



Aggregation of indicators for biological diversity in the Nordic countries

Proceedings and recommendations from the workshop
at Tune Landboskole, Denmark, 29–30 March 2006

*Bo Normander, Anders Glimskär, Odd Stabbetorp, Ari-Pekka
Auvinen, Gregor Levin and Gudmundur A. Gudmundsson*

Aggregation of indicators for biological diversity in the Nordic countries

Proceedings and recommendations from the workshop at Tune Landboskole, Denmark, 29–30 March 2006

TemaNord 2006:554

© Nordic Council of Ministers, Copenhagen 2006

ISBN 92-893-1371-4

Copies: Print-on-Demand

This publication can be ordered on www.norden.org/order. Other Nordic publications are available at www.norden.org/publications

Nordic Council of Ministers

Store Strandstræde 18
DK-1255 Copenhagen K
Phone (+45) 3396 0200
Fax (+45) 3396 0202

Nordic Council

Store Strandstræde 18
DK-1255 Copenhagen K
Phone (+45) 3396 0400
Fax (+45) 3311 1870

www.norden.org

Nordic Environmental Co-operation

The Nordic Environmental Action Plan 2005-2008 forms the framework for the Nordic countries' environmental co-operation both within the Nordic region and in relation to the adjacent areas, the Arctic, the EU and other international forums. The programme aims for results that will consolidate the position of the Nordic region as the leader in the environmental field. One of the overall goals is to create a healthier living environment for the Nordic people.

Nordic co-operation

Nordic co-operation, one of the oldest and most wide-ranging regional partnerships in the world, involves Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland and Åland. Co-operation reinforces the sense of Nordic community while respecting national differences and similarities, makes it possible to uphold Nordic interests in the world at large and promotes positive relations between neighbouring peoples.

Co-operation was formalised in 1952 when *the Nordic Council* was set up as a forum for parliamentarians and governments. The Helsinki Treaty of 1962 has formed the framework for Nordic partnership ever since. The *Nordic Council of Ministers* was set up in 1971 as the formal forum for co-operation between the governments of the Nordic countries and the political leadership of the autonomous areas, i.e. the Faroe Islands, Greenland and Åland.

Content

Preface.....	7
Summary	9
1. Results from the workshop.....	11
1.1 Introduction.....	11
1.2 Objectives of the workshop	11
1.3 Programme and participants.....	11
1.4 Results of group discussions.....	12
1.4.1 Policy relevance.....	12
1.4.2 Data availability.....	13
1.4.3 Choice of index type.....	15
1.5 Conclusions and recommendations for future work.....	17
2. Summaries of the presentations	21
2.1 EU policies on biodiversity – goals and measurements	21
2.2 Streamlining European 2010 biodiversity indicators – the SEBI2010 project	23
2.3 Overview of existing composite biodiversity indices	25
2.4 The use and development of species trend indices.....	27
2.5 The Natural Capital Index: A policy relevant biodiversity indicator	28
2.6 Biodiversity at the national level – Norway.....	30
2.7 Environmental indicators and data on biological diversity in Sweden.....	32
2.8 Biodiversity information in Finland.....	34
2.9 Measuring state of biodiversity in Iceland	35
2.10 Measuring state of biodiversity and assessment of biological condition in Denmark.....	36
Sammenfatning (dansk).....	39
Appendix A: Programme.....	40
Appendix B: Participants.....	42
Appendix C: Other relevant projects	45

Preface

Understanding what happens to our environment forms the fundament for good decisions. Comprehensive indicator sets and indices are among the most important and useful information tools, because they at the same time show what happens to the environment and help explain what causes the changes. This contributes to form the knowledge base for decision makers to respond and act.

The usefulness of indicators has been recognised in socio-economy for several decades. With the adoption of the UN Convention on Biological Diversity (CBD) in 1992 and the recognition of the necessity for sustainable development, the indicator tools have come strongly into focus also for biodiversity, both at national and international level.

The Convention is responsible for a global set of indicators to assess the progress of implementation of the Convention by 2010 and beyond. And the pan-European SEBI2010 programme on streamlining biodiversity indicators for 2010 follows the CBD indicators up from a European perspective.

Biodiversity ranges widely, covering both our ecosystems, the species within them and the genetic resources among species. Therefore, it is not a simple matter to develop indicators and indices that rest on sound data and are both meaningful and understandable and support the CBD Convention. The most problematic aspects concern aggregation of information and inclusion of both quality and quantity perspectives.

The importance of the present report is that for the first time it brings together a number of important contributions on the possibilities and methodologies for developing a set of highly aggregated indicators to show how the quality and quantity of major Nordic ecosystems develop over time.

Further work on actually developing such indicators will be of use in both the Nordic countries as well as for the common Nordic environmental activities, but it will also contribute to the SEBI2010 and the global indicator process.

Ulla Pinborg, Danish Forest and Nature Agency (SNS), 10 May 2006

Summary

In the workshop ‘Aggregation of indicators for biological diversity in the Nordic countries’, the availability and comparability of biodiversity data in the Nordic countries was evaluated. The participants agreed that there is enough data to develop an aggregated index (or indicator set) that can describe the state of biodiversity in the Nordic countries. However, aggregation and harmonisation of the different data sets have to be part of the work.

It was agreed that the Natural Capital Index (NCI), developed in the Netherlands, will be useful as a model for a Nordic biodiversity index, because the NCI focuses on both quantity and quality aspects of state of biodiversity. However, the estimation of quality should be adjusted according to Nordic conditions and priorities.

In a Nordic index, quantity should be measured as area of habitat types that exist in the landscape, both inside and outside protected areas. Quality should be measured as species abundance and, when applicable, as species composition and/or habitat structure (e.g. dead wood).

The index should be easily communicated to politicians and decision makers. Not only must the resulting index be simple and illustrative, but it should be based on assumptions, indicators and calculation procedures that are themselves easy to explain. Finally, the index should constitute an important tool for the evaluation of the policy target of the EU and the five Nordic countries to “halt the loss of biodiversity before 2010”.

The participants of the Nordic countries are hoping to continue the work within a joint project with the Nordic Council. The aim is to develop an aggregated index, including sub-indicators, that can be used to measure the state of biodiversity in the Nordic countries and evaluate the 2010 target.

Bo Normander, Anders Glimskär, Odd Stabbetorp, Ari-Pekka Auvinen, Gregor Levin and Gudmundur A. Gudmundsson, 10 May 2006

1. Results from the workshop

1.1 Introduction

The National Environmental Research Institute of Denmark (Danmarks Miljøundersøgelser; DMU) organised a Nordic workshop on 'Aggregation of indicators for biological diversity in the Nordic countries' on 29-30 March 2006. The workshop was financed by the Nordic Council and took place at Tune Landboskole in Greve, Denmark. Following the workshop, a working group prepared this report, which also includes recommendations for future work in the field of measuring state of biodiversity in the Nordic countries.

The main reason for organising the workshop is that all Nordic countries have reemphasised the policy target of the EU to 'halt the loss of biodiversity by 2010'. The target is highlighted in the Nordic Environmental Action Plan 2005–2008 (chapter 3.2) and in the report Sustainable Development - New Bearings for the Nordic Countries 2005–2008 (chapter 5.3).

However, there is a lack of knowledge about the state of biodiversity in the Nordic countries and how it should be measured. The purpose of the workshop was to discuss how the 2010 target could be evaluated in a Nordic context. The results and recommendations from this workshop should help strengthen the Nordic work on biodiversity and strengthen the coordination of the national biodiversity and nature monitoring programmes.

1.2 Objectives of the workshop

The aim of the workshop was:

- to evaluate the availability and comparability of biodiversity data in the Nordic countries
- to reach a common understanding on how to develop an aggregated index that can be used to measure the state of biodiversity in the Nordic countries
- to outline possibilities of a joint Nordic biodiversity project in cooperation with the Nordic Council

1.3 Programme and participants

Researchers and public servants, who work with monitoring of biodiversity in the Nordic countries, were invited to participate in the workshop.

In addition, internationally recommended keynote speakers were invited to share their knowledge on aggregation of biodiversity indicators. The full programme of the workshop can be found in Appendix A and the list of participants in Appendix B.

1.4 Results of group discussions

On the second day of the workshop, the participants were divided into three discussion groups. The aim was to find an approach to develop an aggregated index for state of biodiversity in the Nordic countries by focussing the discussions on policy relevance, data availability and choice of index type.

1.4.1 Policy relevance

Moderator/reporter: Bo Normander

Question: What kind of index is relevant for the politicians and the general public? What kind of information about biodiversity do they want?

The group initially discussed the policy target to halt the loss of biodiversity by 2010. We should be able to address this target and hence be able to show trends in state of biodiversity, including historical trends. In this project we will not be able to publish our results before 2007 (or 2008). This is very short time before 2010. Therefore, the principles for calculating a biodiversity index should be applied in a way so that we can address both the 2010 target and beyond, i.e. 2015 and 2020.

Politicians are interested in the broad picture of biodiversity, a key message, preferably a value of biodiversity condensed in one figure on a scale from 0 to 10. But we should provide comprehensive data behind this one figure so that different policy interests can be addressed. Politicians also want to set the goals and they want to see progress. The EU Commission wants to see progress regarding Natura 2000, DG Agriculture regarding agriculture/CAP, DG Environment regarding environment etc. And national politicians more often have to respond to EU targets than to own targets and policies. An index should address the interest of different government bodies.

The general public is interested in what can be written in an article on page two of a newspaper. The Living Planet Index and the Ecological Footprint are examples of indices that are well received by both the public and journalists. They are easy to understand, illustrative and give us an image that we are not taking good care of the Earth. Actions from the politicians are needed!

The group also discussed: what are the limits? We can not cover everything and not satisfy all governmental bodies. To describe state of biodiversity we should include both the dimension of quantity and quality (as also agreed by the other discussion groups, see below). Data already available should be used. We should cover the terrestrial environment (including agriculture and urban/semi-urban) and the freshwater environment but not the marine environment. Habitat definitions should be based on already existing definitions from EUNIS (European Nature Information System) and the EU Habitats Directive.

A baseline or base year for a biodiversity index needs to be defined in such a way that politicians can see progress, e.g. from 1970 to 2000. The baseline should not be defined as a pre-historic state of 100% original biodiversity. The baseline could instead be defined as the state of biodiversity in pre-industrial time, as done with the Natural Capital Index.

Finally, climate change in relation to biodiversity was discussed. It is of high political interest and important especially for the Nordic countries. Climate change will presumably have an effect on the state of biodiversity. With an index and the data behind the index it should be possible to see the links between climate change and biodiversity change, for instance the movement of tree lines.

1.4.2 Data availability

Moderator/reporter: Gregor Levin

Question: What kind of data is available? For which species and ecosystems are data available, and in what timeframe?

It was agreed that a profound aggregated indicator for biodiversity in the Nordic countries necessitates both data on quantity and on quality for different habitat types.

For the development and application of an aggregated indicator, data for both quantity and quality exist and are accessible.

A central object of the project must be to:

- Decide on and develop a consistent typology for habitat types across the Nordic countries
- For each habitat type, applicable measures for quality must be found. These can be composed of:
 - Data on abundance of species related to habitats
 - Data on structure (e.g. quantity of dead wood in forests) and on management (e.g. management of semi-natural grasslands) of habitats
- In order to describe changes, for each habitat type and for species data, relevant and applicable timescales must be found. Timescales

should be consistent across countries. Otherwise methods to achieve comparability are to be developed.

- As concerns available data for the development of an aggregated indicator the project should focus on three levels:
 - Currently available data: What data are available now for the development of an aggregated indicator and what decisions/work need to be done?
 - Near future: What data will be available within 3-5 years and how can we secure that these data can be used for an aggregated indicator? Can the indicator be improved?
 - Long term: What data and methods would be necessary to improve the calculation of an aggregated index in the long term?

Quantity of habitat types

For the development of a common Nordic indicator for biological diversity a rather broad typology for habitat types will be most applicable. The EUNIS typology of habitats and the typology of the Habitats Directive are appropriate points of departure. A main task will thus be to decide on a relevant habitat typology and to develop a classification scheme, which is applicable and consistent across all Nordic countries.

If relevant, single habitat types might be divided into subclasses. In order to keep transparency and to keep the option for up- and down-scaling, habitat classes must be kept in a nested hierarchy.

Available data:

- Corine Land Cover (CLC) maps exist for all Nordic countries. CLC has a rather broad spatial and classification resolution, but will form a relevant data source to describe general trends in habitat change (data exist for 1990 and 2000, and 2005 is being prepared now). As CLC forms a total coverage it can be an important source for the evaluation of trends in habitat change derived from national monitoring programmes, which are based on sample areas.
- Data from Landscape monitoring exist in all Nordic countries. IS: LANDNYTJAR; N: 3Q; S: NILS and LiM; SF: NFI; DK: DVBL and NOVANA. These data are applicable for the calculation of the extent of habitat types within cultural landscapes. As data from landscape monitoring are based on sample areas, status and trends in quantities of habitat types should be related to covering data, preferably CLC.
- Forest inventories embracing data on extent, management and structure of forests exist in all Nordic countries. Consistency across the single countries can relatively easily be achieved.
- Registration of Natura 2000 areas exists in Sweden, Finland and Denmark. Comparable registrations of valuable habitat areas exist in Norway and Iceland. These data form an applicable input to the calculation of quantities of different habitats. As these registrations

primarily concern valuable habitat types, these data must be weighted in relation to data on the extent of more “common” habitat types.

Quality of habitat types

In addition to the quantity or extent of habitat types, the development of a profound indicator for biodiversity requires data on the quality of habitat types.

Quality can be measured in terms of species abundance or composition and in terms of structural or management parameters. For each habitat type, relevant species data and/or structural/management data should be chosen. An applicable and transparent method to combine species and structural/management data into a consistent measurement of habitat quality must be developed.

Available species data:

- Species data and trends should involve:
 - Data for rare/specialist species. These are available for all Nordic countries in terms of Red List data.
 - Data for common/generalist species.
- The availability of species data varies highly between species groups. Assessment of species data should thus concentrate on those species groups for which data are easiest available (e.g. bird data are generally best in all Nordic countries).
- Species data should be related to the different habitat types. This can be achieved by:
 - Relating species or species groups to different habitat types
 - Using species data collected within different habitat types (i.e. species abundance / composition at habitat scale)
- Decisions about applicable time scales for description of species trends have to be made.

Available data on structure and management:

- Particularly for forest habitats and for semi-natural habitats structural and management parameters can form a relevant measure of habitat quality.
 - For semi-natural e.g. grasslands grazing pressure and mowing frequency are relevant
 - For forest e.g. abundance of dead wood material is important
- For both structural and management parameters, it is important to find documentation for statistical relations between structural/management parameters and species abundance/composition.

1.4.3 Choice of index type

Moderator/reporter: Gudmundur A. Gudmundsson

Question: What are the strengths/weaknesses of the different indices and index types?

The time frame was discussed and whether the choice of index should be solely for the purpose of testing the 2010 goal or whether we should look further ahead. If looking only to 2010 an index would need to be based on available data, whereas looking further ahead new types of data could be collected. It was agreed that the mandate was to find a common index to describe the state in 2010 and in future.

We addressed a question raised during discussion in the general assembly: should the marine environment be included? The general feeling was that 2010 was too close in time for inclusion of marine environment, but that the indices of choice should suite both terrestrial and freshwater environments.

Six indices were discussed: Natural Capital Index (NCI), Species Trend Index (STI), Living Planet Index (LPI), Red List Index (RLI), Wildlife Richness Index (WRI) and Ecological Footprint (EF). EF was excluded immediately being a measure of pressure and not biological diversity. Both LPI and WRI were considered types of STI and not discussed separately. This left us with three main indices NCI, STI and RLI. Pros and cons of the different indices were discussed and agreed that there is a considerable overlap in data requirements. The group considered it unlikely that one of these indices would serve common Nordic purpose as an aggregated index and felt that a likely outcome would be a combined approach, i.e. an index that is a mixture of those above. It was therefore decided to discuss the components needed to describe the state of biodiversity.

There was a consensus within the group that the state of biological diversity should be addressed on a habitat-type level (e.g. Corine Land Cover or Natura 2000 classification) and that the categories should be rather few. There was concern regarding the grouping which could be misleading if too simplified, especially regarding forest – that one type of forest was not enough for the Nordic countries.

There was a consensus within the group that measures of state of biodiversity should be both quality and quantity. Quantity of a habitat-type is simply the area, but quality can be described in several ways. Measure of quality could be species- and/or population trends or changes in species composition (species lists) depending on the habitat. It was stressed that an important measure of habitat quality in the Nordic countries is structure e.g. the amount of dead wood in forests. The data requirements for the indicator need to be simple so that data acquisition can be maintained in a homogenous way throughout the Nordic countries. The group agreed that birds might serve the purpose of quality measure in many habitat types, being relatively easy to quantify and methods standardized.

The spatial and temporal scales were discussed and it was stressed that an index of choice would need to be functional at the local, national and regional scale. It was also stressed that it would be valuable to be able to use historical data to evaluate changes of state. The output of the index needs to be presentable in an understandable and catching way for the general public.

The RLI was considered an important measure and data gathering useful for this index is already being carried out. Concerns were raised whether sufficient data will be available by 2010. This index will be of importance in the long run.

The group did not agree upon recommending a single index. The group agreed that quality and quantity are important components to measure the state of biodiversity. Trends of both quality and quantity can be presented separately, like in STI, but the NCI combines quality and quantity in a better way. Therefore, an index similar to NCI seems to be a favoured choice, although both new data sources and a new way to present the index may be needed.

1.5 Conclusions and recommendations for future work

Each of the countries presented several data sets that are highly relevant as inputs to aggregated biodiversity indicators and indices. The conclusions were that we have enough data to start working on an aggregated index, but aggregation and harmonisation of the different data sets have to be a part of the development of the index.

In the Nordic countries, it is in particular important to focus on the quality of habitat types and not just the quantity (area). For example, the area of forests may well increase while at the same time the quality for nature conservation purposes decreases. Some forest areas are plantations, whereas others are undisturbed/natural. We favour the idea from the Natural Capital Index (NCI) to establish a biodiversity index on the aspects of both quantity and quality (see figure 1.1). In a presentation of results, however, it is important to be able to separate these two aspects and to present underlying trends.

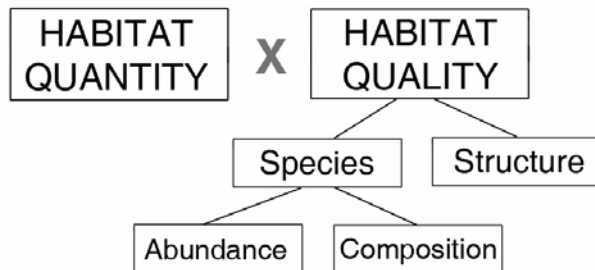


Figure 1.1. The diagram shows proposed elements of a Nordic 'state of biodiversity' index. The index should combine quality and quantity of habitats.

Species abundance can be used as a measure of quality as long as the data can be related to the state of a certain ecosystem or habitat type. However, we agree that species composition and structural indicators are needed as a complement to species abundance information. The tradition of working with structural indicators (such as dead wood) is well-developed in the Nordic countries.

The estimation of quality should be done separately for defined habitat types, but according to general principles so that it is possible to aggregate the habitat types into an overall index. The quality indicators can make use of, for example, the large set of evaluation criteria for Natura 2000 habitats developed in Sweden and Denmark, which contains both structural indicators and species trends for "typical species".

We agree that the index should cover the general landscape, both inside and outside protected areas. In the Nordic countries, a relatively large proportion of the biodiversity values are outside the protected areas. And much conservation efforts are of a more general kind, for example to preserve biodiversity in managed forests. In some specific cases, studies of protected areas may be used for:

- reference areas to which the "everyday landscape" should be compared
- analysis of changes which are not due to local factors (such as local pollution, changes in land use) but to more general factors (such as climate change, nitrogen deposition, acid rain and other long-transported pollutants).

However, such cases should be considered mainly as case studies, and not as a major part of the overall monitoring effort. The habitat classification (see table 1.1) should be harmonised with EUNIS (European Nature Information System) and the EU Habitats Directive.

The index should be easily communicated to politicians and decision makers. Not only must the resulting index be simple and illustrative, but it should be based on assumptions, data and calculation procedures that are themselves easy to explain. The relation to well-known environmental

concerns and objectives must be clearly stated or seen from the concepts used.

With respect to indices like the NCI, many aspects of the need of a baseline for the state of biodiversity were brought forward in the discussions. This was combined with the goal of the EU and all the Nordic countries to “halt the loss of biodiversity before 2010”; a statement that clearly points at the awareness of the decrease in biodiversity.

If we construct an index that can be applied to the 2010 situation, it should also be possible to use the same index for later (or previous) evaluations of the state of biodiversity. For instance, if the index shows a decline in biodiversity from 2000 to 2010, we have to conclude that the 2010 goal was not achieved. In this context, the choice of baseline becomes less important, but the 2010 situation is brought forward as an important point for comparisons.

Compilation of useful data sets should be started early in the project to develop the index within the timeframe of the 2010 goal and in order to detect, at an early stage, what data collection efforts should be done.

As NCI focuses on both quantity and quality aspects of state of biodiversity, we agree that it will be useful as a model for a Nordic biodiversity index. However, the estimation of quality should be adjusted according to Nordic conditions and priorities.

Biodiversity is a very broad concept. Within one index, it is impossible to cover all aspects and all habitats. In short, we recommend the following delimitations in an approach to measure the state of biodiversity in the Nordic countries:

- **Biodiversity aspects:** The index should focus on quantity and quality aspects of biodiversity. Quantity as the area of habitats and quality as species abundance, species composition and/or structure of the habitat (e.g. dead wood).
- **Habitats:** Based on our present knowledge and competence of available information from different habitat types, we will focus on terrestrial and freshwater habitat types, and not on marine and the most man-influenced areas (e.g. urban areas). The development of the index should be done in such a way that new habitat types can be included in a later stage.
- **Species:** Species groups must be chosen and weighted against each other, according to the availability of information. Vascular plants, mosses, lichens, birds, butterflies, mammals and wood-living organisms seem to be the groups with most information available but further evaluations of the data sets are needed.
- **The DPSIR-model:** The project should focus on state of biodiversity and not e.g. on driving forces or pressures.
- **Time frame:** Focus should be at present time (i.e. 2010) and the future. However, to be able to show trends we need to include historical data. Many data sets are established very recently. The index

should be open-ended in the way that it can be calculated with varying inputs, thereby also covering periods with scarce data.

Table 1.1. A proposal for a broad classification of habitat types:

- 1) Arctic/alpine areas
 - Alpine heaths (lower alpine)
 - Snow-beds/middle and high alpine areas
- 2) Forests
 - Mountain and oceanic birch forests
 - Deciduous forests
 - Coniferous forests
- 3) Cultural land
 - Heath land
 - Cropland
 - Meadows
 - Pasture
- 4) Mires
- 5) Seashores
- 6) Built areas
- 7) Geothermal habitats
- 8) Volcanic areas (active)
- 9) Fresh-water, deltas and inland shores

2. Summaries of the presentations

Summaries of the workshop presentations are given below. The first five summaries (2.1–2.5) report on biodiversity policies, indicators and indices applied at the European and international level. The following five presentations (2.6–2.10) uncover what kind of aggregated information on biodiversity that is currently and in the near future will be available in each of the Nordic countries.

Power Point presentations can be obtained by sending a request to Bo Normander at bn@dmu.dk.

2.1 EU policies on biodiversity – goals and measurements

Ulla Pinborg, Danish Forest and Nature Agency (SNS)

The European Community as such is a signatory party to the UN Convention on Biological Diversity with the obligations of a party, but limited by the principle of subsidiarity.

For the European Community no single political instrument covers all the Convention themes. Policies on biodiversity are just like the policies of any country scattered among several sectors and occur as part of many pieces of legislation or guidelines. The main instruments are to be found as overarching Programmes such as the Environment Action Programme with priority themes and action plans and for some themes developed as specifically directed legal instruments such as the Habitats Directive.

For biodiversity all themes were first presented in a Communication and held within the single comprehensive EC Biodiversity Strategy and its four associated Action Plans in the mid-1990's. This basis still holds, but the first commitments were set up prior to the formulation of the global target about significantly reducing the rate of loss of biodiversity by 2010 and the even more ambitious EU and European targets about halting the loss by 2010 (see table 2.1). Also, the Access and Benefit Sharing (ABS) programme and the Biosafety Protocol have been much further developed since the Convention in 1992 and the first EC Communication from 1996 were first adopted.

Therefore an updating and readjustment is necessary and thus a new Communication is in its final stages for political adoption during 2006. It is based on 10 key challenges relating to priority objectives that were identified and agreed upon during the stakeholder conference in Malahide in 2004 and later recommended by Council. A Road Map accompanies the Communication, identifying actions on how to get to the target. Many

actions consist of promoting more strongly the implementation of existing instruments, of ensuring clearer integration in all sectors of Community policies and of intensification of information and of public participation.

One necessary question to put to all concerned is: Do the political and information programmes directed at CBD work effectively and why are they positive, respectively negative? Will the 2010 targets be reached? For this, trustworthy indications of cause-relations are necessary.

For the Convention an indicator framework with sets of aggregated indicators has been agreed by parties and is being developed and tested. These indicators will not compare countries against each others and countries are not obliged to develop the same indicators, but encouraged to have indicators for similar themes and problems. Simultaneously, a European set is being developed to underpin the global set and to suit the regional European needs, including some of the EU needs. This set is the SEBI2010 set – Streamlining European Biodiversity Indicators for 2010. This set will compare countries and countries are encouraged to develop similar indicators.

Indicators are at present being developed by many actors. Some of these are politically mandated to do so, others do so from scientific or other interests, and many are developed by organisations not foremost concerned with CBD themes, but touching these or being necessary for understanding the CBD indicators. Such sets are the EC IRENA agriculture and the pan-European MCPFE forest and several OECD sets, indicators on sustainability, pollution, water consumption, economy, demography. Some also have older histories than the CBD set. This calls for a very strong and emphatic coordination. Again SEBI2010 has a strong role.

Table 2.1. List of Biodiversity policy instruments

Red = Global Blue = European * = Most important for this project

1960–1980's:

- CITES 1963 (1975)
- UNESCO MAB Man & Biosphere Programme 1970
- RAMSAR CONVENTION 1971
- IUCN Red Listings begin (off.1996)
- Coordination of bird associations
- WORLD CULTURAL/NATURAL HERITAGE CONVENT. 1972
- EUROSTAT statistics
- COMMON FISHERIES POLICY (CFP)
- COMMON AGRICULTURAL POLICY (CAP)
- BERN CONVENTION 1979

- * BIRDS DIRECTIVE 1979
 - BONN CONVENTION 1979 (1983)
 - OECD
 - * CORINE (Coordin. of information on the environment 1984- 1992)
- 1990–2000:
- * HABITATS DIRECTIVE 1992
 - CONVENTION ON BIOLOGICAL DIVERSITY (CBD), 1992 (93)
 - * FOREST STRATEGY 1998
 - * BIODIVERSITY STRATEGY 1998
 - LISBON STRATEGY (competiveness, R&D) 2000
 - WATER FRAMEWORK DIRECTIVE 2000
 - AGRI-ENVIRONMENT COMMUNICATION IRENA 2000 (2006)
 - EUROPEAN CLIMATE CHANGE PROGRAMME 2000
 - * EU SUSTAINABILITY STRATEGY 2001
 - BIODIVERSITY ACTION PLANS 2001 (agri, fish, nature, devel.)
 - * 6th EAP and OUR FUTURE, OUR CHOICE 2001-2002
- From 2001: The 2010 target
- PEBLDS BIODIVERSITY DECLARATION 2003
 - MCPFE Forest Protection indicators 2003
 - * BIODIVERSITY STRATEGY POLICY REVIEW 2003
 - * MALAHIDE and COUNCIL CONCLUSIONS 2004
 - MILLENIUM ECOSYSTEM ASSESSMENT 2005
 - SUSTAIN. USE NATURAL RESOURCES STRATEGY 2005
 - * MARINE ENVIRONMENT STRATEGY 2005 in prep
 - GLOBAL BIODIVERSITY OUTLOOK 2006
 - * NEW CAP 2006
 - * FOREST ACTION PLAN in prep 2006
 - * EC BIODIVERSITY COMMUNICATION in prep 2006
 - * SEBI2010 pan-European indicator coordination in prep 2006
 - * CLC2005 (Corine Land Cover update) in prep 2006

Source: Ulla Pinborg

2.2 Streamlining European 2010 biodiversity indicators – the SEBI2010 project

Rania Spyropoulou, European Environment Agency (EEA)

The need to streamline the global¹, Pan-European², EEA³, EU⁴ and national activities on biodiversity indicators was widely recognised in 2004

¹ COP 7, CBD, 2004

and led to establishing the activity on Streamlining European 2010 Biodiversity Indicators (SEBI2010)⁵ in 2005, where the European Environment Agency has a leading role.

Fifteen (generic) biodiversity indicators were listed in the EU headline set in the “Message from Malahide” and ‘Ecological footprint’⁶ was added later on to the set. The 13 of the indicators in the EU headline set are strongly inter-dependent and can be visualised schematically in four focal areas as defined by CBD, and the remaining three are EU response indicators.

Six expert groups worked during 2005 to review, test, refine, document and help produce specific indicators in line with eight of the 16 headline biodiversity indicators. The SEBI2010 coordination team itself reviewed requirements for the other eight indicators. Up to now, a total of over 70 specific, candidate indicators were considered for inclusion in the set of 16 (generic) PEBLDS/EU headline indicators.

The existing indicators on European common farmland birds, some of the IRENA indicators (agriculture), the MCPFE (forests) have been explored, incorporated and extended within SEBI2010. New approaches have also been developed, as for invasive alien species. At its meeting in January 2006, the coordination team considered the state-of-play on 69 candidate proposals, made suggestions on combining some proposals together and ranked the remaining candidates with regard to their level of completed documentation.

Pending questions include how to combine trends in species with trends in ecosystems, habitats, and sustainable management. The CBD proposals for linking to targets are discussed as possible way out of this issue.

² Kiev Resolution on biodiversity, 2003

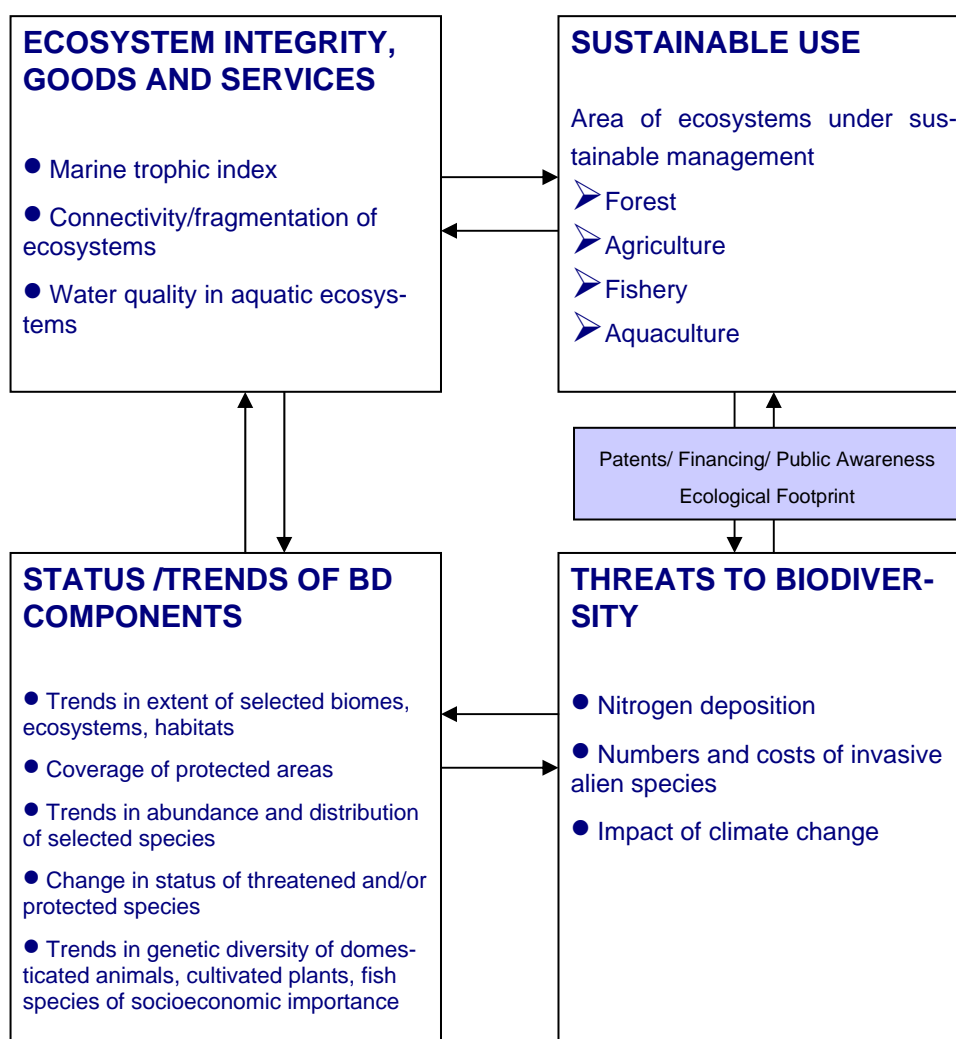
³ EEA Core Set Indicators, Bio-IMP report (2003-5)

⁴ EU Environment Council In June 2004, endorsed the set of headline biodiversity indicators referred to in the “Message from Malahide”

⁵ <http://biodiversity-chm.eea.eu.int/information/indicator/F1090245995>

⁶ The tenth meeting of SBSTTA held in early 2005 recommended (SBSTTA recommendation X/5); EU Biodiversity Group at its meeting in November 2005 endorsed

Figure 2.1. The sixteen headline indicators of SEBI 2010 are structured into four groups:



Source: Rania Spyropoulou

2.3 Overview of existing composite biodiversity indices

Ana Nieto, European Centre for Nature Conservation (ECNC)

For years there has been a debate among scientists and between scientists and policymakers/politicians on the usefulness of aggregating biodiversity parameters and indicators into indices. Scientists are concerned with detail, reliability, replicability, accuracy, etc whereas high level politi-

cians are interested in the broad picture, the key message, preferably a value of biodiversity condensed in one figure on a scale from 0 to 10.

'Aggregating biodiversity indicators for policy purposes: sense or non sense?' is a project, as part of the Alter-Net project, which investigates this dilemma by reviewing existing indices, their value for reporting on progress of achieving the 2010 target and their robustness from the perspective of science. The following indices will be covered in this project: the Natural Capital index (NCI), the Critical Load Exceedence Index (CLE), the Living Planet Index (LPI), the Species Trend Index (STI), the Red List Index (RLI) and the Connectivity Index (CI). A peer-reviewed paper balancing the pros and cons of composite indices will be produced and a workshop will take place to present best ways of communicating these indices to the audience (general public and policymakers).

For the workshop on developing an aggregated index that can be used to measure the state of biodiversity in the Nordic countries an overview of the indices covered in the Alter-Net project and others as the Ecological Footprint will be presented. The presentation will describe the indices and will list the advantages and disadvantages of the indices.

In short NCI is a good index as it can be applied at local, national and global levels. It has a simple structure and is easy to understand and to communicate to all type of audience. It can also be disaggregatable per ecosystem. However, in its way of computation a baseline, status has to be defined and the amount of data needed might be a limitation.

The LPI has a strong public support as it is easy to understand and to communicate. However, the small amount of reliable time series data available to calculate trends and the fact that all species are given the same importance are weaknesses of this index.

The ecological footprint is more and index of sustainability as it compares people's use of nature with nature's ability to regenerate. It has been accepted as part of the EU headline biodiversity indicators and it has public support as it is easy to communicate. It can be disaggregatable by region, per person, etc.

The STI can be applied at local, national and global levels. It has a great biological importance as it takes into account trend in abundance and distribution of species. However the availability of data is a limitation and it should be completed by ecosystems based indicators. It can be disaggregated by species and is an easy index to communicate.

The RLI is a robust and powerful tool for measuring biodiversity loss (2010 target), it is highly representative, consistent and objective, allows comparisons across different taxa, can be applied at global, regional and (in many cases) national scales. By 2010, RLIs will be available for at least mammals, birds, amphibians and cycads, plus first assessments for reptiles, fish, freshwater molluscs, dragonflies, palms and legumes. Limitation in data availability and a fairly coarse temporal resolution of status

change because of the broad nature of Red List categories are weakness of this index.

In conclusion so far no scientific consensus measure exists on an index to measure the state of biodiversity; however this overview will help the Nordic countries select a suitable index that meets their purpose on reporting towards the 2010 target.

Figure 2.2. An example of an STI index; the European farmland bird index:



Source: BirdLife International 2004

2.4 The use and development of species trend indices

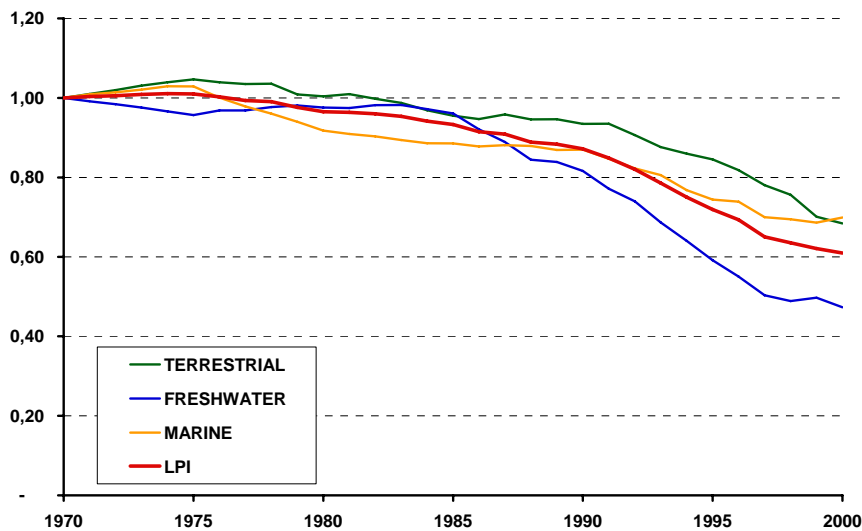
Ben Collen & Jonathan Loh, WWF International

Current unprecedented rates of species and ecosystem change lend urgency to devising accurate and effective means of measuring the rate of global biodiversity loss. WWF's Living Planet Index (LPI) was developed in 1997 to address this problem, and determine the changing state of the world's biodiversity over time. It aims to measure average trends in populations of vertebrates from around the world since 1970.

The LPI was designed to be as comprehensive and representative as possible, with respect to vertebrate class, geography and biome. The Index currently comprises data from around 3000 population time series from over 1100 species in the terrestrial, freshwater and marine ecosystems. Figure 2.3 shows how the index fell by around 40% between 1970 and 2000. When the index is disaggregated into systems, the trends are even more revealing. The freshwater system appears the most adversely affected, showing a 55% decline over three decades. In contrast, the terrestrial and marine systems appear less impacted, though both still exhibit a decline. The extent to which this reflects trends in global biodiversity as a whole is yet to be determined. However, in a new project with the Zoo-

logical Society of London, we are looking to address some of the LPI issues of bias, over-representation or scarcity of data and post stratification weighting.

Figure 2.3. The Living Planet Index (LPI) disaggregated by system.



The LPI is recognised as one of the foremost indicators of the state of global biodiversity based on trends in populations of species from all around the world. It is one of the measures selected for immediate testing by the Convention on Biological Diversity to assess progress towards its target to reduce the rate of global biodiversity loss by 2010. As well as being a measure of our success or failure at reducing the rate of global biodiversity loss, the vision for the LPI is that it will be able to determine the rate of biodiversity loss at regional and in some cases national levels, or to create indicators for monitoring species of particular international interest, such as wetland or migratory species. Norway, for example, has already produced its own Living Planet Index. As such, it could be a good model by which the Nordic countries assess their progress towards meeting the 2010 targets.

2.5 The Natural Capital Index: A policy relevant biodiversity indicator

Mireille de Heer and Ben ten Brink, Netherlands Environmental Assessment Agency (MNP)

The Natural Capital Index (NCI) was developed as a highly aggregated, policy relevant index, to measure status and trends in biodiversity. In

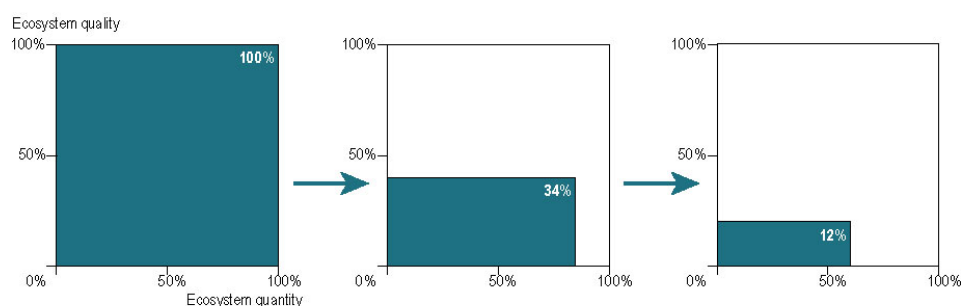
developing this indicator it was recognised that biodiversity loss consists of two components: i) loss of habitats or ‘ecosystem quantity’, resulting from the conversion of natural areas to agricultural or urban use and ii) loss of ecosystem quality (in the remaining area) due to factors such as climate change, pollution, habitat fragmentation and over-exploitation.

The challenge now is to create a tangible, powerful composite indicator that addresses both of the above components for meeting policy requirements. Furthermore, this indicator must be relevant and appealing for policy development, quantitative, sensitive, affordable, measurable and universally applicable. Finally it should represent the entire ecosystem and must be linkable to socio-economic scenarios to make projections.

Given its two main components as mentioned above, the NCI is defined as the product of ecosystem quantity and ecosystem quality. Ecosystem quantity is the percentage remaining natural area of a country. Ecosystem quality is expressed as the density of species relative to a baseline situation, whereby the average is taken of a set of representative species. However, process and structure variables (for example dead wood and vegetation layers in forest ecosystems) can also be used as quality variables.

The NCI range is between 0 and 100%. Figure 2.4 shows how the process of biodiversity loss can be visualised using the NCI. If we assume for a country, for example, that finally 60% of the natural areas remains, with a quality of 20%, the natural capital is 12%. An NCI of 12% means an average abundance of the characteristic species of roughly 12% of the baseline state.

Figure 2.4. The Natural Capital Index



The baseline is the starting point for measuring change and a proper definition of the baseline is essential to obtain meaningful indicator values. Since there is no unambiguous natural baseline in history, practical choices have to be made. NCI uses a baseline which reflects a low-human-impact situation, before large scale human impacts of industrialization and agricultural intensification. This situation can be described using historical data, intact reference ecosystems elsewhere and ecological knowledge and models. It has to be stressed that the baseline is not the

targeted state. Policy makers choose their targets somewhere on the axis between 0 and 100%, depending on the balance between social, economic and ecological interests.

Another essential part of the indicator is the selection of species to determine the ecosystem quality. It is neither necessary nor possible to monitor all species. A representative cross-section of characteristic species can be enough to describe the entire ecosystem. This method is similar to that for economic indicators, such as the retail price index, a representative selection of products monitored in a subset of stores, the so-called shopping bag. Note that only original species are included in the selection, to avoid that increases in alien species mask the decline in native species.

NCI can be calculated for individual ecosystems (e.g. forests, wetlands, tundra) and then be aggregated across the ecosystems to obtain a single value for a country. If desired even aggregation across countries is possible. By calculating the index for subsequent years, changes in time are obtained. Thus the indicator can be used for assessing progress towards the 2010 biodiversity target. For a comprehensive assessment NCI should always be used in combination with complementary indicators on threatened species and specific species groups.

2.6 Biodiversity at the national level – Norway

Harald Bratli¹, Erik Framstad², Jogeir Stokland¹ and Odd Stabbetorp²

¹ *Norwegian Institute of Land Inventory (NIJOS)*

² *Norwegian Institute of Nature Research (NINA)*

The official goal of the Norwegian government says that “the environment shall be managed in a way that maintains the diversity of habitats and landscape types and ensures that there are viable populations of naturally occurring species: This will ensure that biological diversity can continue to evolve. In addition, Norway aims to halt the loss of biodiversity by 2010”.

At the national level biodiversity indices are maintained by the Norwegian Directorate for Nature Management (<http://english.dirnat.no/>). Some national level indicators for biological diversity have been developed, mostly on an aggregated level, with indirect relevance to the status of biodiversity. Examples are “Area without infrastructure development” or “Area protected under the Nature Conservation Act, by vegetation region”. Some indicators are still under development, and data are lacking or do not have satisfactory quality. Further monitoring of biodiversity is in the planning stage.

Since 1999 the mapping of selected nature types has been conducted following standardised guidelines. 56 high priority nature types described on fact sheets are mapped in all municipalities. At present more than 200 (of a total of 430) municipalities have finished mapping. Areas are accessible at a map based website at <http://dnweb5.dirnat.no/nbinnsyn/>.

The 'National forest inventory' is a nationwide grid based monitoring program with ca. 10 000 sample plots and a history back to 1919. The program initially collected information for forest production and management, more recently also for environment management. Relevant information in this program is stand age, tree composition, dead wood, several structural indicators and vegetation. The epiphytes are monitored in a selected sub-sample of the National Forest Inventory plots. The inventory is performed with five years interval.

The 'National Programme for Monitoring Agricultural Landscapes' (3Q) is also a nationwide grid based (ca. 1400 plots 1 km²) collecting structural information of different land cover types at the landscape level by interpretation of aerial photographs with five years interval. In addition, bird censuses and vegetation monitoring are performed in permanently marked plots from a sub-sample of the quadrates.

The 'Monitoring program of terrestrial ecosystems' (TOV) gathers relevant information of species population change. Examples are intensive monitoring of vegetation in 17 spruce and mountain birch forests, based on permanent plots and performed with five years interval. In the mountain birch sites, also epiphytic lichens are monitored with five years interval, while censuses of birds and small rodents are performed annually.

At the species level the official goal is that "Populations of endangered species and species for which Norway has a special responsibility shall be maintained or restored to viable levels". Indicators for a few selected species are gathered, mainly well known species such as the Arctic fox, or commercially important species such as the Atlantic salmon or large carnivores. For some groups of organisms (e.g. birds, mammals) national data sets obtained by NGO's are available. Further information: "State of the Environment Norway" (<http://www.environment.no/>).

The national species data bank (<http://www.artsdatabanken.no/>) was established in 2005. At the end of 2006 the new red list of species in Norway will be finished, and a revised version is planned in 2010.

Table 2.2. Main biodiversity information sources on species and habitats in Norway

Object	Method	Data since	Frequency	Coverage
Forest vegetation (spruce, mountain birch)	Fixed sample plots	1988	Every 5 years/annually	Vascular plants, lichens, bryophytes, small rodents
Forests (National Forest Inventory)	Multiple data sources (incl. sample plots)	1919	Every 5 years	Forests based on a regular grid. Whole country except Finnmark.
Agricultural habitats (3Q)	Aerial photographs	1995	Every 5 years	Representative samples of agricultural land

2.7 Environmental indicators and data on biological diversity in Sweden

Anders Glimskär, Department for Conservation Biology, SLU

In Sweden, much of the work concerning environmental monitoring and the development of indicators is related to the 16 Environmental Objectives, decided by the government. Several of the adopted indicators concerning biotopes and biodiversity relate to areas of protected land, but also some structural indicators (dead wood) and species (reindeer, arctic fox) are included. However, in the revision for 2008, more indicators of ecological status (e.g. species, ecological processes and anthropogenic impact) will be added.

In 1999, twelve Green Headline Indicators were identified, as a policy tool for the work towards a sustainable development. In the development stage, the Swedish Species Information Centre (ArtDatabanken) suggested two indicators for species diversity (general and for red-listed species), but these were not included in the final set of indicators. The only adopted biodiversity index is based on areas of important ecosystems of a certain quality.

For terrestrial ecosystems, there are three monitoring initiatives that collect data for both species and habitats at the national level, the National Forest Inventory (RIS), National Inventory of Landscapes in Sweden (NILS), and the monitoring of Natura 2000 habitats. RIS has a long history of forest inventory, and has included more and more variables and species relevant for biodiversity in the last decades. NILS, which is based on a combination of CIR aerial photo interpretation and field inventory, focuses on biodiversity, land cover and land use in all terrestrial ecosystems. The data collection started in 2003, and the sampling design is similar but complementary to that of RIS. The sampling-based monitoring of Natura 2000 habitats at the biogeographical level will be integrated as closely as possible with the RIS and NILS programmes.

At present, the Swedish Bird Survey is perhaps the most well-developed programme for monitoring of terrestrial species (<http://www.biol.lu.se/zoekologi/birdmonitoring>). However, the landscape data from the NILS programme attracts many new species inventory initiatives, for example, for mushrooms, game and butterflies. In a few years, this will considerably increase the possibilities to combine species and ecosystem data. Another new initiative is the Species Gateway (<http://www.artportalen.se>), where the general public and anyone else can report species observations of birds, butterflies and moths, vascular plants and mushrooms via the web. By March 2006, already over half a million records have been reported.

For vegetation mapping, tests have been made to extend the kNN-method used for mapping forest, in which information from satellite images are combined with plot-based field data from RIS, to the Swedish mountain range, with field data from NILS. This has yielded promising results, and could possibly be used for mapping also other terrestrial ecosystems.

Table 2.3. Main biodiversity information sources on species and habitats in Sweden

Object	Method	Data since	Amount of effort*	Frequency	Coverage
Breeding birds	Line transects, point survey	1969	716	Annual	All species, all habitats
Grouse	Line transects (in NILS)	2003	631	Every 5 years	5 grouse species, all habitats
Forests (National Forest Inventory)	Sample plots	1923	67500	Every 5 years	Forests, other terrestrial habitats. Whole country.
Forest vegetation	Fixed sample plots	1983	23500	Every 10 years	Vascular plants + bryophytes
Agricultural landscape (LiM)	Selected fixed study areas, CIR photos	1992	20	Every 5 years (1992-2001)	Agricultural habitats, whole country
Landscape (NILS)	Sample plots, line transects, CIR photos	2003	631 (7000 plots)	Every 5 years	All terrestrial habitats, whole country
Grassland vegetation	Fixed study areas, sample plots	2006	693 (5000 plots)	Every 5 years	Vascular plants, vegetation, old trees, lichens
Butterflies and bumble bees	Line transects	2006	693	Every 5 years	Grasslands, all species
Forests (key biotopes)	Mapped study areas	1993	47087	NA	Valuable forest stands. Whole country.
Wetlands (VMI)	Mapped study areas	1983	34940	NA	All wetlands (minimum size), whole country.
Grasslands	Mapped study areas	2002	56751	NA	Whole country
Natura 2000 habitat mapping	Mapped study areas	2004	(on-going)	NA	All Natura 2000-habitats
Corine Land Cover	Satellite images	1993	NA	NA	All habitats, whole country
Forest land cover (kNN Sweden)	Satellite images	2000	NA	NA	Forest, whole country
Red-listed species (ArtDatabanken)	Database of public observations	1991	NA	NA	All habitats, whole country
Birds, vasc.plants, mushrooms, butterflies, moths (Artportalen)	Database of public observation	2000	NA	NA	All habitats, whole country

* Number of transects lines, study areas, sample plots etc

2.8 Biodiversity information in Finland

Ari-Pekka Auvinen, Finnish Environment Institute (SYKE)

Although no aggregated biodiversity indicators have yet been produced in Finland there is a considerable amount of information available on which such indicators could be based. There are quite comprehensive statistics on some of the major human activities having an effect on biodiversity (esp. forestry and agriculture) as well as good census data on some aspects of biodiversity itself.

Continuous censuses have been ongoing on breeding birds from late 1970's, on large mammals from 1988 and on butterflies from 1999. Also moths and some fish species are being monitored on an annual basis. Plants in spring cereal fields and forest vegetation have been surveyed every 10–30 years. The extent and state of habitats is less well monitored than species, but especially the results of the National Forest Inventory, Corine Land Cover mapping and a special farmland habitats monitoring scheme could be used for this purpose.

Some aggregated species indices have been constructed, but these have been mainly done for some other purposes than monitoring the state and development of biodiversity (e.g. monitoring the sustainable harvest of game species). A first set of purpose-made 75 biodiversity indicators was recently compiled as a part of the assessment of the National Action Plan for Biodiversity, 1997–2005 (Hildén et al. 2005). These indicators were compiled according to the European Environment Agency's DPSIR-framework and covered all the major habitat types of Finland. The indicator set is due to be expanded and further developed in a project planned for 2006–2008.

Table 2.4. Main biodiversity information sources on species and habitats in Finland

Object	Method	Data since	Amount of effort*	Frequency	Coverage
Breeding birds	Line transects etc.	1978	49	Annual	All species, all habitats
Butterflies	Line transects	1999	28	Annual	Farmland species
Moths	Light traps	1993	50	Annual	All species
Wildlife (game)	Fixed routes	1988	800–1000	Annual	30 mammal + 4 grouse species
Forest vegetation	Fixed sample plots	1951	3000	Every 10–30 years	Vascular plants + bryophytes
Plants in spring cereal fields	Sample quadrates	1961	250–2700	Every 20 years	All vascular plants
Forests (National Forest Inventory)	Multiple data sources (incl. sample plots)	1921	70 000	Every 8–10 years	Forests, but also all other natural terrestrial habitats. Whole country
Land use (Corine Land Cover)	Satellite images	2000	NA	NA	All habitats, whole country
Agricultural habitats	Fixed study areas	1995	58	NA	Southern Finland

* Number of transects lines, light traps, sample plots etc

Source: Hildén, M., Auvinen, A-P & Primmer, E. 2005. Evaluation of the Finnish National Action Plan for Biodiversity (in Finnish with an English summary). Suomen ympäristö 770. Suomen ympäristökeskus. Helsinki.

2.9 Measuring state of biodiversity in Iceland

Borghthor Magnusson and Gudmundur A. Gudmundsson, Icelandic Institute of Natural History (IINH)

The flora and fauna of Iceland is rather poor in diversity in comparison to neighbouring countries due to the isolation of the island and the recent glaciation of the northern hemisphere. The biota is mainly of European origin and endemic species are very few. Volcanic activity has strong influence on landform and habitat distribution and affects ecosystem composition and stability. There are some rare habitat types in Iceland associated with volcanic and geothermal activity.

Distribution of the plants and animals in Iceland is fairly well known and documented; a database is maintained by the IINH showing the distribution of individual species on a 10 x 10 km grid for the whole country.

Detailed mapping of vegetation of Iceland started 50 years ago but classification and mapping of habitat types is less than 10 years old. Corine Land Cover classification was initiated only two years ago as a test project. Complete land coverage has not been accomplished yet in any of these programmes.

A comprehensive programme for measuring and monitoring biodiversity at the national level has not got off the ground in Iceland. There is a strong need to start such programme and the first steps are being taken. Several on-going long-term inventory and monitoring projects are dealing with individual species or groups (e.g. population status of ptarmigan; national winter census of birds) for whole ecosystems (e.g. Lake Myvatn). These projects may be linked and used to some extent for measuring and monitoring biodiversity on a wider scale. It is, however, important to consider new approaches and links to international biodiversity programmes.

Table 2.5. Main biodiversity information sources on species and habitats in Iceland

Object	Method	Data since	Amount of effort*	Frequency	Coverage
Breeding birds	Various	1965	NA	Annual	Ptarmigan, Sea-eagle **
Bird winter counts	Sites	1952	150	Annual	All species
Waterfowl at Lake Myvatn	Various	1976	NA	Annual	All species and food source
Moths	Light traps	1993	3+	Annual	All species
Wildlife (reindeer)	Aerial survey	1980	NA	Annual	Whole population count
Wildlife (arctic fox)	Hunting/age compos.	1950	NA	Annual	Whole population model
Forest vegetation	Fixed sample plots	2002	95	Every 10	Vascular and lower plants
Pasture vegetation	Sample quadrates	1997	100	Every 5 – 10 years	All vascular plants,
Forests (National Forest Inventory)	Multiple data sources (incl. sample plots)	2005	1000+	Start in 2005	Forests, natural and plantations. Whole country.
Land use (Nytjaland)	Satellite images	2000	NA	NA	All habitats, whole country
Vegetation/habitat mapping	Aerial photos	1955	NA	NA	All habitats, 70% field coverage
Freshwater fish	Fishing stat./counts	1946	NA	Annual	All salmon rivers
Lakes	Various	1995	100+	NA	National –wide lake survey

* Number of transects lines, light traps, sample plots etc

** Also covered nationally: Gannet every 5 years since 1982, cormorant annually since 1993, slavonian grebe and gray phalarope every 5-10 years since 1975. Icelandic populations of greylag goose and pink-footed goose have been counted wintering on the British Isles since 1960. Few other species are covered locally: Black-guillemot since 1976, gyrfalcon since 1981 and whooper swan since 1990.

2.10 Measuring state of biodiversity and assessment of biological condition in Denmark

Flemming Skov, Jesper Fredshavn, Gregor Levin and Bo Normander, National Environmental Research Institute (DMU)

The Danish nature monitoring program, Novana, was initiated in 2004. The program's main focus is Natura 2000 areas and the purpose is to present the national and regional status and development of the different habitat types; to identify the yearly variation and distinguish between natural and anthropogenic impacts; and finally to identify the impact of different threats to habitat types (eutrofication, re-growth, climate change etc.). As part of the monitoring, different important habitat types are registered on basis of field surveys and aerial photos.

The Corine Land Cover registration is mainly based on interpretation of satellite images. Data for Denmark exist for 1990 and 2000 and an update for 2005 is planned. The data give general information on landscape changes. However, the classification is very broad and therefore only appropriate for a general evaluation of landscape changes.

The national agricultural registers cover censuses of agricultural land use and animal husbandry. Data exist since 1998 and are updated annually. Among other, the registers provide information on the extent of uncultivated grasslands, which are an important habitat type in the Danish landscape. Furthermore, the registers contain information on land use management and grazing pressure, giving the opportunity to estimate the quality of natural uncultivated grasslands.

Protected natural and semi-natural habitats have since 1992 been registered by the Danish counties. This registration is continually updated but not with a fixed frequency. Therefore, these data do not provide the opportunity to estimate changes in natural and semi-natural habitats. A possibility to measure change is to compare registered habitats with a map of potential habitats. Such maps have been modelled on basis of data for climate and soil properties. On basis of scenarios for agricultural management, it is also possible to model potential habitats for different situations of agricultural intensity.

Since 1982, habitats in agricultural landscapes have been registered as part of the biotope monitoring program. The registration, which is based on field surveys and aerial photos is very detailed in terms of spatial and classification resolutions. The monitoring started in 1981 and is updated every fifth year. The monitoring is carried out for plots of 2 x 2 km and started with 13 plots in 1981, 26 plots in 1986 and since 1991 included 32 plots.

Forest health, production and biodiversity are monitored in a sample-based National Forest Inventory for Denmark (NFI). The purpose of this monitoring scheme is to collect the data and statistics necessary for national and international reporting on forestry and forest development.

Danish Birdlife (DOF) has detailed information about trends and distribution of breeding birds in Denmark. Data collections were generally initiated in the 1970s. However, for some species data go much further back. Surveys of most mammals and reptiles, some butterflies and other species have been performed for decades by DMU, NGOs and private individuals. These recordings have not been done in a systematically way and the collections are widespread and often not available at the internet.

Table 2.6. Main biodiversity information sources on species and habitats in Denmark

Name	Object	Method	Data since	Amount of effort*	Frequency	Coverage
Corine Land Cover	Land use	Satellite images	1990	NA	Every 10 years	Whole country
Agricultural Registers	Agricultural land use	Census	1998	NA	Annual	All agricultural land with EU-subsidies
§ 3 Registration	Protected natural and semi-natural habitats	Field surveys and aerial photos	1992	NA	Continuous updating but not at a fixed frequency	All protected habitat types
Biotope Database	Habitats in agricultural landscapes	Field surveys and aerial photos	1982	32	Every 6 years (7 years since 2001)	32 plots of 4km ² each distributed over the whole country
NOVANA	Habitats	Field surveys and aerial photos	2004	Intensive stations: 201 x 40 plots. Extensive stations: 760 x 40 plots)	Every 6 years (intensive stations every year)	Main focus on NATURA 2000 areas
NFI	Forest health, production and biodiversity	Field surveys on a 2x2 km grid	2004	Ca. 2000 plots	Every 10 years	Whole country
DOF (Danish Birdlife)	Breeding birds	Line transects, point survey	1970s (some since 1900)	50+ species	Annual	Whole country
DMU, NGOs, private etc.	Mammals, reptiles etc.	Various	Various	20+ species	Various	Whole country
Redlist	Threatened species	Various	1997	2000+ species	Continuous	Whole country

* Number of transects lines, light traps, sample plots etc

Sammenfatning (dansk)

På workshoppene ”Aggregering af indikatorer for biodiversitet i de nordiske lande” blev de nordiske landes biodiversitetsdata evalueret i forhold til datamaterialets tilgængelighed og sammenlignelighed.

Deltagerne blev enige om, at der eksisterer tilstrækkelig data til at udvikle et fælles aggregeret indeks (eller indikatorsæt), der kan beskrive tilstanden i biodiversitet i de nordiske lande. Aggregering (eller komprimering) og harmonisering af de forskellige datasæt vil være en nødvendig del af arbejdet.

Det blev besluttet, at det hollandskudviklede Naturkapitalindeks (NKI) kan anvendes som model for et nordisk biodiversitetsindeks, idet NKI fokuserer på både kvantitative og kvalitative aspekter ved biodiversitet. Beregningen af kvalitet vil dog kræve en tilpasning til nordiske forhold og prioriteringer.

I et nordisk indeks skal kvantitet måles som areal af de habitater, der findes i landskabet, både indenfor og udenfor beskyttede/fredede områder. Kvalitet skal måles som populationsstørrelse af udvalgte arter og – om nødvendigt – som artssammensætning og/eller strukturelle indikatorer (f.eks. dødt ved).

Indekset skal være let at kommunikere til politikere og beslutningstagere. Udover at selve indekset skal være enkelt og illustrativt, skal de bagvedliggende antagelser, indikatorer og beregningsmetoder også være enkle at forklare. Endelig skal indekset være et vigtigt redskab i evalueringen af EUs og de fem nordiske landes politiske målsætning om at ”standse nedgangen i biodiversitet senest i 2010”.

Deltagerne fra de nordiske lande ønsker at fortsætte arbejdet i et fælles projekt med Nordisk Råd. Målet er at udvikle et indeks, herunder subindikatorer, der kan anvendes til at beskrive tilstanden i biodiversitet i de nordiske lande og evaluere 2010-målet.

Appendix A: Programme

Aggregation of indicators for biological diversity in the Nordic countries

Workshop at Tune Landboskole, Denmark, 29-30 March 2006.

Wednesday 29 March

11.00-13.00 Arrival and accommodation

Welcome

13.00-13.20 Introduction to the workshop
Bo Normander, National Environmental Research Institute

Halting the decline in biodiversity by 2010

13.20-13.50 EU policies on biodiversity – goals and measurements
Ulla Pinborg, Danish Forest and Nature Agency (SNS)

Aggregation of indicators and indices for biodiversity

14.00-14.30 Streamlining European 2010 biodiversity indicators – the SEBI2010 project
Rania Spyropoulou, European Environment Agency (EEA)

14.30-15.00 Coffee break

15.00-15.30 Overview of existing composite biodiversity indices – methods and requirements
Ana Nieto, European Centre for Nature Conservation

15.30-16.00 Use and development of species trends indices such as the Living Planet Index
Ben Collen, WWF International

16.00-16.30 Use and development of the Natural Capital Index
Mireille de Heer, Netherlands Environmental Assessment Agency (MNP)

16.30-17.00 Discussion

18.00 Dinner

Thursday 30 March

Measuring state of biodiversity at the national level

09.00-09.10 Introduction – What kind of aggregated information on biodiversity is available in the Nordic countries?

09.10-09.40 Norway
Harald Bratli, Norwegian Institute of Land Inventory (NIJOS) and Odd Stabbetorp, Norwegian Institute for Nature Research (NINA)

09.40-10.10 Sweden
Anders Glimskär, Swedish University of Agricultural Sciences (SLU)

10.10-10.40 Finland
Ari-Pekka Auvinen, Finnish Environment Institute (SYKE)

10.40-11.00 Coffee break

11.00-11.30 Iceland
Borghthor Magnusson and Gudmundur A. Gudmundsson, Icelandic Institute of Natural History (IINH)

11.30-12.00 Denmark
Flemming Skov and Gregor Levin, National Environmental Research Institute (DMU)

12.00-12.30 Discussion and questions

12.30-13.30 Lunch

Agreeing on an approach to develop an aggregated index for state of biodiversity in the Nordic countries

13.30-14.30 Evaluation of biodiversity indices in relation to: 2010 policy targets, Relevance to the Nordic countries, Data availability and Methodological complications
Discussions in working groups

14.30-14.50 Coffee break

14.50-15.30 Discussions continued

15.30-16.00 Conclusions and recommendations for the proceedings and the working group

16.00- Departure

Appendix B: Participants

Name	Institution	Country	Email	Tel
Harald Bratli	Norwegian Institute of Land Inventory (NIJOS)	N	hbr@nijos.no	+47 64947880
Jogeir Stokland	Norwegian Institute of Land Inventory (NIJOS)	N	jns@nijos.no	+47 64949779
Odd Stabbetorp	Norwegian Institute for Nature Research (NINA)	N	odd.stabbetorp@nina.no	+47 73801769
Erik Framstad	Norwegian Institute for Nature Research (NINA)	N	erik.framstad@nina.no	+47 73801710
Anders Glimskär	Swedish University of Agricultural Sciences (SLU)	S	anders.glimskar@nvb.slu.se	+46 18 672220
Ola Inghe	Naturvårdsverket	S	ola.inghe@naturvardsverket.se	+46 8698 1000
Johan Abenius	Naturvårdsverket	S	johan.abenius@naturvardsverket.se	+46 8698 1290
Ari-Pekka Auvinen	Finnish Environment Institute (SYKE)	SF	Ari-Pekka.Auvinen@ymparisto.fi	+358 9 403000
Borgthor Magnusson	Icelandic Institute of Natural History (IINH)	IS	borgthor@ni.is	+354 5900 500
Gudmundur A. Gudmundsson	Icelandic Institute of Natural History (IINH)	IS	mummi@ni.is	+354 5900 500
Bo Normander	National Environmental Research Institute (DMU)	DK	bn@dmu.dk	+45 4630 1817
Gregor Levin	National Environmental Research Institute (DMU)	DK	gl@dmu.dk	+45 4630 1822
Flemming Skov	National Environmental Research Institute (DMU)	DK	fs@dmu.dk	+45 8920 1525
Bernd Münier	National Environmental Research Institute (DMU)	DK	bem@dmu.dk	+45 4630 1222
Vibeke Hørlyck	National Environmental Research Institute (DMU)	DK	vibh@dmu.dk	+45 8920 1727
Rasmus Ejrnæs	National Environmental Research Institute (DMU)	DK	rej@dmu.dk	+45 8920 1515
Rania Spyropoulou	European Environment Agency (EEA)	GR	rania.spyropoulou@eea.eu.int	+45 3336 7121
Ana Nieto	European Centre for Nature Conservation (ECNC)	ES	nieto@ecnc.org	+31 135944944
Ben Collen	WWF International	UK	ben.collen@ioz.ac.uk	
Mireille de Heer	Netherlands Environmental Assessment Agency (MNP)	NL	mireille.de.heer@mnp.nl	
Ulla Pinborg	Danish Forest and Nature Agency (SNS)	DK	upi@sns.dk	+45 3947 2821

Members of the working group

Odd Stabbetorp (N), Anders Glimskär (S), Ari-Pekka Auvinen (SF), Gudmundur A. Gudmundsson (IS), Gregor Levin (DK) and Bo Normander (DK).

The working group has prepared this report. The group met and initiated the work 30-31 March following the official workshop.

Other persons involved in the project

Pia Frederiksen	National Environmental Research Institute (DMU)	DK
Helle Skånes	Stockholm University (SU)	S
Margareta Ihse	Stockholm University (SU)	S
Sigurður H. Magnússon	Icelandic Institute of Natural History (IINH)	IS
Heikki Toivonen	Finnish Environment Institute (SYKE)	SF
Ulla-Maija Liukko	Finnish Environment Institute (SYKE)	SF

Appendix C: Other relevant projects

By the Nordic Council:

Indicators related to the Nordic Strategy for Sustainable Development

Achieving the Objectives - A Nordic Set of Indicators (Nord 2003:10). And an ongoing project in which progress towards achieving the goals of the strategy will be assessed. Especially the new assessment will contain many indicators on biodiversity which are highly relevant to this project.

Coordination of Monitoring of Breeding Birds in the Nordic Countries

An ongoing project, which aims at unifying methodologies (data collection, analysis and reporting) and assess which bird species can be used as indicators in relation to the 2010 target.

NOBANIS - Nordic-Baltic network on Invasive Species

An Internet portal providing information on the distribution of invasive species in the Nordic and Baltic countries.
<http://www.artportalen.se/nobanis>

Conservation of Nordic Nature in a Changing Climate

A project carried out in 2004–2005 in which a group of experts looked at the predicted effects of climate change on biodiversity in the Nordic Countries. TemaNord 2005:572.
<http://www.norden.org/pub/sk/showpub.asp?pubnr=2005:572>

Mapping and monitoring of natural areas in the Nordic countries

Proceedings from workshop 2002. ANP 2005:711.

By ALTER-Net:

Work Package R2: Biodiversity assessment and change

A range of European projects to develop methodologies to monitor and analyse trends in biodiversity in terrestrial and freshwater ecosystems. Coordinated by Michael Bredemeier (FERC) and Erik Framstad (NINA). ALTER-Net is a "Network of Excellence" funded by the EU's 6th Framework Programme. <http://www.alter-net.info>

By the European Union:

Streamlining European Biodiversity Indicators, SEBI201

A joint project between EEA, ECNC and UNEP-WCMC, which attempts to develop a set of European biodiversity indicators for assessing progress towards the 2010 target. Especially relevant is the work of two expert groups: Expert Group 1 – Species and Expert Group 2 – Ecosystems. <http://biodiversity-chm.eea.eu.int/information/indicator/F1090245995>

BioScore - Biodiversity impact assessment using species sensitivity scores

BioScore is a project that aims to develop a cost-effective tool that allows for monitoring and assessing the impacts of key drivers and pressures from Community policies on biodiversity (species) with the ultimate aim of helping to halt the loss of biodiversity in the EU by 2010. Lead by ECNC.

http://www.ecnc.org/StateOfEuropeanNatur/Bioscore_529.html

Indicator Reporting on the integration Environmental concerns into Agricultural policy, IRENA

A set of indicators providing information on the current state and trends of the farming environment. Some indicators are relevant to biodiversity monitoring.

http://themes.eea.eu.int/IMS_IRENA/Topics/IRENA/indicators/

By the UN Convention on Biological Diversity:

Global Biodiversity Outlook 2

An indicator based assessment of global biodiversity published at the COP8 meeting in Curitiba, Brazil. This assessment represents for the first time how CBD's biodiversity indicators are applied in practise.

<http://www.biodiv.org/doc/gbo2/cbd-gbo2.pdf>

Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA)

This CBD's subsidiary body tackles issues related to biodiversity monitoring and indicators. <http://www.biodiv.org/convention/sbstta.asp>