by the birds directive. Habitats

and species to be affected by the directive and special measures to be taken are listed in Annex I–VI to the directive.

Convention on Biological Diversity

The objectives of the Convention on Biological Diversity (CBD), laid down in Article 1, are threefold (UNEP, 1992):

- the conservation of biological diversity;
- the sustainable use of its components;
- the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.

Because CBD is global in scope the above objectives are presented in general terms. Articles 6 through to 20 of the CBD formulate specific measures and objectives. A detailed analysis of these articles lists a total of 63 measurable objectives for which indicators may be developed. All except three of these objectives would require response indicators reporting on activities carried out. Two of the objectives (Article 7a and b) may result in a status indicator and one (Article 7c) can provide an impact indicator.

Pan-European biological and landscape diversity strategy

The pan-European strategy (PEBLDS) sets out to achieve the following objectives over the period 1996–2016 (Council of Europe *et al.*, 1996):

- conservation, enhancement and restoration of key ecosystems, habitats, species and features of the landscape through the creation and effective management of the pan-European ecological network;
- sustainable management and use of the positive potential of Europe's biological and landscape diversity through making optimum use of the social and economic opportunities on a local, national and regional level;
- integration of biological and landscape diversity conservation and sustainable use objectives into all sectors managing or affecting such diversity;
- improved information on, and awareness of, biological and landscape

diversity issues, and increased public participation in actions to conserve and enhance such diversity;

- improved understanding of the state of Europe's biological and landscape diversity and the processes that render them sustainable;
- assurance of adequate financial means to implement the strategy.

Ministerial Conference on the Protection of Forests in Europe

The Conference Declaration of the First Ministerial Conference of the Protection of Forests in Europe (MCPFE, Strasbourg, 1990) formulates the intentions of some 40 European countries on protection of forests. These are to:

- promote and reinforce cooperation between European States in the field of forest protection and sustainable management, by developing exchanges of information and experience, and by supporting the efforts of the international organisations concerned;
- improve exchanges of information between forestry research workers, managers and policy-makers, both within and between the signatory countries, in order that the most recent advances can be integrated into the implementation of forest policies;
- encourage operations for restoring damaged forests;
- demonstrate, by way of an agreement on common objectives and principles, their will to implement, progressively, the conditions and the means necessary for the long-term management and conservation of the European forest heritage;
- examine the follow-up of decisions taken during the present conference and pursue the actions that will have been initiated, in the course of any subsequent meetings of government ministers or officials, and of international institutions, responsible

for seeing that forests fully assume their ecological, economic and social functions.

In terms of biodiversity, specific objectives have been formulated under the MCPFE framework in the biodiversity work programme ⁽⁵⁾, that was jointly developed by the MCPFE and the pan-European ministerial process 'Environment for Europe', These are:

- conservation and appropriate enhancement of biodiversity in sustainable forest management;
- adequate conservation of all types of forests in Europe;
- clarification of the role of forest ecosystems in enhancing landscape diversity;
- clarification of impacts of activities from other sectors on forest biological diversity.

EC water framework directive

Specifically point (a) of Article 1 of this directive is of relevance to biodiversity, as it sets out '[...] to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems' (European Community, 2000).

EC biodiversity strategy

The EC biodiversity strategy is the EU's response to the Convention on Biological Diversity and aims '[...] to anticipate, prevent and attack the causes of significant reduction or loss of biological diversity at the source. This will help both to reverse present trends in biodiversity reduction or losses and to place species and ecosystems, which includes agro-ecosystems, at a satisfactory conservation status, both within and beyond the territory of the European Union' (European Commission, 1998).

5) Work programme on the conservation and enhancement of biological and landscape diversity in forest ecosystems, 1997–2000 (<http://www.mcpfe.org/Basic/FS-Work-Programmes.html>).

This overall objective is supported by specific objectives as formulated for eight policy areas in Section III of the strategy. In addition, concrete objectives and how to achieve them are laid down in four sectorial biodiversity action plans, published in 2001 (European Commission, 2001c).

A detailed analysis of the objectives as formulated in Section III of the EC biodiversity strategy reveals the need for 58 response indicators to measure progress in achieving these objectives.

EU sustainable development strategy

Although it is a generic instrument that relates to the broader environment, the EU sustainable development strategy includes three 'headline objectives' focusing on natural resources. These are to 'break the links between economic growth, the use of resources and the generation of waste; protect and restore habitats and natural systems and halt the loss of biodiversity by 2010; and improve fisheries management to reverse the decline in stocks and ensure sustainable fisheries and healthy marine ecosystems, both in the EU and globally' (European Commission, 2001b).

Sixth EU environment action programme

Also, the sixth EU environment action programme has a scope that covers the wider environment but has at the same time, like the sustainable development strategy, a component focusing on biodiversity with the objective '[...] to protect and restore the functioning of natural systems and halt the loss of biodiversity in the European Union and globally. To protect soils against erosion and pollution' (European Commission, 2001d).

3.2. Common policy questions

If one wants to monitor whether objectives or targets have been met, these objectives should be formulated following the

SMART principle (specific, measurable, achievable, result oriented, time bound). However, the objectives of the 12 instruments listed above, as a rule, do not match this principle fully because they are generic in terms and scope (e.g. use of terms such as 'favourable conservation state', 'to promote', 'to maintain', etc.). Still, the policy questions that relate to the objectives can be formulated in a more concrete way.

The short list of questions presented below is derived from the main objectives in the 12 listed policy instruments:

1. What is the threat status and the trend of Europe's biodiversity (wild flora and fauna and their natural habitats) (6)?
2. What is the conservation status of Europe's biodiversity?
3. What measures are taken to conserve or restore biodiversity?
4. Are these measures effective in reaching the objectives?
5. Are biodiversity conservation measures integrated into other sectors of society?
6. Is use of biodiversity components carried out in a sustainable way?
7. What is the status of awareness and participation of the public and policy-makers?
8. What is the status of information availability and understanding of biodiversity?
9. Are financial means available for biodiversity conservation and how are they spent?
10. What driving forces impact on biodiversity?
11. Are pressures on biodiversity or causes for biodiversity loss being tackled?
12. What is the level of the main pressures on biodiversity?

A similar list, containing 45 (sub)questions arranged according to the pressure-state-response framework, was presented to CBD/SBSTTA-7 (UNEP, 2001) and focuses on the CBD.

6) For the EU, this general question can be phrased more directly as: 'Are we reaching the target of halting loss of biodiversity by 2010?'

4. Overview of existing initiatives for developing biodiversity indicators

4.1. Information sources

For the purpose of this study, the following information sources on developing biodiversity-related indicators on the (supra)national level have been analysed.

From these information sources, the table of indicators as listed in the annex is derived:

- a framework for indicators for the economic and social dimensions of sustainable agriculture and rural development (European Commission, 2001a)
- agri-environmental indicators for sustainable agriculture in Europe (Wascher, 2000)
- an approach to assessing biological diversity (Prescott-Allen *et al.*, 2000)
- biodiversity indicators for integrated environmental assessments at the regional and global level (WCMC, 1996)
- biodiversity indicators for policy-makers (Reid *et al.*, 1993)
- biodiversity indicators for the OECD environmental outlook and strategy (Ten Brink, 2000)
- CBD indicators of biological diversity (UNEP, 1997, 1999, 2001)
- CSD working list of indicators of sustainable development (UNCSD, 1996)
- EEA indicators (EEA web site, 2002)
- environmental indicators for agriculture (OECD, 2001)
- environmental signals 2001 (EEA, 2000a)
- environmental signals 2002 — draft list of contents (EEA, 2001b)
- european environmental state indicators (Bosch & Söderbäck, 1997)
- indicators and environmental impact assessment (UNEP, 2001)
- indicators for the integration of environmental concerns into the common agricultural policy (European Commission, 2000b)
- indicators of climate change in the UK (Cannell *et al.*, 1999)
- living planet report 2000 (Loh, 2000)
- MCPFE AG draft recommendations for the improvement of the pan-European indicators for sustainable forest management for criteria 2, 4 and 5 (discussion document, MCPFE, 2001a)
- minutes of the second MCPFE workshop on the improvement of pan-European indicators for SFM held on 24 and 25 September 2001 (MCPFE, 2001b)
- questionnaire on the state of the environment (OECD & Eurostat, 2001)
- pan-European criteria and indicators for sustainable forest management (MCPFE, 1998)
- proposed core indicators for water (EEA, 2001a)
- scoping study for fisheries indicators (Zenetos, 2001)
- statistical information needed for indicators to monitor the integration of environmental concerns into the common agricultural policy (European Commission, 2001e)
- TEPI — Towards environmental pressure indicators for the EU (Eurostat, 2001)
- TERM 2000 (EEA, 2000b)
- towards ecological quality objectives for North Sea benthic communities (de Boer *et al.*, 2001)
- using bird data to develop biodiversity indicators for agriculture (Heath & Rayment, 2001)
- water and wetland index (Hygum *et al.*, 2001)
- world conservation strategy (IUCN, 1980)
- world resources 2000–01 (UNDP *et al.*, 2000)

4.2. Experts consulted

- BirdLife International: Des Callaghan, Melanie Heath
- Dutch Butterfly Conservation (De Vlinderstichting): Chris van Swaay
- EFI: Mercedes Rois
- Eionet National Reference Centres
- EEA (ETC/ACC): André Jol, Roel van Aalst

- ETC/NPB: Dominique Richard, Sophie Condé
 - EEA (ETC/TE): Chris Steenmans
 - EEA (ETC/Water): Anita Künitzer, Niels Thyssen
 - EEA (ETC/WMF): Dimitrios Tsotsos
 - IFEN: Laurent Duhautois
 - JNCC: James Williams
 - JRC: Sten Folving
 - NINA: Erik Framstad
 - NoLIMITS project: Ian Simpson, Andrew Sier
- (<http://nolimits.nmw.ac.uk>)
- OECD: Kevin Parris
 - Wetlands International: Ward Hagemeyer

4.3. International initiatives

Below is an overview of the ongoing and planned international indicator initiatives most relevant to biodiversity in Europe and a tentative overview of the linkages (or lack of) between them:

Name	Topic	Lead organisation	Aim	Type of organisation	Status	Linkages
Core set of biodiversity indicators	Biodiversity	EEA and ETC/NPB	EEA assessment and reporting	Intergovernmental	Development (ready mid-2002)	Other ETCs, CBD, EFI, BirdLife Int., Wetlands Int., ECNC, OECD, MCPFE
Biodiversity headline indicators	Biodiversity	EEA and ETC/NPB	EU Council spring meetings	Intergovernmental	Development (ready by April 2002)	Other ETCs, EC
IBAs, threatened birds, common birds	Biodiversity based on bird data	BirdLife International	Reporting and assessment	NGO	Development/ implementing	EEA, OECD,
Wetland indicators	Biodiversity of wetlands	Wetlands International	Reporting	NGO/convention	Development	EEA, Ramsar
Forest biodiversity indicators	Forest biodiversity, sustainable forestry	MCPFE	MCPFE meetings	Intergovernmental	Development, ready by 2003	EEA, EFI, CBD
Core set of biodiversity indicators	Biodiversity	CBD, SBSTTA	CBD/COP, national reporting	Intergovernmental	Development, ready by COP7	EEA, MCPFE
ELISA agri-environmental indicators	Agri-environment	ECNC (for EC DG Research)	Assessment agricultural policies	Intergovernmental	Testing in ENRISK project	OECD, EEA, FAO, Eurostat
Integration indicators	Agri-environment	EC DG Agriculture	Reporting on integration of environment in agriculture	Intergovernmental	Proposed	EEA, OECD, ELISA, FAO, Eurostat
Sustainability indicators	Sustainable development	EC	EU Council Spring meetings	Intergovernmental	Proposed	EEA, UNCSD
Agri-biodiversity indicators	Agri-biodiversity	OECD	National reporting	Governmental	Testing, implementing	ELISA, EEA, Eurostat, FAO, EC
Living planet index	Biodiversity	WWF	Global reporting	NGO	Implementing	UNEP-WCMC
Sustainable development indicators	Sustainable development	UNCSD	Global reporting	Intergovernmental	Implementing	EEA, EC
Index development	Biodiversity, based on red lists	IUCN	National reporting	NGO	Proposed	CBD
TEPI environmental pressure indicators	Environmental pressure	Eurostat	National reporting, sectorial assessment	Intergovernmental	Implementing	EEA, EC
World resources	Environment, inc. biodiversity	WRI	Global reporting	NGO	Implementing	UNDP, UNEP, World Bank

5. Overview of existing biodiversity indicators

From the information sources listed in the previous section, an extensive list — totalling 655 including duplicates — has been compiled of all biodiversity-related indicators proposed or used (see annex). While completing the list, it was found difficult to draw the cut-off line on which indicators to include and which not. Especially in the light of integrated monitoring, virtually all types of indicators could be regarded as relevant to biodiversity in one way or another.

For example, when reviewing the list as used by UNDP *et al.* (2000) for the World resources 2000–01 publication data for economic indicators such as international tourism receipts or national poverty is included. For the current study, however, only those indicators with a direct link to biodiversity have been included, which inherently creates a certain level of subjectivity in choosing.

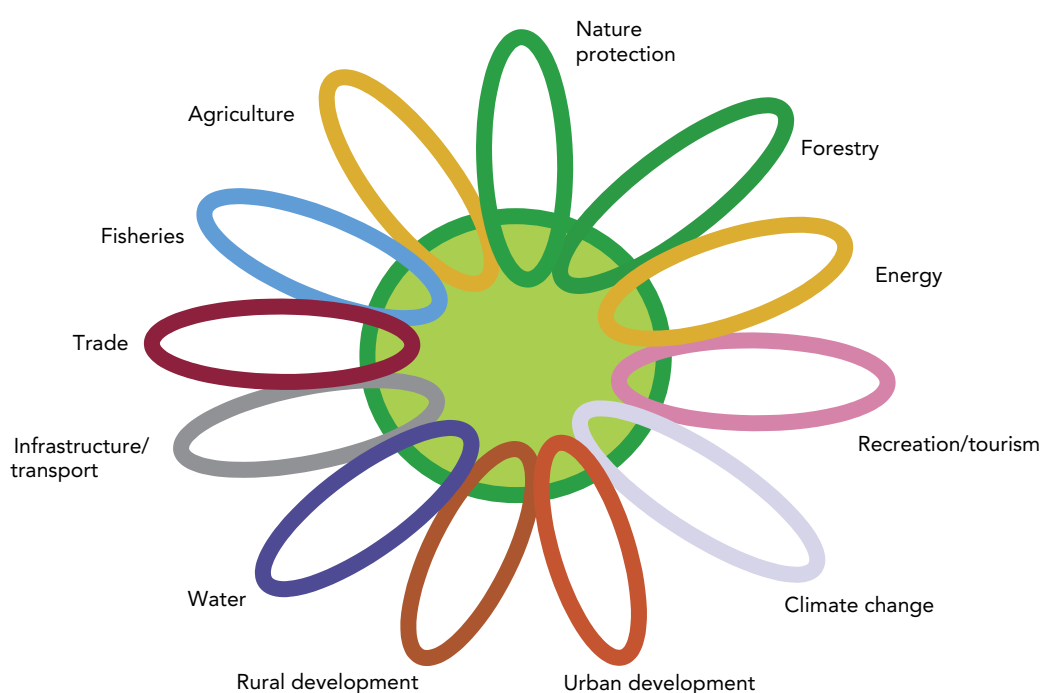
Also, in terms of state indicators, it turned out to be difficult to draw the line, since biodiversity indicators have hierarchical relationships (see e.g. Noss, 1990) and hence a certain duplication factor (e.g. total number of swallowtail butterfly species < total number of butterfly species < total number of species). The study only took into account biodiversity indicators (indicators that can be used to measure biodiversity) and not biological indicators (indicators that can be used to measure an environmental or ecological characteristic using a biological component) and tries to include those that can be used as direct indicators. Indirect indicators (such as biological oxygen demand of freshwaters) need to be weeded out at a later stage.

5.1. The indicator list

Separate ‘sub-lists’ have been compiled for different ‘sectors’ and issues (see Figure 1).

Flower model representing the linkages between the EEA core set of biodiversity indicators (middle circle) and the related sectors and issues

Figure 1



Each 'sub-list' presents for each indicator the following characteristics:

No:

Sequential number of the indicator, as used for this study only.

DPSIR:

indicates for which component of the DPSIR assessment framework (EEA, 1999) the indicator can be used. Based on expert judgement and open for debate.

Indicator name and definition:

the name of the indicator as used in the information source. Some may be very similar but still have minor differences. Aggregation and clustering is required.

Use:

indicates which stage of usage this indicator is in, whether it is only scientifically developed or implemented in monitoring activities already.

Information source:

bibliographical reference that mentioned this indicator.

5.2. Indices

Throughout the list of indicators a number of indices have been listed. These are actually composed of an aggregation of indicators and may need special attention in the light of developing a core set of indicators or even the headline indicators, as desired by the European Commission. The indices listed are:

- algae index (no definition included) (UNEP, 2001)
- biological quality index (no definition included) (Bosch & Söderbäck, 1997)
- forest physical fragmentation (no definition included) (Bosch & Söderbäck, 1997)
- habitat index: (undisturbed area + 0.25 (partially disturbed area)) / total area x 100 (Hannah *et al.*, 1994a, b)

- index for biodiversity and nature and cultural heritage values in the arable landscape (no definition included) (Bosch & Söderbäck, 1997)
- index of biotic integrity (IBI): used for aquatic ecosystems and based on multiple species-based metrics (Karr, 1987)
- living planet index (LPI): average of forest, freshwater and ocean index, each of which measures the average population trend over time of a sample of animal species (Loh, 2000)
- national biodiversity index (NBI): index derived from data on richness and endemism in the four terrestrial vertebrate classes and vascular plants, adjusted to country area (SCBD, 2001)
- natural capital index (NCI): ecosystem quantity * ecosystem quality (Ten Brink, 2000)
- relative wilderness index (no definition included) (UNEP, 2001)
- species risk index: number of endemic species per unit area in a community multiplied by the percentage of the natural community that has been lost (Reid *et al.*, 1993, UNEP, 2001)
- system aqua index: based on both prerequisites for and the actual biodiversity, using several physical, chemical and biological parameters (Bosch & Söderbäck, 1997)
- water resource vulnerability index (no definition included) (UNEP, 2001)
- world Bank/Gef natural capital indicator (NCI): each country's part of the world's total of remaining natural areas, adjusted for by its biodiversity richness, which is defined as the actual number of species (vertebrates and vascular plants) plus the number of endemics per country (Rodenburg *et al.*, 1995).

6. List of biodiversity-related indicators

Nature protection

Biodiversity-related indicators, Inventory January 2002, Nature protection

No	DPSIR	Indicator name and definition	Use	Information source
1	S	Species richness (number of species, number of species per unit area, and number of species per habitat type)	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
2	S	Species (populations) threatened with extinction (number or percentage)	Developed	Reid <i>et al.</i> , 1993
3	S	Species (populations) threatened with extirpation (number or percentage)	Developed	Reid <i>et al.</i> , 1993
4	S	Endemic species (number or percentage)	Developed	Reid <i>et al.</i> , 1993
5	S	Endemic species threatened with extinction (number or percentage)	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
6	S	Species risk index (number of endemic species per unit area in a community multiplied by the percentage of the natural community that has been lost)	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
7	S	Species (populations) with stable or increasing populations (number or percentage)	Implemented	Reid <i>et al.</i> , 1993
8	S	Species (populations) with stable or decreasing populations (number or percentage)	Implemented	Reid <i>et al.</i> , 1993
9	S	Threatened species in protected areas (number or percentage)	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
10	S	Endemic species in protected areas (number or percentage)	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
11	R	Threatened species maintained in <i>ex situ</i> collections (number or percentage)	Developed	Reid <i>et al.</i> , 1993
12	R	Threatened species with viable (reproducing) <i>ex situ</i> populations (number or percentage)	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
13	P	Species used by local residents (number or percentage)	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
14	S	Percentage (extent) of area (province/nation/ecoregion) dominated structurally by non-domesticated species	Developed	Reid <i>et al.</i> , 1993
15	I	Rate of change from structural dominance of non-domesticated species to domesticated species	Developed	Reid <i>et al.</i> , 1993
16	S	Percentage (extent) of area (province/nation/ecoregion) dominated by non-domesticated species occurring in patches greater than 1 000 km ²	Developed	Reid <i>et al.</i> , 1993
17	R	Percentage (extent) of area (province/nation/ecoregion/community type) in strictly protected status	Implemented	Reid <i>et al.</i> , 1993
18	R	Accessions of crops and livestock in <i>ex situ</i> storage (number or percentage)	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
19	R	Accessions of crops regenerated in the past decade (percentage)	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
20	I	Crops (livestock) grown in an ecoregion or a nation as a percentage of the number grown 30 years previously	Developed	Reid <i>et al.</i> , 1993
21	I	Varieties of each crop (livestock) grown in an ecoregion or a nation as a percentage of the number grown 30 years previously	Developed	Reid <i>et al.</i> , 1993
22	I	Coefficient of kinship or parentage of crops	Implemented	Reid <i>et al.</i> , 1993; UNEP, 2001
23	S	Original/potential land area of major land ecosystems and habitats	Testing	Prescott-Allen <i>et al.</i> , 2000
24	S	Current area of the major land ecosystems/habitats. Percentage unconverted/converted to cultivation/converted to infrastructure — 3 variants	Testing	Prescott-Allen <i>et al.</i> , 2000
25	I	Degree of fragmentation of the unconverted portion of each land ecosystem — 2 variants	Testing	Prescott-Allen <i>et al.</i> , 2000
26	S	Status and trend of ecological communities within each land ecosystem (communities at risk as a percentage of all communities in that ecosystem)	Testing	Prescott-Allen <i>et al.</i> , 2000
27	S	Original/potential area of major aquatic ecosystems and habitats	Testing	Prescott-Allen <i>et al.</i> , 2000

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28	S	Current area of major aquatic ecosystems/habitats. Percentage unconverted/converted to infrastructure	Testing	Prescott-Allen et al., 2000
29	I	Degree of fragmentation of unconverted portion of each aquatic ecosystem	Testing	Prescott-Allen et al., 2000
30	S	Percentage of each aquatic ecosystem (unconverted portion) natural/modified	Testing	Prescott-Allen et al., 2000
31	S	Status and trend of ecological communities within each aquatic ecosystem (communities at risk as a percentage of all communities in that ecosystem)	Testing	Prescott-Allen et al., 2000
32	S	Percentage of species threatened with extinction/extirpation	Testing	Prescott-Allen et al., 2000
33	S	Status and trend of specified indicator species (or species groups)	Testing	Prescott-Allen et al., 2000
34	S	Percentage of population of particular wild species at risk of extinction	Testing	Prescott-Allen et al., 2000
35	I	Percentage of varieties or breeds of a particular crop or livestock species threatened	Testing	Prescott-Allen et al., 2000
36	I	Turnover rate of varieties and breeds	Testing	Prescott-Allen et al., 2000
37	I	Number of varieties or breeds making up 90 % (or 80 %) of production of selected crops or livestock	Testing	Prescott-Allen et al., 2000
38	I	Number of varieties or breeds accounting for at least 2 % (or at least 5 %) of production of selected crops or livestock	Testing	Prescott-Allen et al., 2000
39	I	Coefficient of kinship or parentage of selected crops or livestock	Testing	Prescott-Allen et al., 2000
40	P	Main human stresses on each land ecosystem or habitat. Percentage contribution of each stress to ecosystem/habitat concerned	Testing	Prescott-Allen et al., 2000
41	P	Main human stresses on each aquatic ecosystem or habitat. Percentage contribution of each stress to ecosystem/habitat concerned	Testing	Prescott-Allen et al., 2000
42	P	Main human stresses on each species assessed as threatened or declining. Percentage contribution of each stress to species concerned	Testing	Prescott-Allen et al., 2000
43	P	Main human stresses on each population, variety or breed assessed as threatened or declining. Percentage contribution of each stress to ecosystem/habitat concerned	Testing	Prescott-Allen et al., 2000
44	P	Total stress on biodiversity due to habitat destruction due to ecosystem conversion/habitat destruction due to modification of unconverted ecosystem/stock depletion/pollution and poisoning/translocation of species	Testing	Prescott-Allen et al., 2000
45	P	Total stress on biodiversity due to each of the main economic sector or human activities	Testing	Prescott-Allen et al., 2000
46	P	Harvesting pressure on land animals and plants	Testing	Prescott-Allen et al., 2000
47	I	Likelihood of a specific biodiversity component being lost and the probable magnitude of that loss	Testing	Prescott-Allen et al., 2000
48	D	Benefits from extracted resources from domesticated species and converted ecosystems, by sector	Testing	Prescott-Allen et al., 2000
49	D	Benefits from extracted resources from wild species and unconverted ecosystems, by sector and by biodiversity component	Testing	Prescott-Allen et al., 2000
50	D	Benefits from on-site resources by tourism services, total and by biodiversity component	Testing	Prescott-Allen et al., 2000
51	D	Benefits from genetic resources, by sector and by biodiversity component	Testing	Prescott-Allen et al., 2000
52	D	Benefits from species services, by sector and by biodiversity component	Testing	Prescott-Allen et al., 2000
53	D	Benefit by a given sector or use per unit of stress on the ecosystem	Testing	Prescott-Allen et al., 2000
54	D	Benefit from a given biodiversity component per unit of stress on that component	Testing	Prescott-Allen et al., 2000
55	I	Number of specific uses considered being sustainable. Percentage of the total number of specific uses assessed	Testing	Prescott-Allen et al., 2000
56	I	Number of ecosystems/communities/species/populations considered being sustainable. Percentage of total number assessed	Testing	Prescott-Allen et al., 2000
57	D	Main social and economic factors behind the stresses	Testing	Prescott-Allen et al., 2000
58	D	Percentage of specified benefit obtained or received by specified groups	Testing	Prescott-Allen et al., 2000

59	D	Flow of benefits from a specified genetic resource	Testing	Prescott-Allen <i>et al.</i> , 2000
60	R	National strategy/plan/programme developed for conservation and sustainable use of biodiversity	Testing	Prescott-Allen <i>et al.</i> , 2000
61	R	Sectoral or cross-sectoral plans/programmes/policies providing for conservation and sustainable use of biodiversity	Testing	Prescott-Allen <i>et al.</i> , 2000
62	R	Additional procedures to implement the CBD and improve the state of biodiversity	Testing	Prescott-Allen <i>et al.</i> , 2000
63	R	Provisions made to implement these procedures	Testing	Prescott-Allen <i>et al.</i> , 2000
64	R	System of protected areas established	Testing	Prescott-Allen <i>et al.</i> , 2000
65	S	Number of threatened species maintained in protected areas. Percentage of total number of threatened species	Testing	Prescott-Allen <i>et al.</i> , 2000
66	R	Area of degraded ecosystem undergoing rehabilitation or restoration/has been rehabilitated or restored. Percentage of total area of degraded ecosystem	Testing	Prescott-Allen <i>et al.</i> , 2000
67	R	Number of threatened species subject to recovery plan/recovering/no longer threatened. Percentage of total number of threatened species in group concerned	Testing	Prescott-Allen <i>et al.</i> , 2000
68	S	Status and trend of introduced species	Testing	Prescott-Allen <i>et al.</i> , 2000
69	R	Additional actions for in situ conservation	Testing	Prescott-Allen <i>et al.</i> , 2000
70	R	Number of threatened species maintained in <i>ex situ</i> collections. Percentage of total number of threatened species. Number reintroduced into their natural habitats.	Testing	Prescott-Allen <i>et al.</i> , 2000
71	R	Number of varieties or breeds of selected crops or livestock species maintained in gene banks. Percentage of total number of varieties or breeds of these species	Testing	Prescott-Allen <i>et al.</i> , 2000
72	R	Additional actions for <i>ex situ</i> conservation	Testing	Prescott-Allen <i>et al.</i> , 2000
73	R	Actions taken for sustainable use of components of biodiversity	Testing	Prescott-Allen <i>et al.</i> , 2000
74	S	Natural capital index: NCI = ecosystem quantity * ecosystem quality	Testing	ten Brink 2000
75	S	Ecosystem quantity: self-regenerating habitat	Proposed	UNEP, 1999
76	S	Ecosystem quantity: man-made habitat	Proposed	UNEP, 1999
77	S	Ecosystem quality: native vegetation fragmentation	Proposed	UNEP, 1999
78	S	Ecosystem quality: wetland drainage and filling	Proposed	UNEP, 1999
79	S	Ecosystem quality: conversion of coastal areas	Proposed	UNEP, 1999
80	S	Ecosystem quality: erosion	Proposed	UNEP, 1999
81	S	Ecosystem quality: irrigation	Proposed	UNEP, 1999
82	S	Ecosystem quality: species richness	Proposed	UNEP, 1999
83	S	Ecosystem quality: change in abundance and/or distribution of a selected core set of species	Proposed	UNEP, 1999
84	S	Ecosystem quality: % of total species or certain taxonomic group threatened	Proposed	UNEP, 1999
85	S	Ecosystem quality: % endemic species threatened	Proposed	UNEP, 1999
86	S	Ecosystem quality: threatened species in protected areas	Proposed	UNEP, 1999
87	S	Ecosystem quality: replacement of indigenous crops	Proposed	UNEP, 1999
88	S	Ecosystem quality: replacement of land races with few imported ones	Proposed	UNEP, 1999
89	P	Changes in proportion of commercial species	Proposed	UNEP, 1999
90	P	Soil quality	Implemented	UNEP, 1999; UNEP, 2001
91	P	% habitat colonised by invasive species	Proposed	UNEP, 1999
92	P	% protected area colonised by invasive species	Proposed	UNEP, 1999
93	R	% habitat protected as IUCN classes I–III	Proposed	UNEP, 1999
94	R	% habitat protected as IUCN classes IV–V	Proposed	UNEP, 1999

95	P	% habitat managed for production	Proposed	UNEP, 1999
96	P	Number of fires/areas burnt per year	Proposed	UNEP, 1999
97	S	% special habitat remaining	Proposed	UNEP, 1999
98	R	% special habitat protected	Proposed	UNEP, 1999
99	I	Protected area, loss, damage and defragmentation	Development	Eurostat, 2001
100	I	Wetland loss	Development	Eurostat, 2001
101	P	Change in traditional land-use practice	Development	Eurostat, 2001
102	S	Percentage area of biotopes important for biodiversity of total area	Proposed/implemented	Bosch & Söderbäck, 1997
103	S	Size of selected (threatened) ecosystem	Proposed/implemented	Bosch & Söderbäck, 1997
104	S	Changes in the area of natural and ancient semi-natural forest types	Proposed/implemented	Bosch & Söderbäck, 1997
105	I	Forest physical fragmentation (index)	Proposed/implemented	Bosch & Söderbäck, 1997
106	S	Tree species mix	Proposed/implemented	Bosch & Söderbäck, 1997
107	S	Proportion of annual area of natural regeneration in relation to total area regenerated	Proposed/implemented	Bosch & Söderbäck, 1997
108	S	Number of threatened species	Proposed/implemented	Bosch & Söderbäck, 1997
109	S	Number of endemic species of higher plants and vertebrates (excl. fish), respectively, at national level	Proposed/implemented	Bosch & Söderbäck, 1997
110	S	Percentage threatened species of total number of (forest dependent) species	Proposed/implemented	Bosch & Söderbäck, 1997
111	S	Number and percentage of threatened animal species by category	Proposed/implemented	Bosch & Söderbäck, 1997
112	S	Red lists	Proposed/implemented	Bosch & Söderbäck, 1997
113	S	Change in the number of species over time	Proposed/implemented	Bosch & Söderbäck, 1997
114	S	Fluctuations of populations	Proposed/implemented	Bosch & Söderbäck, 1997
115	S	Population levels of key forest species across their range	Proposed/implemented	Bosch & Söderbäck, 1997
116	S	Fluctuation in forest bird populations	Proposed/implemented	Bosch & Söderbäck, 1997
117	S	Point counts of migrating birds	Proposed/implemented	Bosch & Söderbäck, 1997
118	S	Nesting success of forest birds, predation pressure	Proposed/implemented	Bosch & Söderbäck, 1997
119	S	Selected birds, number and trends	Proposed/implemented	Bosch & Söderbäck, 1997
120	S	State and trends of some species groups: reptiles and amphibians	Proposed/implemented	Bosch & Söderbäck, 1997
121	S	State and trends of some species groups: mammals	Proposed/implemented	Bosch & Söderbäck, 1997
122	S	Changes in mammal populations	Proposed/implemented	Bosch & Söderbäck, 1997
123	S	Population status of forest mammals at risk	Proposed/implemented	Bosch & Söderbäck, 1997
124	S	Forest lichen and vascular plant indicator species	Proposed/implemented	Bosch & Söderbäck, 1997
125	S	Lichens and mosses	Proposed/implemented	Bosch & Söderbäck, 1997
126	S	Number of dragonfly and butterfly species changing in distribution	Proposed/implemented	Bosch & Söderbäck, 1997
127	S	Presence of moths and beetles	Proposed/implemented	Bosch & Söderbäck, 1997
128	S	Presence of amphibians	Proposed/implemented	Bosch & Söderbäck, 1997
129	P	Release of GMOs	Proposed/implemented	Bosch & Söderbäck, 1997
130	S	Index for biodiversity and nature and cultural heritage values in the arable landscape	Proposed/implemented	Bosch & Söderbäck, 1997
131	P	Land management, indexed	Proposed/implemented	Bosch & Söderbäck, 1997
132	P	pH and deposition of N	Proposed/implemented	Bosch & Söderbäck, 1997
133	S	Population levels of key species across their range	Proposed/implemented	Bosch & Söderbäck, 1997
134	S	Fluctuation in bird populations	Proposed/implemented	Bosch & Söderbäck, 1997

135	S	Mean number of plant species per plot in semi-improved grassland	Proposed/implemented	Bosch & Söderbäck, 1997
136	S	Mean number of plant species per plot in hedgerows	Proposed/implemented	Bosch & Söderbäck, 1997
137	S	Mean number of plant species per plot on streamsides	Proposed/implemented	Bosch & Söderbäck, 1997
138	S	Classification and distribution of valuable pasture lands	Proposed/implemented	Bosch & Söderbäck, 1997
139	S	Percentage of threatened species of total number	Proposed/implemented	Bosch & Söderbäck, 1997
140	P	Number of permits for GMO distribution	Proposed/implemented	Bosch & Söderbäck, 1997
141	S	Percentage of wetland area of total area	Proposed/implemented	Bosch & Söderbäck, 1997
142	S	Percentage of wet forest land	Proposed/implemented	Bosch & Söderbäck, 1997
143	S	Total area of wetlands	Proposed/implemented	Bosch & Söderbäck, 1997
144	S	Depth distribution of brown algal belts (<i>Fucus vesiculosus</i>)	Proposed/implemented	Bosch & Söderbäck, 1997
145	S	Freshwater invertebrates	Proposed/implemented	Bosch & Söderbäck, 1997
146	S	Biological quality index	Proposed/implemented	Bosch & Söderbäck, 1997
147	P	Peat cutting and other mining activities	Implemented	BEF, 2000
148	S	Threatened species on a national scale	Implemented	BEF, 2000
149	S	Threatened species on an international scale	Implemented	BEF, 2000
150	R	Protected areas according to IUCN category 1A and 1B	Implemented	BEF, 2000
151	R	Protected areas according to national law	Implemented	BEF, 2000
152	R	Fines for killing certain 'charismatic' species	Implemented	BEF, 2000
153	P	Pressures on grasslands	Implemented	EEA, 2001c
154	I	Change in area and use of grasslands	Implemented	EEA, 2001c
155	S	Species in dry grasslands	Implemented	EEA, 2001c
156	R	Protection of grasslands	Implemented	EEA, 2001c
157	R	Designation of SPAs	Implemented	EEA, 2001c
158	R	Number and extent of protected areas	Implemented	UNDP <i>et al.</i> , 2000
159	S	Species number per species group	Implemented	UNDP <i>et al.</i> , 2000
160	S	Number of endemic species per species group	Implemented	UNDP <i>et al.</i> , 2000
161	R	CITES entered into force	Implemented	UNDP <i>et al.</i> , 2000
162	R	% CITES reporting requirements met as of 1997	Implemented	UNDP <i>et al.</i> , 2000
163	P	Number of individuals traded by species group	Implemented	UNDP <i>et al.</i> , 2000
164	S	Number of seagrass species	Implemented	UNDP <i>et al.</i> , 2000
165	S	Number of Scleractinia coral genera	Implemented	UNDP <i>et al.</i> , 2000
166	S	Presence and abundance of threatened plant and bird species	Proposed/implemented	Fammler <i>et al.</i> , 1998; Roots & Talkop, 1997
167	S	Presence and abundance of bats, terrestrial beetles and bugs, breeding birds, lichens, threatened vascular plant species, mosses, community forming vascular plants	Proposed/implemented	From & Söderman, 1997
168	S	Presence of vagile (non-sessile) species (amphibians, mammals, crabs) on roads, numbers of accidental kills, forming of meta-populations, population characteristics (colonisation, local extinction rates, survivorship and mortality) of threatened species, genetic variability, inbreeding in populations	Proposed/implemented	Noss, 1990
169	S	Presence and abundance of threatened and specialised species	Proposed/implemented	Fammler <i>et al.</i> , 1998
170	S	Presence and abundance of threatened vascular plant species	Proposed/implemented	Fammler <i>et al.</i> , 1998; Roots & Talkop, 1997
171	I	Presence and abundance of specialised, threatened plant species	Proposed/implemented	Roots & Talkop, 1997

172	I	Changes in fish populations, benthic protozoans	Proposed/implemented	Tamás-Dvihally, 1987;; Nosek & Bereczky, 1993
173	S	Number of taxa and abundance of phytoplankton, bacterioplankton, number and abundance of macrophytes, zooplankton groups, fish species, coli index	Proposed/implemented	Roots & Talkop, 1997; Framstad, 1999; Sykes & Lane, 1996; Bíró, 1997; Somlyódi & van Straten, 1986
174	S	Number and abundance of molluscs, crustacean species	Proposed/implemented	Sykes & Lane, 1996
175	I	Number and abundance of fish species	Proposed/implemented	Bíró, 1997; Tamás-Dvihally, 1987
176	I	Analysis of food webs, number and abundance of molluscs, and fish species, state of fish stocks	Proposed/implemented	Framstad, 1999
177	S	Presence of threatened vascular plant, moss and bird species	Proposed/implemented	Fammler <i>et al.</i> , 1998; From & Söderman, 1997
178	S	Presence and abundance of breeding and migrating birds, terrestrial molluscs, moths, orchid species, terrestrial and epiphytic fungi, butterflies, frogs, community forming and threatened plant species and grazing animals, other invertebrates	Proposed/implemented	From & Söderman, 1997; Sykes & Lane, 1996
179	S	Presence and abundance of terrestrial and epiphytic fungi, breeding birds, soil micro-organisms, mosses, orchids, species composition and abundance of vascular plants	Proposed/implemented	From & Söderman, 1997; Roots & Talkop, 1997; Noss 1990
180	S	Presence and abundance of threatened vascular plant, moss, mollusca species, soil micro-organisms	Proposed/implemented	From & Söderman, 1997; Roots & Talkop, 1997
181	I	Species composition and abundance of vascular plants, mosses, birds, soil micro organisms and epilithic lichens	Proposed/implemented	From & Söderman, 1997; Sykes & Lane, 1996
182	I	Abundance of terrestrial beetles and bugs, species composition and abundance of vascular plants	Proposed/implemented	de Groot <i>et al.</i> , 1995
183	I	Species composition and abundance of plants, proportion of threatened, endemic, rare species, primary production	Proposed/implemented	Sykes & Lane, 1996; Roots & Talkop, 1997; Kovács-Láng <i>et al.</i> , 2000a; GTOS, 1997
184	I	Distribution of plant species among nature conservation values	Proposed/implemented	Simon, 1988
185	S	Presence and abundance of pollinators	Proposed/implemented	Roots & Talkop, 1997
186	I	Changes in invertebrate populations	Proposed/implemented	Sykes & Lane, 1996; Horváth <i>et al.</i> , 1997
187	I	Plant species composition and abundance, proportion of rare and endangered species	Proposed/implemented	Roots & Talkop, 1997; Sykes & Lane, 1996; Hill & Carey, 1997
188	I	Net primary production (NPP) and leaf area index (LAI)	Proposed/implemented	GTOS, 1997
189	I	Abundance of insect populations	Proposed/implemented	Kozár, 1997
190	S	Plant species composition and abundance, number and abundance of bird species, terrestrial beetles and bugs, terrestrial and epiphytic fungi, terrestrial molluscs, mosses, orchids, small rodents, butterflies	Proposed/implemented	From & Söderman, 1997; Roots & Talkop, 1997; Sykes & Lane, 1996
191	I	Crown defoliation, leaf discoloration, epiphytic algae and lichens, terrestrial and epiphytic fungi, mosses, terrestrial molluscs	Proposed/implemented	De Vries <i>et al.</i> , 1998; From & Söderman, 1997; Roots & Talkop, 1997; Framstad, 1999; de Zwart, 1999; Eichhorn <i>et al.</i> , 1998
192	I	Plant species composition and abundance, appearance of invasive species	Proposed/implemented	de Groot <i>et al.</i> , 1995
193	S	Plant species composition and abundance in the herb layer, presence and abundance of bats, sub-cortical beetles and bugs, breeding birds, terrestrial molluscs, nocturnal moths, butterflies, small rodents	Proposed/implemented	From & Söderman, 1997; Sykes & Lane, 1996
194	I	Structural characteristics (presence of vertical layers) plant species composition and abundance, ways of post-fire succession, presence and abundance of birds, mammals, and soil biota	Proposed/implemented	SEPA, 1998; Noss, 1990; Ferretti, 1997
195	S	Soil biota	Proposed/implemented	Ferretti, 1997
196	S	Presence and abundance of community forming and threatened plant species, birds, wild animals	Proposed/implemented	Horváth <i>et al.</i> , 1997; Kovács-Láng <i>et al.</i> , 2000a

197	S	Plant species composition and abundance, presence and abundance of threatened species	Proposed/implemented	Zólyomi & Précshényi, 1964
198	I	Plant species composition and abundance, distribution of plant species among nature conservation values	Proposed/implemented	Simon, 1988
199	I	Plant species composition and abundance	Proposed/implemented	Kovács-Láng <i>et al.</i> , 2000b; De Vries <i>et al.</i> , 1998; Eichhorn <i>et al.</i> , 1998
200	I	Activity of soil micro-organisms, abundance of earth worm populations, colony-forming micro-organisms	Proposed/implemented	Roots & Talkop, 1997
201	S	Living planet index (LPI)	In use	Loh, 2000
202	S	Threatened species as a percentage of total native species	Testing	UNCSD, 1996
203	R	Protected area as a percentage of total area	Testing	UNCSD, 1996
204	S	Ecosystem area	Proposed	WCMC, 1996
205	S	Ecosystem quality	Proposed	WCMC, 1996
206	S	Threatened/extinct species	Proposed	WCMC, 1996
207	P	Biodiversity use	Proposed	WCMC, 1996
208	S	Number of wild species	Proposed	WCMC, 1996
209	S	Number of domesticates	Proposed	WCMC, 1996
210	S	Habitat index	Implemented on	Hannah, 1994a,b global scale
211	S	Keystone species	Proposed	Paine, 1969
212	S	World Bank/GEF natural capital indicator	Implemented	Rodenburg <i>et al.</i> , 1995
213	S	WRI ecosystems at risk indicator	Implemented on global scale	Bryant <i>et al.</i> , 1995; Bryant, 1997
214	S	Total number of known species (mammals, birds, amphibians, reptiles, fish, invertebrates, vascular plants, non-vascular plants)	Implemented	Eurostat
215	S	Number of endangered species (mammals, birds, amphibians, reptiles, fish, invertebrates, vascular plants, non-vascular plants)	Implemented	Eurostat
216	S	Number of critically endangered species (mammals, birds, amphibians, reptiles, fish, invertebrates, vascular plants, non-vascular plants)	Implemented	Eurostat
217	S	Number of vulnerable species (mammals, birds, amphibians, reptiles, fish, invertebrates, vascular plants, non-vascular plants)	Implemented	Eurostat
218	S	Number of declining species (mammals, birds, amphibians, reptiles, fish, invertebrates, vascular plants, non-vascular plants)	Implemented	Eurostat
219	S	Land use 1950–99 (30 land-use types)	Implemented	Eurostat
220	P	Change in land use 1950–99 (30 land-use types)	Implemented	Eurostat
221	P	Land degradation: soil erosion (12 land-use types)	Implemented	Eurostat
222	R	Percentage of protected area to total area	Implemented	UNEP, 2001
223	R	Total area of protected areas (using IUCN definition of protected areas)	Implemented	UNEP, 2001
224	R	Size and distribution of protected areas	Implemented	UNEP, 2001
225	R	Percent area in strictly protected status	Implemented	UNEP, 2001
226	P/S	Frozen ground activity	Implemented	UNEP, 2001
227	P/S	Karst activity	Implemented	UNEP, 2001
228	P/S	Slope failure (landslides)	Implemented	UNEP, 2001
229	S	Relative wilderness index	Implemented	UNEP, 2001
230	S	Changes in limiting factors for key species e.g. nest holes for parrots, fruit bat roosting trees	Implemented	UNEP, 2001

231	S	Volcanic unrest	Implemented	UNEP, 2001
232	S	Difference in total area of a particular habitat type	Implemented	UNEP, 2001
233	S	Changes in largest block of a particular habitat type	Implemented	UNEP, 2001
234	S	Changes in average size of a particular habitat type	Implemented	UNEP, 2001
235	S	Change in mean nearest distance between blocks of a particular habitat type	Implemented	UNEP, 2001
236	S	Change in average width of break in an identified habitat corridor	Implemented	UNEP, 2001
237	S	Change in habitat boundaries	Implemented	UNEP, 2001
238	S	Percentage of area dominated by non-domesticated species	Implemented	UNEP, 2001
239	S	Degree of connectivity of food web	Implemented	UNEP, 2001
240	R	Existence of institutional capacity, policy and regulatory framework for the planning, management and conservation of biological diversity	Implemented	UNEP, 2001
241	S	Change in number and/or distribution of keystone or indicator species	Implemented	UNEP, 2001
242	P	Number of introduced species and genomes	Implemented	UNEP, 2001
243	P	Change in presence, location, area, numbers of invasive plant or animal species	Implemented	UNEP, 2001
244	P	Quantity of specimens or species of economic/scientific interest removed from the environment	Implemented	UNEP, 2001
245	S	Percentage of area dominated by non-domesticated species occurring in patches greater than 1 000 km ² .	Implemented	UNEP, 2001
246	S	Population growth and fluctuation trends of special interest species	Implemented	UNEP, 2001
247	S	Sex ratio, age distribution and other aspects of population structure for sensitive species, keystone species, and other special interest species	Implemented	UNEP, 2001
248	S	Presence of taxa on environmental integrity	Implemented	UNEP, 2001
249	S	Recorded species present by group	Implemented	UNEP, 2001
250	S	Indigenous species present by group	Implemented	UNEP, 2001
251	S	Non-indigenous species present by group	Implemented	UNEP, 2001
252	S	Number of endemic/threatened/ endangered/vulnerable species by group	Implemented	UNEP, 2001
253	S	Temporal change in number of species (increase/decrease)	Implemented	UNEP, 2001
254	S	Change in composition of species overtime	Implemented	UNEP, 2001
255	S	Species group: total number versus threatened species	Implemented	UNEP, 2001
256	S	Species with small populations vs. larger population size	Implemented	UNEP, 2001
257	S	Spatial differences in the number of rare vs. common species	Implemented	UNEP, 2001
258	S	Spatial differences in the restricted vs. wide-range species	Implemented	UNEP, 2001
259	S	Representativeness of intra-specific variability of endangered and economically important species	Implemented	UNEP, 2001
260	S	Diversity of native fauna	Implemented	UNEP, 2001
261	S	Species threatened with extirpation	Implemented	UNEP, 2001
262	S	Species threatened with extinction (number or percentage)	Implemented	UNEP, 2001
263	S	Species with stable or increasing populations	Implemented	UNEP, 2001
264	S	Species with decreasing populations	Implemented	UNEP, 2001
265	R	Threatened species in <i>ex situ</i> collections	Implemented	UNEP, 2001
266	S	Percentage of threatened species	Implemented	UNEP, 2001
267	P	Number of visitors to protected areas	Implemented	UNEP, 2001
268	S	Number of endangered mammal, bird, fish, and reptile species	Implemented	UNEP, 2001

269	S	Number of threatened species of mammal, bird, fish and reptile species	Implemented	UNEP, 2001
270	R	Government programmes, awareness campaigns	Implemented	UNEP, 2001
271	R	Government conservation legislation and policies	Implemented	UNEP, 2001
272	R	International conventions acceded to	Implemented	UNEP, 2001
273	R	NGOs programmes and action plans	Implemented	UNEP, 2001
274	P	Game-hunting rate — diversity and abundance	Implemented	UNEP, 2001
275	R	Percentage of protected area of different ecosystem types	Implemented	UNEP, 2001
276	S	Species of communal interest of all indigenous species (percentage)	Implemented	UNEP, 2001
277	S	Endangered species of all indigenous species (percentage)	Implemented	UNEP, 2001
278	P	Alien species of all indigenous species (percentage)	Implemented	UNEP, 2001
279	R	Endangered species with plans of action (all categories of endangerment and all types of plans of action)	Implemented	UNEP, 2001
280	S	Total number and area of communal interest habitats. Identification of priorities	Implemented	UNEP, 2001
281		ENP percentage with planning of approved arrangement, utilisation and management	Implemented	UNEP, 2001
282	P	Ratio between exotic species and native species in plantation area	Implemented	UNEP, 2001
283	S	Self-generating area per habitat type	Implemented	UNEP, 2001
284	S	Self-generating area as a percentage of total area	Implemented	UNEP, 2001
285	R	Percentage of protected area with clearly defined boundaries	Implemented	UNEP, 2001
286	S	Area and length and numbers of biological corridors	Implemented	UNEP, 2001
287	P	Annual volume and area of timber harvested — indigenous and plantation	Implemented	UNEP, 2001
288	S	Estimate of carbon stored	Implemented	UNEP, 2001
289	S	Absolute and relative abundance, density, basal area, cover, of various species	Implemented	UNEP, 2001
290	S	Threatened tree species as a percentage of the 20 most used for commercial purposes	Implemented	UNEP, 2001
291	S	Number of threatened, keystone, flagship species	Implemented	UNEP, 2001
292	S	Number of extinct, endangered, threatened, vulnerable and endemic forest dependent species by group (e.g. birds, mammals, vertebrates, invertebrates)	Implemented	UNEP, 2001
293		List of flora and fauna	Implemented	UNEP, 2001
294	R	Existence of procedures for identifying endangered, rare, and threatened species	Implemented	UNEP, 2001
295	R	Existing strategies for <i>in situ/ex situ</i> conservation of genetic variation within commercial, endangered, rare and threatened species of forest flora and fauna	Implemented	UNEP, 2001
296	S	Number of forest dependent species whose populations are declining	Implemented	UNEP, 2001
297	S	Population levels of representative species from diverse habitats monitored across their range	Implemented	UNEP, 2001
298	P	Number and extent of invasive species	Implemented	UNEP, 2001
299	S	Number of forest-dependent species that occupy a small portion of their former range	Implemented	UNEP, 2001
300	S	The status (threatened, rare, vulnerable, endangered, or extinct) of forest-dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment	Implemented	UNEP, 2001
301	S	The number of forest-dependent species	Implemented	UNEP, 2001
302	P	Rate of vegetation clearing by activity (agriculture, urban development, deforestation)	Implemented	UNEP, 2001
303	P	Outbreak of veld fires by frequency	Implemented	UNEP, 2001
304	P	Percentage of habitat colonised by invasive species	Implemented	UNEP, 2001

305	P	Percentage of protected area colonised by invasive species	Implemented	UNEP, 2001
306	P	Habitat loss by km ² through human activities, and through natural causes.	Implemented	UNEP, 2001
307	S/P	Habitat loss through habitat fragmentation	Implemented	UNEP, 2001
308	S	Area and state of indigenous vegetation	Implemented	UNEP, 2001
309	P	Distribution of species considered as pests	Implemented	UNEP, 2001
310	P	Number of exotic and local species outbred and location of affected areas	Implemented	UNEP, 2001
311	R	Area of protected areas by vegetation type as percentage of total area	Implemented	UNEP, 2001
312	R	Revegetated areas by species or genus in hectares per annum and reasons thereof	Implemented	UNEP, 2001
313	S	Changes in crown cover	Implemented	UNEP, 2001
314	P	Number of wild species used as food sources by communities	Implemented	UNEP, 2001
315	S	Woodlands (km ²)	Implemented	UNEP, 2001
316	S	Riverine forest (km ²)	Implemented	UNEP, 2001
317	S	Riverine percentage of total land	Implemented	UNEP, 2001
318	S	Mangrove forest (km ²)	Implemented	UNEP, 2001
319	S	Mangrove percentage of total land	Implemented	UNEP, 2001
320	S	Agricultural biodiversity	Implemented	UNEP, 2001
321	D	Agricultural area by crops (cereal, oil crops, forage, woodlands)	Implemented	UNEP, 2001
322	D	Agricultural area (intensively farmed, semi-intensively farmed and uncultivated)	Implemented	UNEP, 2001
323	S	Number of vertebrate species using habitat on agricultural land by species	Implemented	UNEP, 2001
324	S	Differences in species diversity and abundance of arthropods and earthworms in organically and conventionally cultivated arable land	Implemented	UNEP, 2001
325	S/P	Rate of change from dominance of non-domesticated species to domesticated species	Implemented	UNEP, 2001
326	P/S	Species diversity used for food	Implemented	UNEP, 2001
327	S	Erosion/loss of genetic diversity patrimony	Implemented	UNEP, 2001
328	S/P	Crops/livestock grown as a percentage of number of 30 years before	Implemented	UNEP, 2001
329	S/P	Replacement of indigenous crops	Implemented	UNEP, 2001
330	S/P	Inbreeding/outbreeding rate	Implemented	UNEP, 2001
331	S/P	Rate of genetic interchange between populations (measured by rate of dispersal and subsequent reproduction of migrants)	Implemented	UNEP, 2001
332	D	Share of irrigated agricultural land	Implemented	UNEP, 2001
333	P	Replacement of land races with imported ones	Implemented	UNEP, 2001
334	S	Changes in vegetation type along water courses	Implemented	UNEP, 2001
335	?	Water resource vulnerability index	Implemented	UNEP, 2001
336	P	Ratio between maximum sustained yield and actual average abundance	Implemented	UNEP, 2001
337	S	Glacier fluctuations	Implemented	UNEP, 2001
338	S	Wetland area	Implemented	UNEP, 2001
339	P	Extent of wetland drainage and filling	Implemented	UNEP, 2001
340	S	Fish family diversity	Implemented	UNEP, 2001
341	S	Benthic macroinvertebrates: communities	Implemented	UNEP, 2001
342	S	Macrophytes: species composition and depth distribution	Implemented	UNEP, 2001
343	S	Threatened freshwater fish species as a percentage of total freshwater fish species	Implemented	UNEP, 2001

344	P	Number of inland fish species introduced	Implemented	UNEP, 2001
345	P	Number of exotic flora and fauna species, e.g. fish, aquatic weeds	Implemented	UNEP, 2001
346	S	Number of endemic flora and fauna	Implemented	UNEP, 2001
347	S	Changes in distribution and abundance of native flora and fauna	Implemented	UNEP, 2001
348	S	Number of extinct, endangered, threatened/endangered/vulnerable/ endemic inland water species by group, e.g. birds, aquatic mammals, invertebrates, amphibians, vascular plants, bottom fauna	Implemented	UNEP, 2001
350	S	Indicator species	Implemented	UNEP, 2001
351	P	Rate of destruction of water habitats per annum	Implemented	UNEP, 2001
352	S	Area and state of water per habitat, i.e. riverine areas and wetlands	Implemented	UNEP, 2001
353	P	Rate of destruction of water habitats by types of activities	Implemented	UNEP, 2001
354	S	Genetic monitoring of salmon and whitefish	Implemented	UNEP, 2001
355	S	Reservoir that has eutrophication	Implemented	UNEP, 2001
356	S	Availability of regulated water resources: reserves of reservoir water	Implemented	UNEP, 2001
357	R	Improvements in the distribution of water	Implemented	UNEP, 2001
358	S	Coastal and marine biodiversity	Implemented	UNEP, 2001
359	S/P	Annual rate of mangrove conversion	Implemented	UNEP, 2001
360	S	Coral chemistry and growth pattern	Implemented	UNEP, 2001
361	S/P	Surface displacement	Implemented	UNEP, 2001
362	P	Amount of poison chemicals and dynamite used for reef fishing	Implemented	UNEP, 2001
363	S	Algae index	Implemented	UNEP, 2001
364	S	Threatened fish species as a percentage of total fish species known	Implemented	UNEP, 2001
365	S/P	Change in proportion of fish catches by species per specific season	Implemented	UNEP, 2001
366	R	Protected coastal area	Implemented	UNEP, 2001
367	R	Length of artificial coral reef	Implemented	UNEP, 2001
368	P	Contamination in critical points	Implemented	UNEP, 2001
369	R	Implementation of integrated management programmes of coastal areas	Implemented	UNEP, 2001
370	R	Gleaning or fishing off reef per village	Implemented	UNEP, 2001
371	S	Trends in seabird population	Implemented	UNEP, 2001
372	S/P	Pollutants in polar bears	Implemented	UNEP, 2001
373	?	Biological limits	Implemented	UNEP, 2001
374	S	Monitoring of population trends in marine mammals	Implemented	UNEP, 2001
375	S	Trends in wild bird populations: globally threatened species	Implemented	Heath & Rayment, 2001
376	S	Trends in wild bird populations: significant populations of species of European conservation concern	Implemented	Heath & Rayment, 2001
377	S	Trends in wild bird populations: significant populations of species listed on Annex I to the EU birds directive	Implemented	Heath & Rayment, 2001
378	S	Trends in wild bird populations: other common and widespread species	Implemented	Heath & Rayment, 2001
379	S	Change in cover of land-use types	Implemented	Heath & Rayment, 2001
380	P	Change in impact of 25 classes of impact to IBAs	Implemented	Heath & Rayment, 2001
381	R	Change in overlap of IBAs with national and international protected areas	Implemented	Heath & Rayment, 2001
382	R	Change in presence of management plans for IBAs	Implemented	Heath & Rayment, 2001
383	S	Species in dry grasslands	Implemented	EEA website, 2002

384	R	Protection of grasslands	Implemented	EEA website, 2002
385	P	Pressures on grasslands	Implemented	EEA website, 2002
386	D	Change in area and use of grasslands	Implemented	EEA website, 2002
387	S	National biodiversity index (NBI)	Implemented	SCBD, 2001

Forestry

Biodiversity-related indicators, Inventory January 2002, Forestry

No	DPSIR	Indicator name and definition	Use	Information source
1	D	Export of timber and timber products	Implemented	BEF, 2000
2	P	Total forest felling	Implemented	BEF, 2000
3	S	Forest extent 1990	Implemented	UNDP <i>et al.</i> , 2000
4	S	Forest extent 1995	Implemented	UNDP <i>et al.</i> , 2000
5	P	Average annual % change of forests 1990–95	Implemented	UNDP <i>et al.</i> , 2000
6	S	Extent natural forest 1990	Implemented	UNDP <i>et al.</i> , 2000
7	S	Extent natural forest 1995	Implemented	UNDP <i>et al.</i> , 2000
8	P	Average annual % change of natural forests 1990–95	Implemented	UNDP <i>et al.</i> , 2000
9	S	Extent plantations 1990	Implemented	UNDP <i>et al.</i> , 2000
10	S	Extent plantations 1995	Implemented	UNDP <i>et al.</i> , 2000
11	P	Average annual % change of plantations 1990–95	Implemented	UNDP <i>et al.</i> , 2000
12	R	Extent natural forests certified with FSC label	Implemented	UNDP <i>et al.</i> , 2000
13	R	Extent plantations certified with FSC label	Implemented	UNDP <i>et al.</i> , 2000
14	R	Extent mixed forests certified with FSC label	Implemented	UNDP <i>et al.</i> , 2000
15	S	Number of tree species threatened 1990s	Implemented	UNDP <i>et al.</i> , 2000
16	S	Forest stands older than 100 years and distribution of dominant tree species in these stands	Implemented	BEF, 2000
17	S	Changes in the proportion of stands managed for the conservation and utilisation of forest genetic resources	Implemented	Bosch & Söderbäck, 1997; UNEP, 2001
18	P	Total area of drained forest land & total length of forest ditches	Proposed/implemented	Bosch & Söderbäck, 1997
19	S	Percentage mono-specific forests of total forest area	Proposed/implemented	Bosch & Söderbäck, 1997
20	S	Changes in the proportion of mixed stands of 2–3 tree species	Proposed/implemented	Bosch & Söderbäck, 1997
21	S	Percentage area young coniferous forests with more than 20 % deciduous trees	Proposed/implemented	Bosch & Söderbäck, 1997
22	S	Proportion of deciduous trees in coniferous forests	Proposed/implemented	Bosch & Söderbäck, 1997
23	S	Number of trees more than 30 cm in diameter/ha in young forests	Proposed/implemented	Bosch & Söderbäck, 1997
24	S	Tree age class distribution (index)	Proposed/implemented	Bosch & Söderbäck, 1997
25	S	Number of large trees per ha in young forests	Proposed/implemented	Bosch & Söderbäck, 1997
26	S	Amount of dead wood in forests	Proposed/implemented	Bosch & Söderbäck, 1997
27	S	Number of dead trees more than 10 cm in diameter/ha in cut forest areas	Proposed/implemented	Bosch & Söderbäck, 1997
28	S	Total area of mixed stands	Proposed/implemented	Bosch & Söderbäck, 1997
29	I	Forest damage	Development	Eurostat, 2001
30	I	Rate of timber extraction from forests	Testing	Prescott-Allen <i>et al.</i> , 2000
31	S	Total forest area	Implemented	UNEP, 2001
32	S	Total forest area as a percentage of total land area	Implemented	UNEP, 2001

33	S	Percentage of forest cover by forest type (primary, secondary or plantation)	Implemented	UNEP, 2001
34	P	Fragmentation of forests	Implemented	UNEP, 2001
35	P	Number and size of forest fires	Implemented	UNEP, 2001
36	R	Reforested and afforested areas	Implemented	UNEP, 2001
37		Area and extent of degraded lands reclaimed through forest operations	Implemented	UNEP, 2001
38		Area and percentage of forest area affected by anthropogenic effects (logging, harvesting for subsistence).	Implemented	UNEP, 2001
39		Area and percentage of forest area affected by natural disasters (insect attack, disease, fire and flooding)	Implemented	UNEP, 2001
40		Area and percentage of forests managed for catchment protection	Implemented	UNEP, 2001
41		Area of forest rebuilding stands	Implemented	UNEP, 2001
42		Area of managed forest with special environmental values	Implemented	UNEP, 2001
43		Area of seed forest stands	Implemented	UNEP, 2001
44		Burnt forest area per year	Implemented	UNEP, 2001
45		Change in land use, conversion of forest land to other land uses (deforestation rate)	Implemented	UNEP, 2001
46		Contribution of forest sector to gross domestic product	Implemented	UNEP, 2001
47		Extent of area by forest type and by age class or successional stage	Implemented	UNEP, 2001
48		Extent of area by forest type in protected area categories as defined by IUCN or other classification systems	Implemented	UNEP, 2001
49		Extent of area by forest type relative to total forest area	Implemented	UNEP, 2001
50		Extent of mixed stands	Implemented	UNEP, 2001
51		Forest area change by forest type (primary, secondary or plantation)	Implemented	UNEP, 2001
52		Forest area with revitalisation or ecological sites	Implemented	UNEP, 2001
53		Forest conversion affecting rare ecosystems by area	Implemented	UNEP, 2001
54		Forest protection rate	Implemented	UNEP, 2001
55		Fragmentation of forest types	Implemented	UNEP, 2001
56		Managed forest ratio	Implemented	UNEP, 2001
57		Per capita wood consumption	Implemented	UNEP, 2001
58		Percentage of protected productive forest area of total productive area	Implemented	UNEP, 2001
59		Percentage of forest land managed for recreation and tourism to total forest area	Implemented	UNEP, 2001
60		Percentage of forest managed for wood production	Implemented	UNEP, 2001
61		Percentage of forest protected areas by forest type by age, class, and successional stage)	Implemented	UNEP, 2001
62		Percentage of forest used by people for subsistence	Implemented	UNEP, 2001
63		Percentage of protected area of total forest area	Implemented	UNEP, 2001
64		Relationship between forest cover and frequency of flooding	Implemented	UNEP, 2001
65		Seedlings planted annually, exotic vs. indigenous	Implemented	UNEP, 2001
66		Wood harvesting intensity	Implemented	UNEP, 2001
67	S	Changes in the area of natural and ancient semi-natural forest types	Proposed	MCPFE, 2001a
68	R	Changes in the area of strictly protected forest reserves	Proposed	MCPFE, 2001a
69	R	Changes in the area of forests protected by special management regime	Proposed	MCPFE, 2001a
70	S	Changes in the number and percentage of threatened species in relation to the total number of forest species	Proposed	MCPFE, 2001a

71	S	Total area and changes in the area of forests and OWL which is undisturbed by man, natural or ancient semi-natural managed forest and OWL	Proposed	MCPFE, 2001b
72	R	Total number, proportion and changes of forest-related species for selected species of which number of species whose status is 'indeterminate', 'rare', 'vulnerable', 'endangered', 'extinct/endangered' or 'extinct'	Proposed	MCPFE, 2001b
73	R	Total area and changes in area of tree stands managed for the conservation and utilisation of tree/forest genetic resources (<i>in situ</i> and <i>ex situ</i> gene conservation)	Proposed	MCPFE, 2001b
74	S	Total area and changes in area of forest and OWL classified by number of main tree species occurring in stands and by main forest types	Proposed	MCPFE, 2001b
75	S	Total area of forest and OWL and changes in area classified by indigenous and introduced tree species	Proposed	MCPFE, 2001b
76	S	Total volume and changes in volume of deadwood by forest type and decomposition stage	Proposed	MCPFE, 2001b
77	S	Total area and changes in area of regeneration, by regeneration type	Proposed	MCPFE, 2001b
78	S	Total area and changes in area of forest and other wooded land by various layers by forest type	Proposed	MCPFE, 2001b

Energy

Biodiversity-related indicators, Inventory January 2002, Energy

No	DPSIR	Indicator name and definition	Use	Information source
1	P	Oil spills	Implemented	EEA website, 2002

Recreation/tourism

Biodiversity-related indicators, Inventory January 2002, Recreation/tourism

No	DPSIR	Indicator name and definition	Use	Information source
1	P	Household expenditure for tourism and recreation	Implemented	EEA website, 2002
2	R	Tourism eco-labelling	Implemented	EEA website, 2002
3	P	Tourism intensity	Implemented	EEA website, 2002
4	P	Tourism travel by transport mode	Implemented	EEA website, 2002

Climate change

Biodiversity-related indicators, Inventory January 2002, Climate change

No	DPSIR	Indicator name and definition	Use	Information source
1	I	Dates of insect appearance and activity	Implemented	Cannell <i>et al.</i> , 1999; ETC/ACC, 2001
2	S	Insect abundance	Implemented	Cannell <i>et al.</i> , 1999; ETC/ACC, 2001
3	I	Arrival date of the swallow	Implemented	Cannell <i>et al.</i> , 1999
4	I	Egg-laying dates of birds	Implemented	Cannell <i>et al.</i> , 1999; ETC/ACC, 2001
5	I	Small bird population changes	Implemented	Cannell <i>et al.</i> , 1999
6	P	Climatic change	Proposed	UNEP, 1999
7		Droughts: change in annual rainfall compared to the long-term average rainfall	Implemented	UNEP, 2001
8		Phenology/changes in the growing season	Proposed	ETC/ACC, 2001
9		Arrival date of birds	Proposed	ETC/ACC, 2001
10		Mountains and sub-arctic environments	Proposed	ETC/ACC, 2001
11		Changes in the composition of ecosystems	Proposed	ETC/ACC, 2001
12		Extreme events (fires, storms, etc.)	Proposed	ETC/ACC, 2001

Urban development

Biodiversity-related indicators, Inventory October 2001, Urban development

No	DPSIR	Indicator name and definition	Use	Information source
1	P	Rate of housing development	Proposed	UNEP, 1999
2	P	Dams	Proposed	UNEP, 1999
3	P	Population density in/adjacent to key habitats	Proposed	UNEP, 1999
4	P	Population density in/adjacent to protected areas	Proposed	UNEP, 1999

Water

Biodiversity-related indicators, Inventory January 2002, Water

No	DPSIR	Indicator name and definition	Use	Information source
1	P	Annual groundwater withdrawals as percentage of annual recharge	In use	UNDP <i>et al.</i> , 2000
2	P	Degree of river fragmentation	In use	UNDP <i>et al.</i> , 2000
3	S	Percentage of watershed that is cropland	In use	UNDP <i>et al.</i> , 2000
4	S	Percentage of watershed that is forest	In use	UNDP <i>et al.</i> , 2000
5	S	Percentage of watershed that is grassland	In use	UNDP <i>et al.</i> , 2000
6	P	Percentage of watershed that is built-up area	In use	UNDP <i>et al.</i> , 2000
7	P	Percentage of watershed that is irrigated area	In use	UNDP <i>et al.</i> , 2000
8	S	Percentage of watershed that is arid area	In use	UNDP <i>et al.</i> , 2000
9	S	Percentage of watershed that is wetland	In use	UNDP <i>et al.</i> , 2000
10	R	Number of Ramsar sites	In use	UNDP <i>et al.</i> , 2000
11	P	Percentage channelled watercourses of total length	Proposed/implemented	Bosch & Söderbäck, 1997
12	P	Water quality	Proposed	UNEP, 1999
13	I	Extent and degree of water pollution	Testing	Prescott-Allen <i>et al.</i> , 2000
14	I	Rate of water extraction	Testing	Prescott-Allen <i>et al.</i> , 2000
15	I	Transitional and coastal waters: proportion of different types of transitional waters and coastal waters below good ecological status	Available	EEA, 2001a
16	P	Biochemical oxygen demand (BOD) of water bodies (eutrophication)	Implemented	UNEP, 2001
17	S	Fish family diversity	Implemented	UNEP, 2001
18	S	Benthic macro-invertebrates (communities)	Implemented	UNEP, 2001
19	P	Change in proportion of fish catches by species per specific season	Implemented	UNEP, 2001
20	S	Threatened fish species as a percentage of total fish species known	Implemented	UNEP, 2001
21	S	Shoreline position	Implemented	UNEP, 2001
22	I	Escherichia coli counts and nutrient levels as a percentage of baseline levels	Implemented	UNEP, 2001
23		Coastal population without purification treatment of sewage	Implemented	UNEP, 2001
24		Coastline land cover	Implemented	UNEP, 2001
25		Denatured coast	Implemented	UNEP, 2001
26		Depletion of water points	Implemented	UNEP, 2001
27		Dumping of pollutants to the ocean water basins	Implemented	UNEP, 2001
28		Ground water quality: nitrates, salinity, toxicants	Implemented	UNEP, 2001
29		Groundwater level (water table level)	Implemented	UNEP, 2001
30		Lake levels and salinity	Implemented	UNEP, 2001

31		Organic contamination	Implemented	UNEP, 2001
32		Other alternatives of water production: drinkable water through techniques of desalination and water collected from rain	Implemented	UNEP, 2001
33		Percentage of coastal zone with populations exceeding 100 inhabitants/km ²	Implemented	UNEP, 2001
34		Quality of water in the ocean	Implemented	UNEP, 2001
35		Rivers with good quality according to biotic indexes	Implemented	UNEP, 2001
36		Salinisation of aquifers (coastal and inland) of human origin	Implemented	UNEP, 2001
37		Stream flow	Implemented	UNEP, 2001
38		Stream sediment storage and load	Implemented	UNEP, 2001
39		Surface water quality: nitrogen, dissolved oxygen, pH, pesticides, heavy metals, temperature	Implemented	UNEP, 2001
40	S	System aqua index	Proposed/implemented	Bosch & Söderbäck, 1997
41		Total boats, canoes operated on island or per village	Implemented	UNEP, 2001
42		Water consumption index by the sectors (agricultural, energy, industry, tourism and services), the index being the quotient between the consumptive demand (detraction — return) and the potential resource	Implemented	UNEP, 2001
43	S	Index of biotic integrity (IBI)	Implemented	Karr, 1987

Infrastructure/transport

Biodiversity-related indicators, Inventory January 2002, Infrastructure/transport

No	DPSIR	Indicator name and definition	Use	Information source
1	P	Road density	Implemented	BEF, 2000
2	P	Traffic intensity on the roads of European importance	Implemented	BEF, 2000
3	P	Total length of the roads, railroads and powerlines per area	Proposed/implemented	Bosch & Söderbäck, 1997
4	P	Density of infrastructure network	Proposed/implemented	Bosch & Söderbäck, 1997
5	P	Areas more than 5 km from the nearest road, railway or powerline	Proposed/implemented	Bosch & Söderbäck, 1997
6	I	Fragmentation of forests and landscapes by roads/intersections	Development	Eurostat, 2001
7	P	Road and transportation networks	Proposed	UNEP, 1999
8	P	Density of road network	Implemented	UNEP, 2001
9	P	Proximity of transport infrastructure to designated nature areas	Implemented	EEA, 2000
10	P	Land take by transport infrastructure	Implemented	EEA, 2000
11	S	Fragmentation of ecosystems and habitats	Implemented	EEA website, 2002

Trade

Biodiversity-related indicators, Inventory January 2002, Trade

No	DPSIR	Indicator name and definition	Use	Information source
1	P	Tropical wood imports	Implemented	OECD, 1999
2	P	Net imports of specimens of wildlife species listed in annexes of CITES	Implemented	Traffic, 1999

Fisheries

Biodiversity-related indicators, Inventory January 2002, Fisheries

No	DPSIR	Indicator name and definition	Use	Information source
1	P	Marine fish catch metric tons 1995–97	Implemented	UNDP <i>et al.</i> , 2000
2	P	Marine fish catch percentage change since 1985–87	Implemented	UNDP <i>et al.</i> , 2000
3	P	Freshwater fish catch metric tons 1995–97	Implemented	UNDP <i>et al.</i> , 2000
4	P	Freshwater fish catch percentage change since 1985–87	Implemented	UNDP <i>et al.</i> , 2000
5	P	Mollusc and crustacean catch metric tons 1995–97	Implemented	UNDP <i>et al.</i> , 2000
6	P	Mollusc and crustacean catch percentage change since 1985–87	Implemented	UNDP <i>et al.</i> , 2000
7	P	Pressure on fisheries	Testing	Prescott-Allen <i>et al.</i> , 2000
8	P	Fishing mortality	Proposed	Zenetos, 2001
9	P	Percentage of stocks outside safe biological limits	Proposed	Zenetos, 2001
10	S	Biomass of commercial fish species	Proposed	Zenetos, 2001
11	P	Catch per unit effort	Proposed	Zenetos, 2001
12	I	Relative abundance of juveniles versus adults	Proposed	Zenetos, 2001
13	I	Physical damage to habitats and species	Proposed	Zenetos, 2001
14	I	Discards	Proposed	Zenetos, 2001
15	I	Bird population changes	Proposed	Zenetos, 2001
16	P	By-catch (unwanted) of mammals	Proposed	Zenetos, 2001
17	P	By-catches in fisheries	Implemented	UNEP, 2001
18	P	Changes in fish catches by species	Implemented	UNEP, 2001
19	P	national fishing grounds	Implemented	UNEP, 2001
20	D	Number of boats and capacity of the national fishing fleet in the countries	Implemented	UNEP, 2001
21	S	Number of commercial fish populations inside/outside safe size	Implemented	UNEP, 2001
22	D	Number of large scale bottom trawling vessels per 1 000 km of coastal area	Implemented	UNEP, 2001

Agriculture

Biodiversity-related indicators, Inventory January 2002, Agriculture

No	DPSIR	Indicator name and definition	Use	Information source
1	S	Total number of crop varieties/livestock breeds that have been registered and certified for marketing	Implemented	OECD, 2001
2	S	Share of key crop varieties in total marketed production for individual crops	Implemented	OECD, 2001
3	S	Share of key livestock breeds in respective categories of livestock numbers	Implemented	OECD, 2001
4	S	Number of national crop varieties/livestock breeds that are endangered	Implemented	OECD, 2001
5	S	Trends in population distributions and numbers of wild species related to agriculture	Implemented	OECD, 2001
6	S	Share of each crop in the total agricultural area	Implemented	OECD, 2001
7	I	Share of organic agriculture in the total agricultural area	Implemented	OECD, 2001
8	S	Share of agricultural area covered by semi-natural agricultural habitats	Implemented	OECD, 2001
9	I	Net area of aquatic ecosystems converted to agricultural use	Implemented	OECD, 2001
10	I	Area of 'natural' forest converted to agricultural use	Implemented	OECD, 2001
11	I	Share of habitat use units for which habitat area increased, decreased or remained constant	Implemented	OECD, 2001

12	S	Boundaries between patches	Proposed/testing	Wascher, 2000
13	S	Number of boundary types	Proposed/testing	Wascher, 2000
14	S	Landscape heterogeneity	Proposed/testing	Wascher, 2000
15	S	Proportion of cropped to uncropped land	Proposed/testing	Wascher, 2000
16	S	Length of linear landscape features in the habitat	Proposed/testing	Wascher, 2000
17	S	Extent of habitats associated with agricultural land management	Proposed/testing	Wascher, 2000
18	S	Extent of natural habitats as part of agricultural land	Proposed/testing	Wascher, 2000
19	S	Linkages between valuable natural/semi-natural habitat types	Proposed/testing	Wascher, 2000
20	S	Habitat diversity	Proposed/testing	Wascher, 2000
21	S	Proportion of declining to stable and increasing species	Proposed/testing	Wascher, 2000
22	S	Species richness/average species richness per taxon group	Proposed/testing	Wascher, 2000
23	S	Presence of particular indicator species or groups	Proposed/testing	Wascher, 2000
24	S	Ratio of specialist to wide-spread species	Proposed/testing	Wascher, 2000
25	S	Percentage of extinct vertebrate species	Proposed/testing	Wascher, 2000
26	S	Percentage of threatened vertebrate species	Proposed/testing	Wascher, 2000
27	S	Proportion of red data species/species with an unfavourable conservation status	Proposed/testing	Wascher, 2000
28	S	Proportion of species listed as key species in biodiversity action plans	Proposed/testing	Wascher, 2000
29	S	Gene pool diversity within populations of farm-related plant and animal species in semi-natural agricultural land	Proposed/testing	Wascher, 2000
30	S	Hedgerow length in farms < 2ha /tot. UAA	Proposed/testing	Wascher, 2000
31	S	Hedgerow length in farms > 50 ha/tot. UAA	Proposed/testing	Wascher, 2000
32	S	Ratio of number of field-grown varieties over No of land races in gene banks	Proposed/testing	Wascher, 2000
33	S	UAA to crop varieties with genetic resistance to pathogen and pest species	Proposed/testing	Wascher, 2000
34	S	Number of field-grown varieties	Proposed/testing	Wascher, 2000
35	S	Number of crop varieties with genetic resistance to pathogens and pests	Proposed/testing	Wascher, 2000
36	S	Change of the sum of all recognised varieties of domesticated livestock and plants over time	Proposed/testing	Wascher, 2000
37	S	UAA with higher genetic diversity/tot. UAA	Proposed/testing	Wascher, 2000
38	S	UAA with lower genetic diversity/tot. UAA	Proposed/testing	Wascher, 2000
39	R	Number of crop varieties under regulation for plant genetic resources conservation	Proposed/testing	Wascher, 2000
40	R	Commercials that encourage traditional products	Proposed/testing	Wascher, 2000
41	R	Proportion of biodiversity action plan targets met	Proposed/testing	Wascher, 2000
42	P	Landcover destruction	Development	European Commission, 2000b
43	P	Increase in agricultural genetic diversity	Development	European Commission, 2000b
44	P	Preservation of semi-natural habitats	Development	European Commission, 2000b
45	S	Preservation of high nature and culture value landscapes	Development	European Commission, 2000b
46	S	Species richness (bird species)	Development	European Commission, 2000b
47	S	Bird species on agricultural land	Development	European Commission, 2000b
48	P	Average annual fertiliser use	Implemented	UNDP et al., 2000

49	P	Pesticide use	Implemented	UNDP <i>et al.</i> , 2000
50	P	Sown area	Implemented	BEF, 2000
51	I	Fragmentation of arable land	Proposed/implemented	Bosch & Söderbäck, 1997
52	S	Total length of hedgerows and walls	Proposed/implemented	Bosch & Söderbäck, 1997
53	P	Percentage environmentally managed land of total agricultural land	Proposed/implemented	Bosch & Söderbäck, 1997
54	P	Percentage area with intensive cropping of total agricultural land	Proposed/implemented	Bosch & Söderbäck, 1997
55	S	Changes in area of heathland, fallowland and hedgerows	Proposed/implemented	Bosch & Söderbäck, 1997
56	P	Agriculture intensity: area used for intensive arable agriculture	Development	Eurostat, 2001
57	P	Harvest production totals	Proposed	UNEP, 1999
58	P	Harvest export totals	Proposed	UNEP, 1999
59	P	Harvest import totals	Proposed	UNEP, 1999
60	P	Harvest local processing capacity	Proposed	UNEP, 1999
61	P	Harvest catch/effort	Proposed	UNEP, 1999
62	I	Extent and degree of soil degradation	Testing	Prescott-Allen <i>et al.</i> , 2000
63	R	Area under agri-environmental management contracts	Implemented	EEA, 2001b
64	R	Area under organic farming	Implemented	EEA, 2001b
65	P	Use of agricultural pesticides	Implemented	UNEP, 2001
66	S	Agricultural area by crops (cereals, oil crops, forage, woodlands)	Implemented	UNEP, 2001
67	P	Change in area of agricultural land area (conversion to or from agriculture)	Implemented	UNEP, 2001
68	S	Agricultural area (intensively farmed, semi-intensively farmed and uncultivated)	Implemented	UNEP, 2001
69	P	Intensification and extensification of agricultural land use	Implemented	UNEP, 2001
70	S	Species diversity used for food	Implemented	UNEP, 2001
71	P/S	Arable land per capita	Implemented	UNEP, 2001
72	P/S	Number of species of crops and trees used by local residents	Implemented	UNEP, 2001
73	S	Number of species threatened by agriculture by group (e.g. birds, mammals, vascular plants, vertebrates, invertebrates)	Implemented	UNEP, 2001
74	P	Percentage of agricultural land under exploitation	Implemented	UNEP, 2001
75	P	Use of fertilisers	Implemented	UNEP, 2001
76	R	Organic farming	Implemented	EEA website, 2002
77	D	Agricultural intensity	Implemented	EEA website, 2002
78	R	Agri-environmental management contracts	Implemented	EEA website, 2002
79	S	Availability of wildlife habitat on farmland	Implemented	Neave <i>et al.</i> , 2000
80	R	Area of farmland covered by the agri-environmental programmes under Regulation 1257/99 classified by type of activity	Proposed	European Commission, 2001e
81	R	Area and percentage of farmland subject to restrictions (due to Natura 2000 or by voluntary agreements), classified by type of farmland	Proposed	European Commission, 2001e
82	R	Area under organic farming	Proposed	European Commission, 2001e
83	P	Trends: intensification/extensification, specialisation	Proposed	European Commission, 2001e
84	P	Trends: marginalisation	Proposed	European Commission, 2001e
85	P/I	Matrix of changes in land cover classified by type and size	Proposed	European Commission, 2001e

86	S	Total number and shares in production of main crop varieties/livestock breeds	Proposed	European Commission, 2011e
87	I	Number of national crop varieties/livestock breeds that are endangered	Proposed	European Commission, 2011e
88	S	Area of high nature value	Proposed	European Commission, 2011e
89	S	Species richness	Proposed	European Commission, 2011e
90	S	Density of linear elements and diversity of land cover at the level of the holding	Proposed	European Commission, 2011e
91	S/I	Indices of overall and of agricultural diversity and of their evolution through time	Proposed	European Commission, 2011e

7. Acronyms and abbreviations

AG	advisory group
CBD	Convention on Biological Diversity
CMS	Convention on Migratory Species
COP	Conference of the Parties
CSD	Commission for Sustainable Development (of UN)
DPSIR	driving force–pressure–state–impact–response (monitoring framework EEA)
DSR	driving force–state–response (monitoring framework OECD)
EC	European Community
ECNC	European Centre for Nature Conservation
EEA	European Environment Agency
EIONET	Environment Information and Observation Network (EEA)
ETC/ACC	European Topic Centre on Air and Climate Change (EEA)
ETC/NPB	European Topic Centre on Nature Protection and Biodiversity (EEA)
ETC/TE	European Topic Centre on Terrestrial Environment (EEA)
ETC/Water	European Topic Centre on Water (EEA)
ETC/WMF	European Topic Centre on Waste and Material Flows (EEA)
EU	European Union
Eurostat	European Statistical Office
GTOS	Global Terrestrial Observing System (FAO)
IBI	index of biotic integrity
IFEN	Institut Français de l'Environnement
IUCN	International Union for the Conservation of Nature (The World Conservation Union)
JNCC	Joint Nature Conservation Committee (UK)
JRC	Joint Research Centre (of the EC)
MCPFE	Ministerial Conferences for the Protection of Forests in Europe
NGO	non-governmental organisation
NINA	Norwegian Institute for Nature Research
OECD	Organisation for Economic Cooperation and Development
PEBLDS	pan-European biological and landscape diversity strategy
ROD	reporting obligations database (EEA)
SAC	special area for conservation (under EU habitats directive)
SBSTTA	Subsidiary Body for Scientific, Technical and Technological Advice (CBD)
SCBD	Secretariat of the CBD
SPA	special protection area (under EU birds directive)
TEPI	towards environmental pressure indicators (by Eurostat)
TERM	transport and environment reporting mechanism (EU)
UNCSD	United Nations Commission for Sustainable Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP-WCMC	UNEP World Conservation Monitoring Centre
WCMC	World Conservation Monitoring Centre (under UNEP since 2000)

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