



postnote

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BIODIVERSITY INDICATORS

The UK is committed to a demanding European target to halt biodiversity loss and a less stringent global target to reduce the rate of biodiversity loss by 2010.

Biodiversity indicators measure progress towards these targets. This POSTnote explains the different suites of indicators that will be used and looks at issues surrounding them.

Background

Biodiversity is the variability among life forms from all sources including, terrestrial, marine, and other aquatic ecosystems¹ and the ecological complexes of which they are part. This includes genetic, species and ecosystems diversity.

Biodiversity underpins ecosystem goods and services (POSTnote 281) that are vital to human well-being, such as food production. Governments around the world recognise this and committed to reducing the current rate of loss of biodiversity by 2010 while governments in Europe have aimed to halt losses completely by 2010 (Box 1).

The 2010 target framework

In 2004, the Conference of the Parties to the UN Convention on Biological Diversity (CBD) decided on a framework to help to achieve and measure progress towards this goal. Seven focal areas were created, associated with a number of goals and sub-targets². To measure progress towards these, a suite of indicators (Table 1) was proposed for each focal area, which are:

- **status and trends of the components of biological diversity** - examines the state of biodiversity in terms of species, habitats and genes;
- **threats to biodiversity** - examines some of the pressures on biodiversity such as pollution, invasive species and climate change;
- **ecosystem integrity and ecosystem goods and services** - identifies major changes in the functioning of ecosystems;
- **sustainable use** - considers the extent to which biodiversity is being used in a sustainable fashion;

- **access and benefit sharing** - tracks how benefits from biodiversity (mainly in terms of genetic resources) are being equitably shared;
- **status of resource transfer and use** - depicts how much resources are allocated to biodiversity;
- **status of traditional knowledge innovation and practices** - tracks traditional knowledge. However, the EU and the UK substitute **public opinion**, which measures people's interest in biodiversity, for this focal area.

Box 1. 2010 Policy Commitments

Global level: In 2002, the 6th Conference of the Parties (COP) to the Convention on Biological Diversity (CBD) adopted a strategic plan **"to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level** as a contribution to poverty alleviation and to the benefit of all life on earth". In 2004, a framework and first set of indicators for assessment and communication of the target were adopted.

Pan-European level: In 2003, the "Environment for Europe" ministerial conference endorsed a resolution to **"halt the loss of biodiversity at all levels by the year 2010"** framed around seven target areas: forests and biodiversity (POSTnote 275); agriculture and biodiversity (POSTnote 254); ecological networks (POSTnote 300); invasive alien species (POSTnote 303); financing biodiversity; monitoring and indicators and public participation and awareness.

EU level: In 2001, the European Council adopted the EU Strategy for Sustainable Development which aims to "manage natural resources more responsibly" and "to halt biodiversity decline by 2010". The first set of EU headline indicators was adopted in the Council Conclusions and published in the EC Biodiversity Communication in 2006.

Indicators

Indicators are measures that summarise complex data into simple, standardised and communicable figures. However, they are also often difficult for people without relevant knowledge to understand. This is especially the case for biodiversity indicators since they encompass many complex concepts and processes.

Many indicators relating to some aspect of biodiversity exist and none capture biodiversity in its entirety. Each of the goals and sub-targets listed by the CBD requires a different measure. The CBD has a list of 18 headline indicators³ which are intended for use at the global level and the EU a list of 26 (SEBI2010)⁴ for Europe. The UK has a national suite of 18 indicators⁵ to measure its own progress towards the 2010 target (Table 1).

Table 1: CBD/EU/UK indicators for 2010 target

Blue = **state** indicator, red = **pressure** indicator, green = **response**

CBD indicators	EU indicators	UK indicators
Focal area 1: Status and trends of the components of biological diversity		
1 Abundance and distribution of selected species	1 Abundance and distribution of selected species	1 Abundance and distribution of selected species
2 Red List Index (tracks species' IUCN Red List categorisation through time)	2 Red List Index	2 Plant diversity
3 Trends in extent of selected biomes, ecosystems and habitats	3 Species of European interest	3 UK Biodiversity Action Plan (BAP) priority species
4 Genetic diversity	4 Ecosystem coverage	4 UK BAP priority habitats
5 Coverage of protected areas	5 Habitats of European interest	5 Genetic diversity
	6 Livestock genetic diversity	6 Protected areas
	7 Nationally designated protected areas	
	8 Sites designated under EU Habitats and Birds Directive	
Focal area 2: Threats to Biodiversity		
6 Nitrogen deposition	9 Nitrogen deposition	7 Impacts of air pollution
7 Invasive alien species	10 Invasive alien species in Europe	8 Invasive alien species
	11 Occurrence of temperature-sensitive species	9 Spring Index (tracks the onset of spring)
Focal area 3: Ecosystem integrity and ecosystem goods and services		
8 Marine trophic index (Box 4)	12 Marine trophic index	10 Marine trophic index
9 Connectivity / fragmentation of ecosystems	13 Fragmentation of natural and semi-natural areas	11 Habitat connectivity
10 Water quality	14 Fragmentation of river systems	12 River quality
11 Health and well-being of communities	15 Nutrients in transitional, coastal and marine waters	
12 Biodiversity for food and medicine	16 Freshwater quality	
Focal area 4: Sustainable use		
13 Areas under sustainable management	17 Forest growth and felling	13 Sustainable woodland management
14 Proportion of products from sustainable sources	18 Forest deadwood	14 Area of agri-environment land
15 Ecological footprint	19 Agricultural nitrogen balance	15 Sustainable fisheries
	20 Agriculture managed with biodiversity in mind	
	21 Commercial fish stocks	
	22 Aquaculture effluent	
	23 Ecological footprint	
Focal area 5: Access and benefits sharing		
16 Not yet defined	24 Patent applications	
Focal area 6: Status of resource transfers and use		
17 Assistance provided in support of the Convention	25 Financing biodiversity management	16 Expenditure on UK biodiversity
		17 Expenditure on global biodiversity
Focal area 7: Public opinion / status of traditional knowledge, innovations and practices		
18 Linguistic diversity	26 Public awareness	18 Conservation volunteering

Types of indicators

Indicators provide different types of information. The European Environment Agency (EEA) classifies the EU indicators in the driving force-pressure-state-impact-response⁶ (DPSIR) framework (Box 2). CBD and UK indicators are not explicitly set in this framework but can be placed in three of the categories :

- **State** indicators, which measure the state of biodiversity, such as how species abundance change through time (indicator 1) or the condition of important habitats (indicator 5/4 EU/UK). They aim to indicate whether or not the 2010 target has been reached.
- **Pressure** indicators, which measure some of the factors causing biodiversity loss such as pollution (6/9/7 – CBD/EU/UK) or habitat fragmentation (9/13/11 – CBD/EU/UK).
- **Response** indicators, which track the efforts to conserve biodiversity though do not describe its state.

Box 2. Indicator Categories and DPSIR

The driving force-pressure-state-impact-response (DPSIR) framework is a commonly used approach to structure and analyse indicators. This framework aims to describe the interactions between society and the natural environment.

Driving forces are the societal, demographic, and economic changes such as population growth and development.

Pressures are the consequence of these changes and include land use and emissions.

State is the condition of the environment in terms of quality and quantity.

Impacts are effects on ecosystems and human health resulting from adverse environmental conditions.

Responses are the measures taken to address the drivers, pressures, state or impacts.

Indicator levels

There are many biodiversity indicators in use. Indeed, many NGOs have developed their own (for instance the WWF Living Planet Index). In terms of the 2010 target, the UK will have three “official” sets with which to contend: global, European and national.

Specific indicators work better at different scales. For instance, species extinction is more relevant at EU or global levels while coverage of protected areas is more important at a national level.

The indicators used by each country do not have to be the same, although reporting of the targets has take account of the set focal areas. This allows the use of whatever data and indicators are already in existence. Moreover, different countries have a range of ecological, climatic and geophysical differences which may preclude using the same indicator. However, while it may not be possible to have identical indicators at different levels and scales, compatibility is important so that measurements are comparable at these different levels⁷.

The UK's set of 18 indicators (Table 1) are built up partly from country level indicators and some are already in use by the devolved administrations in different policy schemes (UK Biodiversity Action Plan⁸, Public Service Agreements⁹, UK Sustainable Development Strategy¹⁰). Biodiversity indicators can also be used at a local level

(in council Local Area Agreements), where they may be more useful in terms of management than national indicators.

Reporting of progress towards the target

At the UK level, the reporting of indicators is done through the Joint Nature Conservation Committee (JNCC) website and in "Biodiversity Indicators in your Pocket" which was published in 2007 and updated annually⁵. In England, Natural England published the State of the Natural Environment 2008, while Scotland published its report in 2007¹¹. Together these demonstrate that the UK's biodiversity is still under pressure but that conservation measures are in some instances successful.

At an international level, a first EU (SEBI2010) assessment report will be published in 2009. The global set of indicators was published in the Global Biodiversity Outlook2 (2006) which will be updated in 2010. In terms of reporting for the 2010 target, Parties to the CBD will submit their results for the 4th National Report to the CBD in 2009.

Issues

The indicator sets represent the best information that exists in terms of their coverage of biodiversity. However, creating a set of indicators for the 2010 target has been a challenging process because of four key factors:

- **vagueness of targets** - which meant that defining indicators was difficult;
- **time available** - which meant an "adopt and adapt" strategy was needed, leading to some indicators not being fully developed or entirely fit-for-purpose;
- **lack of knowledge of the mechanisms driving changes in some biodiversity state indicators**¹²;
- **data availability** - the indicators are based upon existing data which are restricted in coverage often because they are collected from voluntary and/or academic projects.

Choice of indicators

Indicators need to be relevant (at all levels) and scientifically sound. Those adopted have inherent strengths and weaknesses⁴, but are the best currently available. Some are already well established and extremely useful as policy instruments. For example, the Common Bird Index (Box 3) has scientific credibility and wide public resonance.

However, using an eclectic set of pre-existing indicators limits their usefulness. Many of the state indicators are not directly linked with pressure indicators which is necessary for policy and management reactions. Moreover, some of the indicators may not be the best for the target. For instance, the Marine Trophic Index (MTI), a well known indicator (Box 4), is relatively insensitive to important changes in biodiversity and cannot be applied at small spatial scales.

The EEA and Defra have stated that the indicators should be used as a suite of tools in conjunction with other information to assess progress towards targets. For instance, combining the MTI with the Fish Stocks Indicator and new analyses of trawl survey data may

show how effective marine conservation measures have been.

Box 3. Common Bird Index

The Common Bird Index, which is one of the indicators for the 2010 target, is currently used in UK¹³ and EU¹⁴ policy. It tracks the abundance of common birds through time. Because these are found in a wide range of ecosystems and are sensitive to disruptions experienced by the totality of species, this indicator provides a barometer of ecosystem health.

The success of this index stems from a firm understanding of the ecological processes, accessible data which are gathered by a network of professionals and amateurs, and ease of interpretation and policy relevance.

Links between the indicators (necessary for cause and effect to be understood) and gaps in the current set are currently being investigated. The biodiversity indicator framework will evolve to overcome these problems⁷.

Box 4. MTI and EcoQOs

The **Marine Trophic Index** is based on trends in fish catches (reported to the United Nations Food and Agriculture Organisation) and depicts the trophic level (rank of species in the food chain from primary producers to large predators) of the catch. This indicator reveals changes through time in the average trophic level of fish catches and can be considered as an indicator of an ecosystem's diversity and health. However, there are several scientific issues⁴ surrounding this indicator, such as the extent to which fisheries catches reflect the state of biodiversity. This has led to the suggestion that this indicator should be interpreted with other marine health indicators¹⁵ such as EcoQOs.

The **Ecological Quality Objectives** (EcoQOs)¹⁶ of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) provide a means by which OSPAR contracting Parties in the North Sea define desired qualities of the marine environment, identify how measures for management of human impacts are working and address gaps or seek improvements. Targets are closely linked with indicators. EcoQOs describe the ecological quality desired (e.g. a healthy seabird population), how this state is to be monitored (such as the proportion of oiled birds dead on beaches) and what the objective is (for example, that no more than 10% of dead birds be found oiled).

Number of indicators

The number of indicators is a contested issue. Decision-makers would like to have as few as possible, whereas scientists may desire more, so as to be able to make sound assessments of the status of biodiversity. The current number of indicators has been achieved through a streamlining operation done by the COP to the CBD and the EEA, reducing the indicators from about 200 to the current number (18 and 26 respectively).

Dealing with numerous indicators does risk causing saturation and confusion especially since they cannot be combined to give an overall clear message as to whether or not the target of reducing the rate of loss of biodiversity has been achieved. Instead the indicators need to be interpreted carefully to give an overall picture. However, as a set, viewed in the DPSIR framework, these indicators provide a very useful policy instrument

and allow different questions to be answered. Having an overall indicator would simply not be useful.

Value of the biodiversity indicators

Indicators are useful not only for defining policy targets and measuring outcomes, but also because they inform about specific questions, focus research, provide a basis for discussion and act as a communication tool. The House of Commons Environmental Audit Committee has launched an inquiry into the UK's progress and efforts towards the 2010 target¹⁷. It has raised two questions concerning biodiversity indicators:

Are the indicators meaningful?

Defra and the EEA state that, as a set taken together, the indicators are a meaningful tool to complement other sources of information for measuring the 2010 target. Some indicators (most of those in the focal area on the status and trends of the components of biodiversity) are more meaningful than others because their link to biodiversity and the mechanisms driving the change in the indicator are well understood and they have shown their usefulness in policy. Other indicators suffer because of lack of knowledge and some of the newer indicators (e.g. those relating to invasive species or climate change) need more research and time to reveal their usefulness.

Are there enough data to assess progress and define targets?

Unlike other areas in environmental science, such as air pollution, there is no single monitoring programme for biodiversity. Limited data exist in a fragmented fashion across institutions and NGOs, which would benefit from better co-ordination and common standards. The Environment Research Funders' Forum (ERFF) and the Biodiversity Research Advisory Group (BRAG) suggest this is an area that needs to be addressed. Lack of funding and coordination was identified as at the root of these problems¹⁸.

Currently, for some indicators, there are enough data (e.g. birds) at a sufficiently fine resolution to be useful. For others, such as the Red List Index (Table 1), data are available only for some species and at a coarse global or regional level. However, many areas of biodiversity are data poor (e.g. genetics) and knowledge of ecological systems is incomplete.

Future Challenges

Biodiversity indicators are likely to play an increasing role in climate change, economics and ecosystem services assessments. The Millennium Ecosystem Assessment (2005) identified the ecosystem approach (Box 5), a principle adopted by the CBD, as a useful framework for assessing biodiversity and ecosystem services and for evaluating and implementing potential responses. Beyond 2010, it is likely that new targets and biodiversity indicators become more tightly linked and consistent with the ecosystem approach, in a fashion similar to the EcoQOs in the OSPAR Convention (Box 4). Indeed, this development is a priority in Defra's environmental policy¹⁹.

Box 5. Ecosystem Approach

The ecosystem approach is the primary framework for action under the Convention on Biological Diversity²⁰. It is a strategy for the integrated management of land, air, water and living resources that promotes conservation and sustainable use in an equitable way. For Defra, the ecosystem approach is a paradigm, where the value of ecosystems is reflected in decision-making, promotes adaptive management of the environment and ensures that maintaining healthy ecosystems is embedded in policy-making and delivery¹⁹.

Overview

- The UK is committed to halting biodiversity loss by 2010. Biodiversity indicators help to measure progress towards this target as well as answering specific questions and raising awareness of biodiversity issues.
- Due to the complexity of biodiversity and the different sectors that biodiversity cuts across, several indicators and sets of indicators are needed.
- Biodiversity indicators track the state of the environment, the pressures on biodiversity and any responses in conserving aspects of biodiversity.
- There are inherent limitations with individual indicators. However, they represent the best currently available and are intended to be used alongside other information.

Endnotes

¹ Ecosystem is defined as a community of life forms together with its environment, functioning as a unit.

² <http://www.cbd.int/2010-target/goals-targets.shtml>

³ <http://www.twentyten.net/target.aspx>

⁴ http://reports.eea.europa.eu/technical_report_2007_11/en

⁵ <http://www.jncc.gov.uk/page-3921>

⁶ EEA (1999) *Environmental indicators: typology and overview*.

⁷ European Environment Agency, personal reference: Ivone Pereira Martins and Frederik Schutyser.

⁸ <http://www.ukbap.org.uk/>

⁹ http://www.hm-treasury.gov.uk/media/1/3/pbr_csr07_psa28.pdf

¹⁰ Defra (2006) *Sustainable development indicators in your pocket*

¹¹ <http://www.scotland.gov.uk/Publications/2007/10/08091435/0>

¹² Balmford et al. (2005) *Science*: 307, 212

¹³ Defra (2006) *Working with the grain of nature – taking it forward: Volume II. Measuring progress on the England Biodiversity Strategy: 2006 assessment*

¹⁴ http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-77-07-115/EN/KS-77-07-115-EN.PDF

¹⁵ <http://www.jncc.gov.uk/page-3964>

¹⁶ http://www.ospar.org/eng/html/EcoQO_eng.htm

¹⁷ <http://www.parliament.uk/eacom/>

¹⁸ http://www.jncc.gov.uk/pdf/BRAG_REPORT_2003-2006.pdf and

http://www.erff.org.uk/reports/reports/reportdocs/enviro_monitoring.pdf

¹⁹ Defra (2007) *Securing a healthy environment: an action plan for embedding an ecosystem approach*.

²⁰ <http://www.cbd.int/programmes/cross-cutting/ecosystem/>

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