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Biodiversity Trends & Threats in Europe

development and test of a species trend indicator

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Preface

At the global level, Heads of State and Government have agreed to significantly reduce the rate of biodiversity loss by 2010. Within Europe, they have decided on an even more ambitious target of halting biodiversity loss in the same period. These 2010 targets will require strong will and focussed action across a wide range of human activities and resulting pressures on biodiversity to ensure that they are reached successfully. They will also require better quality data and information to help achieve and to monitor progress.

Indicators are increasingly recognised as one of the most important forms of information for tracking progress and showing where action is required. They need to be scientifically sound with a clear and simple message that can be readily appreciated by experts, lay-people, politicians and decision-makers alike.

Significant progress has been made during 2004 in agreeing the first sets of indicators to assess progress to the 2010 targets; firstly within the Convention on Biological Diversity for the global target then, on the basis of the Convention set, at the pan-European and European Union level. Each set recognises the need for an indicator on the trends in the abundance and distribution of selected species.

This report provides a major contribution to the development of such an indicator by reviewing available data within Europe and showing how these data can be aggregated to produce an index (or composite indicator) for a range of species for which good data are already available. The report clearly sets out requirements for the indicator, the methodology for producing it and the data available. It then provides a step-by-step example of how data can be aggregated to produce the composite indicator and hence how the indicator can be decomposed into its constituent parts. Those interested in the overall picture can appreciate and respond to the composite indicator whereas those concerned with action on specific threats affecting individual species in different regions can make use of the relevant constituent parts.

As summarised in the report, further work is required to improve monitoring, the involvement of the many non-governmental organisations active in this field and data handling procedures and hence improve the quality of this key indicator. The pilot study presented in this report will provide a very useful contribution to the upcoming process on the implementation of the 2010 indicators at the European, EU and national levels. It can also provide the basis to start monitoring trends and for taking action to meet the targets. There is not a moment to lose! We can improve the indicator as we proceed but if we lose biodiversity we lose it for a long time, if not forever.

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Summary

This report presents a trial of a species population trend indicator for evaluating progress towards the 2010 biodiversity target in Europe, using existing data. The indicator integrates trends on different species (groups), and can be aggregated across habitats and countries. Thus, the indicator can deliver both headline messages for high-level decision making and detailed information for in-depth analysis, using data from different sources, collected with different methods.

International NGOs mobilised data on over 2800 historical trends in national populations of birds, butterflies and mammals, for a total of 273 species. These were combined by habitat and biogeographical region to generate a pilot Pan-European scale indicator. The trial indicator suggests a decline of species populations in nearly all habitats, the largest being in farmland, where species populations declined by an average of 23% between 1970 and 2000.

The indicator is potentially useful for monitoring progress towards 2010 biodiversity targets, but constraints include: the limited sensitivity of the historical data, which leads to conservative estimates of species decline; a potential danger of ambiguity because increases in opportunistic species can mask the loss of other species; and failure to account for pre-1970 population declines. We recommend mobilising additional existing data, particularly for plants and fish, and elaborating further the criteria for compiling representative sets of species. For a frequent, reliable update of the indicator, sound, sensitive and harmonised biodiversity monitoring programmes are needed in all countries across Pan-Europe.

1. Introduction

In response to global concern over the rapid loss of the world's biodiversity, the 6th Conference of the Parties of the Convention on Biological Diversity (CBD) adopted a global target to reduce the rate of biodiversity loss by 2010 (CBD 2002). This target, which was later endorsed by the World Summit on Sustainable Development (United Nations 2002), has also been adopted by a number of regional scale policies and processes. The European Union Sustainable Development Strategy (2001a) and various other European Union policies (EC 1998, 2001b, c) set similar or even more ambitious biodiversity goals. The Pan-European Ministerial 'Environment for Europe' process adopted a resolution on halting the loss of biodiversity by 2010 (UN/ECE 2003).

This widespread adoption of targets for reducing the rate of biodiversity loss has highlighted a need for indicators that will allow policy makers to track progress towards these ambitious goals. Recognising this need, the CoP of the CBD identified a series of biodiversity indicators for immediate testing (UNEP 2004). Such indicators are needed at national, regional and global levels. In June 2004 the Environment Council of the EU adopted a set of 15 headline indicators for biodiversity to evaluate progress towards the 2010 target (Council of the European Union 2004). This set was recommended by the EU Biodiversity Expert Group and its Ad Hoc Working Group on Indicators, Monitoring and Assessment, and the Malahide stakeholder conference (Anonymous 2004).

Both the CBD decision and the European documents recommend, among other indicators for immediate testing, indicators of trends in abundance and distribution of selected species. Species trend indicators are considered a sensitive measure of biodiversity change (Balmford *et al.* 2003; Ten Brink *et al.* 1991; Ten Brink 2000), and one such approach, composite species trend indicators, has been increasingly widely applied. In addition to the global-scale Living Planet Index (Loh 2002; Loh *et al.* 2005) there are several instances of the successful implementation of such indicators, principally at national scales (Jenkins *et al.* 2004). The UK Headline indicator of wild bird populations (Gregory 2003a) is one example. The European Bird Census Council (EBCC) has used a similar approach to develop the Pan-European Common Bird Index for farmland and woodland birds (Gregory 2003b; Gregory *et al.* 2005).

To address the need for regional scale biodiversity indicators in (Pan-) Europe, this study set out to identify suitable data and build upon existing methods to develop an appropriate indicator of trends in species abundance and distribution for use at the Pan-European scale (the whole of Europe west of the Ural mountains and including the Anatolian part of Turkey; i.e. the European Union plus 18 other European countries). The target audience for the indicator is policy makers on the Pan-European and national levels, who will use the indicator to support high-level decision-making on the environment and biodiversity-related sectoral activities. The indicator should also be suitable for informing the general public on biodiversity trends. It should match the set of requirements as listed in the CBD general guidelines and principles for developing national-level biodiversity monitoring programmes and indicators (UNEP 2003a). These principles require that an indicator be, among other characteristics: policy and biodiversity relevant; scientifically sound; broadly accepted; affordable to produce and update; sensitive; representative; flexible and amenable to aggregation.

In this paper, we present a proposed method for calculating such a composite indicator to evaluate progress towards the 2010 target for terrestrial biodiversity in Europe, an evaluation of the existing data available for the purpose and our experience of mobilising them, and the results of a trial application of the proposed method to some of the available data. We also offer recommendations as to how the data and the methodology can be improved based upon this pilot experience.

2. Methods

The challenges in developing an indicator on the trends in abundance and distribution of selected species lie in finding appropriate data, and in identifying how best to select the component trends and how to combine them in a way that is representative of the system and trends of interest. These require choices on the classification of the study area, selection of the species, and the procedure for calculation and aggregation.

2.1 Geographical scope and classification of the study area

This study focused on the whole of Europe west of the Urals, including the Anatolian part of Turkey. The area was categorised (*Table 1*) by combining the 11 Pan-European biogeographical regions (*Figure 1*; Roekaerts 2002) with the 10 top-level habitat types from the EUNIS habitat classification adopted by the European Environment Agency (*Appendix 1*; Davies and Moss 2002). The EUNIS classes 'Grassland and tall forb habitats' and 'Regularly or recently cultivated agricultural, horticultural and domestic habitats' have been merged into a single class, called 'Farmland'. By combining the biogeographical regions and the major habitat types we aimed to cover the main variation in Europe's biodiversity. We have termed the combination of a habitat type and a biogeographical region an ecoregion.

Table 1. The approximate areas (in thousands of km^2) of the Pan-European ecoregions defined for this study by combining biogeographical regions with EUNIS habitat types. Those ecoregions selected for the pilot study are in red. Note that the EUNIS classes 'grasslands' and 'cultivated habitats' have been merged into a new category: 'farmland'. The approximate area of each ecoregion was calculated from GIS overlays of biogeographical regions (Roekarts 2002) with habitat maps derived from the CORINE land cover map (ETC/TE 2000) and the Global Landcover 2000 map (Batholome 2002). Parts of Russia, Ukraine and Turkey were not included in these statistics.

Biogeographical region	Alpine	Anatolian	Arctic	Atlantic	Black Sea	Boreal	Continental	Macaronesian	Mediterranean	Pannonian	Steppic	Total
EUNIS Habitat type												
Marine habitats	?	?	?	?	?	?	?	?	?	?	?	?
Coastal habitats	< 1	?	< 1	2	< 1	< 1	1	< 1	2	< 1	< 1	6
Inland surface water habitats	15	?	3	8	< 1	61	17	< 1	6	2	3	116
Mire, bog and fen habitats	26	?	6	18	1	23	4	< 1	2	1	2	83
Heathland, scrub and tundra habitats	21	?	13	53	< 1	1	16	2	136	2	2	246
Woodland and forest habitat and other wooded land	336	?	10	133	9	669	534	1	299	27	11	2,028
Inland unvegetated or sparsely vegetated habitats	107	?	62	13	< 1	2	13	1	9	< 1	16	222
Constructed, industrial and other artificial habitats	6	?	< 1	41	< 1	8	66	< 1	15	8	3	148
Farmland	146	?	30	539	8	177	1,198	2	581	121	101	2,909

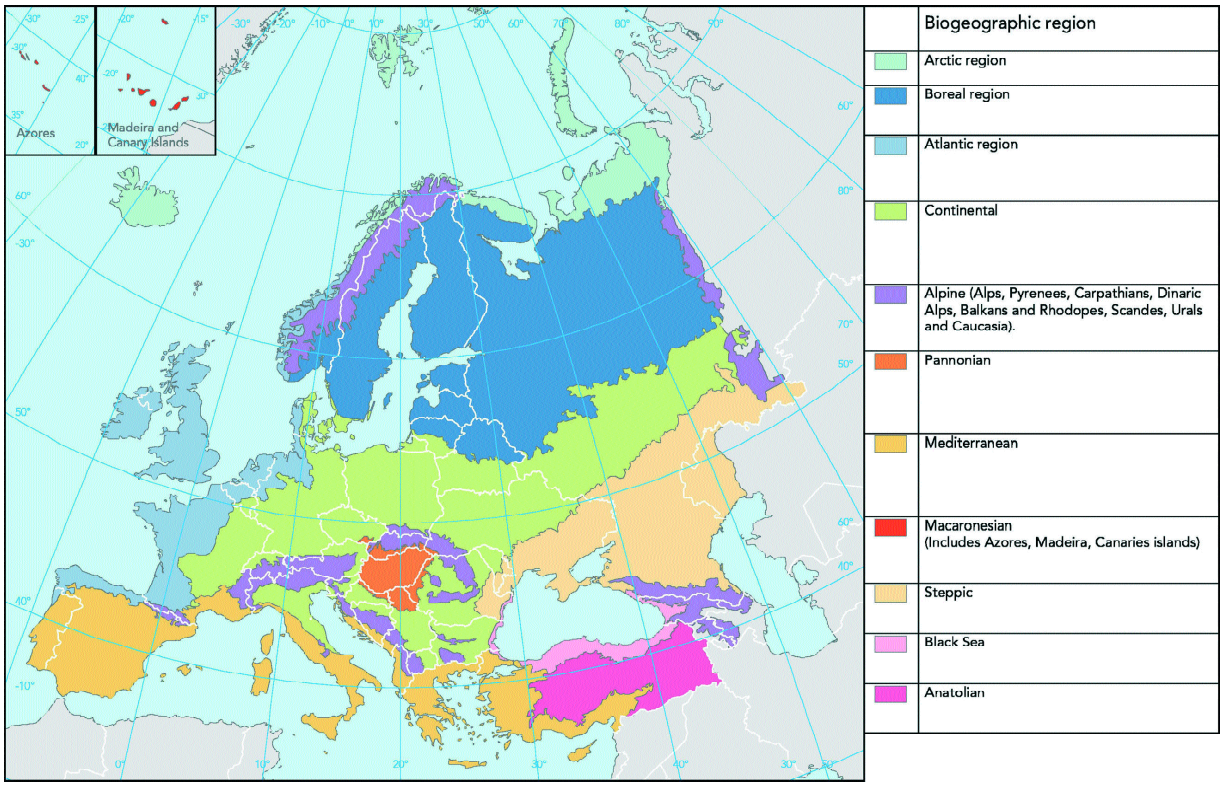

Figure 1. Biogeographical regions and countries in Pan-Europe (Roekaerts 2002)

In this pilot study we have focussed on the 22 ecoregions in red in *Table 1*, which were selected based on an a priori estimation of the availability of relevant data, their size and their perceived importance for biodiversity.

2.2 Locating, mobilising and compiling data*

The various studies that have investigated ongoing biodiversity monitoring in Europe have concluded that the many monitoring activities existing at international, national and local scales are patchy and scattered among places and organisations, and there is little coordination among them (Delbaere & Nieto in prep.; ETC/NPB 2003; Fischer 2002). Moreover, with some exceptions, most of the monitoring programmes have been running for only a limited number of years. Compiling a European database of long-term trends is therefore a significant challenge.

Much of the coordination that does exist is provided by species-oriented non-governmental organisations (NGOs), which mostly have wildlife conservation as their main objective. To help direct their conservation activities, these NGOs rely on networks of experts and organisations from (nearly) all Pan-European countries, which are involved to varying degrees in

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Table 2. The seven large NGOs used as the principal data providers for this study and their focal taxonomic groups.

Species group	NGO	Website
birds	BirdLife International	http://www.birdlife.net/
	European Bird Census Council	http://www.ebcc.info
	Wetlands International	http://www.wetlands.org/default.htm
butterflies	Butterfly Conservation Europe	http://www.vlinderstichting.nl/
mammals	Large Carnivore Initiative Europe	http://www.lcie.org/
	Large Herbivore Foundation	http://www.largeherbivore.org/
plants	Planta Europa	http://www.plantaeuropa.org/html/about_pe.htm

monitoring and surveying programmes. The NGOs help to coordinate monitoring activities and to bring together the resulting data. In many countries the NGOs have access to information that can not easily be obtained from more formal focal points for e.g. the CBD or the EEA. This is because the information has often not been collected in the framework of a formal governmental biodiversity monitoring programme. Thus these NGOs are European nodes that, with their networks, can provide a unique overview of, and access to large amounts of data on status and trends in their focal species groups.

For this study, seven of largest and best established NGOs involved in species trend data collection throughout Europe were identified as the most promising providers of species trend data (*Table 2, Appendix 2*). These NGOs work with a broad range of partners (local NGOs, research institutes and universities, herbaria and botanical gardens, hunters' organisations, forestry organisations, etc.) and accordingly draw on data collected in many different contexts (conservation, research, game management, policy support, public information, etc.).

The NGOs made available a number of major data sources (*Table 3*; Burfield *et al*. 2004; Van Swaay 2004; Van de Vlasakker Eisenga 2004; LCIE 2004), including both existing European databases, where data from many sources in many countries had already been brought together, and data that were still held by the original researchers and brought together for this project. For breeding birds and butterflies in Pan-Europe, population trend data were available for *all* species and *all* countries. For mammals, data availability was best for 5 species of large carnivores and 7 species of large herbivores in most of the relevant countries. However, for mammals in quite a few countries the data are available for only one point in time and no trends can be calculated. For all three species groups data were mobilised for as many species as was possible within the context of this project, with the exception of invasive species and species with highly fluctuating populations that would hide long-term trends. The principal source of bird data, the European Bird Database has its own definition for this category, and the NGOs and experts applied similar filters for the other taxonomic groups. In the context of this (pilot) project it was not feasible to collect data on plants and wintering water birds.

The original data were obtained by a wide variety of methods, including:

- standardised monitoring schemes with fixed sampling sites
- estimates of total population size, either by direct observation or indirectly, e.g. inferred from the total number of shot animals
- counts of number of populations or meta-populations
- repeated distribution atlases (especially for butterflies) which were used to obtain a proxy of population decline (see also Thomas *et al.* 2004)
- expert judgement.

Table 3. The principal data sources used by the NGOs to provide time series data for this study. Data derived from these sources were standardised as indices of population change between 1970 and 2000.

Group	Data source(s)	Number of species	Lowest spatial resolution	Coverage	Time interval for which trends are available	Reference
birds	European Bird Database I and II (EBD), incorporating data from the Pan-European Common Bird Monitoring Scheme	515	country	all Pan-European countries	1970-1990, 1990-2000	BirdLife International/European Bird Census Council (2000), BirdLife International (2004)
butterflies	Red Data Book of European butterflies (and underlying database)	576	country	all Pan-European countries	1970-2000	Van Swaay & Warren (1999)
	national and regional atlases	many	country or region within country	many Pan-European countries	varies by country	see references in Van Swaay (2004)
	national monitoring schemes	many	country or region within country	Finland, The Netherlands, Spain, UK, Ukraine	varies by country; from a few years to since 1976 (UK)	see references in Van Swaay (2004)
mammals, large carnivores	Species Action Plans and many data sources residing with individual researchers and institutes	5	country	all Pan-European countries	varies by species and by country; since 1960-70	see references in LCIE (2004)
mammals, large herbivores	many data sources residing with individual researchers and institutes	7	country	all Pan-European countries	varies by species and by country; since 1960-70	see references in Van de Vlasakker Eisenga (2004)

Therefore, the original data were expressed in different units and were associated with varying degrees of uncertainty.

The two largest data sources for butterflies and birds, as well as the earliest mammal, counts date back to the 1970s. Very few data are available for the 1980s, while data collection became far more common practice in the 1990s. Trends are therefore often given for a larger time interval of two or three decades, i.e. without intermediate years.

To address this variability, all data were re-expressed as the proportional change between a pragmatic baseline, the year 1970, and an approximation of the present, around the year 2000. In most cases the data were provided in classes (e.g. 30-50% decline), or indicated as 'greater than' or 'less than' (e.g. > 50% increase). In these cases the index was assigned respectively as the middle of the class (e.g. 40% decline) or the specified boundary value

(e.g. 50%). The value 1 was added to all indices to avoid calculation problems generated by zero values when taking logarithms.

The NGOs also supplied an indication of the data quality for each of the time series according to a standard set of categories developed for this project and provided autecological information for each of the species.

Ideally the data on species trends would be collected at the level of ecoregions within countries, but nearly all the data provided by the NGOs were available only at the level of countries (*Table 3*). Therefore, for each ecoregional index we included the national trends of those species using
the focal habitat within the biogeographical region (the ecoregion) as their primary habitat.

This approach is similar to that used for the European indicators of farmland and woodland birds (Gregory *et al.* 2003b, 2005). For *breeding birds* the link between species and ecosystems was made through the use of existing databases on the habitat preferences of the species, in combination with expert judgement from the international NGO (Burfield *et al.* 2004). For *butterflies* the link between species and habitats was made through the judgement of national experts and the international NGO (Van Swaay, 2004). For those bird and butterfly species considered to be specific for a certain habitat, but occurring in more than one biogeographical region in a country, the same national trend was assigned to all biogeographical regions. For *mammals* the link between the species and the habitats was based on the information provided by the NGOs (LCIE 2004; Van de Vlasakker Eisenga 2004) and additional expert judgement. The mammal species were assigned to the habitats and biogeographical regions where the majority of the populations occur.

2.3 Calculation and aggregation

For each ecoregion, species population trend data are incorporated for each country. The combination of an ecoregion and a country is termed a building block and is the lowest level for the data of this indicator. For each of the building blocks the indicator is calculated as the geometric mean of the trends (indices) of the selected species. Species from all species groups are taken together; every species has equal weight. The results can then be aggregated on an area-weighted basis. Thus, for a given ecoregion, the index is the average of each of the building block indices in the ecoregion, weighted by the area of the building block. For example:

Atlantic Forest (AF) Ecoregion Index =

$$\frac{\sum [(\text{AF index Ireland})(\text{area AF in Ireland})] + [(\text{AF index UK})(\text{area AF in UK})] + \ldots}{\text{Total area of AF}}$$

The resulting ecoregional indices can then be similarly aggregated towards the habitats. Thus, a European Forest species trend indicator would be obtained by averaging all of the forest ecoregion indices on an area-weighted basis.

The data on area of the building blocks were obtained from GIS overlays of countries with biogeographical regions (Roekaerts 2002; downloaded from EEA website) and habitats.

Habitat maps were derived from the CORINE land cover map (ETC/TE 2000; coverage: EU25, with the exception of Sweden, Cyprus, Malta and Bulgaria, Romania) or from the Global Land Cover 2000 map (Bartholome 2002) for those countries not included in the CORINE assessment (see *Appendix 3* for remap tables).

Finally, the results can be aggregated towards an index for Europe as a whole, by aggregating across the habitats. All habitats are given equal weight, by applying a non-weighted averaging of the values per habitat. The results can also be aggregated by individual countries or clusters of countries. *Appendix 4* presents an example of the calculation and aggregation procedure.

3. Results

3.1 Evaluation of the available data

In total the NGOs mobilised data on 2810 time series for 273 unique species, which are mostly birds and butterflies, but also include some large mammals (*Table 4*). The number of species per ecoregion ranged from 6 in Atlantic mires, bogs and fens to 38 for Mediterranean farmlands (*Table 5*, see *Appendix 5* for species lists), with an average of 22 species per ecoregion. The data come from 43 countries, with an average of around 5 ecoregions per country (*Appendix 6*).

Table 4. The total number of unique species and the total number of time series obtained

Species group	Number of species	Number of time series
butterflies	119	1359
birds	142	1389
mammals	12	62
total	273	2810

Generally the data are well distributed across the habitats, biogeographical regions and countries. Countries with a large area of a given ecoregion usually have a fairly large number of time series for that ecoregion. There are more than 50 time series available for most habitats, with the exception of the EUNIS class 'Mires, bogs & fens' for which only 8 time series are available. Over 900 time series were available for farmland. Over 100 time series were available for all but three *biogeographical regions*, the Steppic, Arctic and Pannonian. Only very few data could be obtained for Bosnia and Herzegovina, Yugoslavia (Serbia and Montenegro) and some of the very small countries.

The autecological information provided by the NGOs showed that the species set, both as a whole and for most ecoregions, includes representatives of most guilds (herbivores, carnivores, piscivores, insectivores, omnivores), species with a wide range of dispersal distances and area requirements, and migratory as well as sedentary species (*Appendix 7*). Both rare and common species, and both threatened and non-threatened species were included in the data for all countries, and some endemic species were included for all ecoregions. The NGOs' assessments of the causes of change indicate that the dataset includes species with different sensitivities to all major human pressures as well as species that seem not to be very sensitive to human activities.

The categorisation of data quality provided by the NGOs (*Table 6*) shows that the majority were based on limited quantitative data with some corrections and interpretation by experts. Especially for butterflies, these include measures of change in distribution, which are often relatively conservative measures of overall change. A minority of the time series were based on complete quantitative data.

Table 5. The number of (unique) species incorporated into the pilot indicator per ecoregion. Only those habitat types and biogeographical regions addressed in the pilot indicator are included.

Biogeographical region	Alpine	Arctic	Atlantic	Black Sea	Boreal	Conti-nental	Macaro-nesian	Mediter-ranean	Panno-nian	Steppic
Coastal habitats			27					16		
Inland surface water habitats			20			21				
Mire, bog and fen habitats			6							
Heathland, scrub and tundra habitats			12	17				17		
Woodland and forest habitat and other wooded land	31		23		36	35		23		
Inland unvegetated or sparsely vegetated habitats	15	3								
Farmland	27		36		14	37		38	20	5

Table 6. The quality of the data included in the pilot indicator, shown as the number of time series belonging to each data quality category for each taxonomic group.

		Frequency				
Cate-gory	Description	Birds	Butterflies	Mammals: carnivores	Mammals: herbivores	Overall
a	Complete quantitative data	163	25		7	11
b	Limited quantitative data, some corrections and interpretations applied	810	207	1	13	1018
c	Limited quantitative data, no corrections and interpretations applied	11	504	9		513
d	Extensive expert judgement	412	1	6	3	422
e	Limited expert judgement		36	9		45
f	Red Data Book for Butterflies (no quality indication obtained)		586			586
g	Unknown	4		9	5	20
	Total number of time series	1389	1359	34	28	2810

3.2 A first trial of the indicator

The data described above were the basis for the first trial of the indicator. From the total of 2810 time series, we excluded the 513 time series with class c quality (Limited quantitative data, no corrections and interpretations applied). These were mainly butterfly data, derived from repeated atlases but without corrections for changes in recording intensity, and therefore potentially misleading. Most of the remaining 2297 time series showed either stable or decreasing populations within a building block (*Figure 2*), while a minority (19%) represented increasing populations. About 1% of the time series showed local extinction of the species within a building block.

A further 60 time series were excluded because they related to building blocks of unknown area (small and fragmented habitats not detected by the land cover maps). Last, European Russia (72 time series) was excluded, to avoid the indicator being dominated by one single country. Thus, 2165 time series were used for this first analysis.

When calculated for each major habitat type at Pan-European scale, the indicator shows that populations declined in nearly all habitats between 1970 and 2000. Farmland showed the largest decrease in population index, 23%; all of the natural habitats had much smaller calculated changes (*Figure 3)*. The population index for natural habitats collectively showed a decline of only 2%, which contrasts strongly with the index for farmland (*Figure 4*).

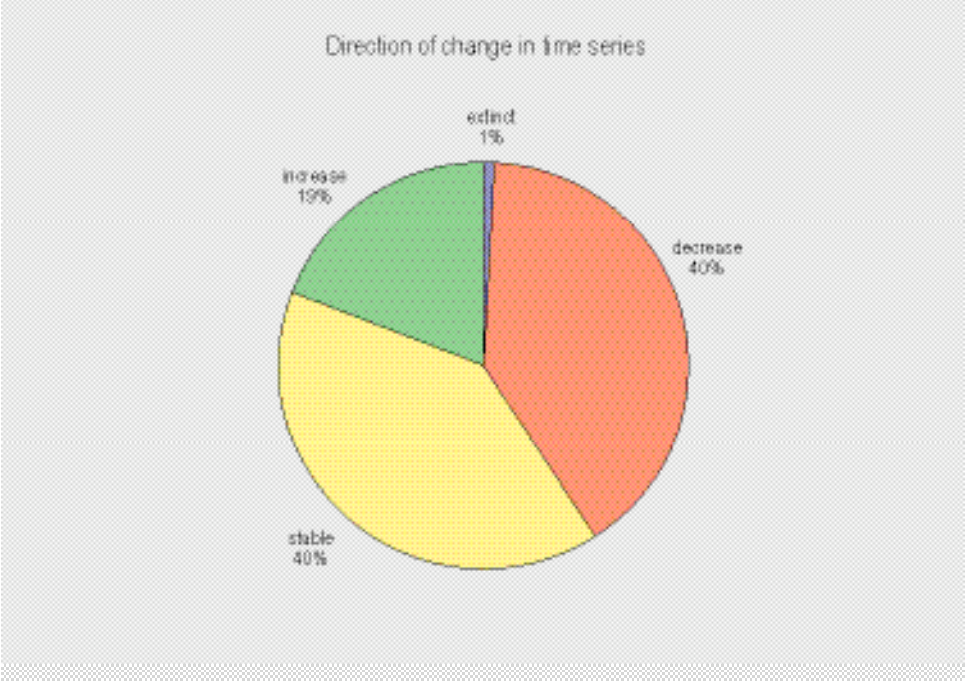

Figure2. Distribution of the direction of change among the 2297 time series obtained. Those classed as stable showed no net change in population between 1970 and 2000 (0 was the midpoint of the range of possible change). Those classed as decreasing or increasing had non-zero change, and a few time series showed the species becoming extinct within the building block.

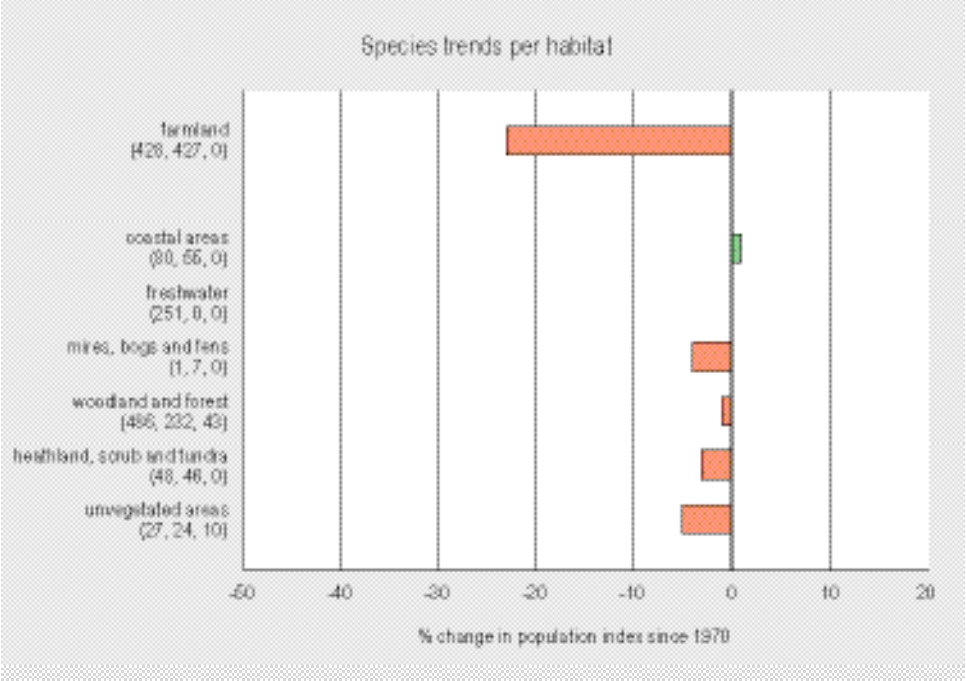

Figure3. The percentage change in the species population index of each EUNIS habitat between 1970 and 2000. The number of time series included in the index for each habitat is shown in brackets as (birds, butterflies, mammals).

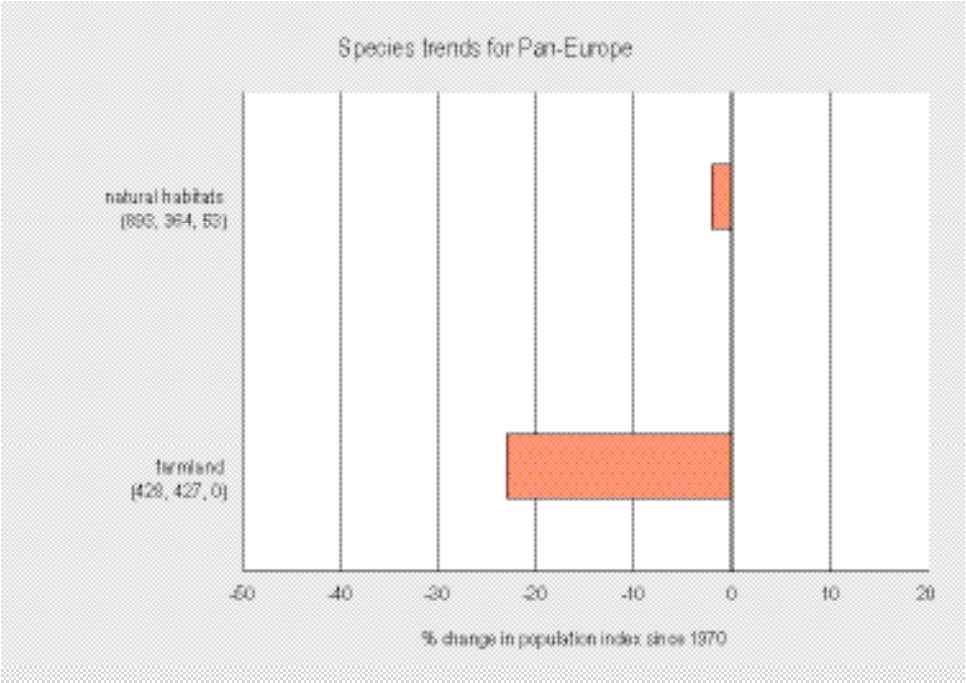

Figure 4. The percentage change in species population index between 1970 and 2000 for natural and farmland habitats at Pan-European scale (43 countries). Number of time series in brackets.

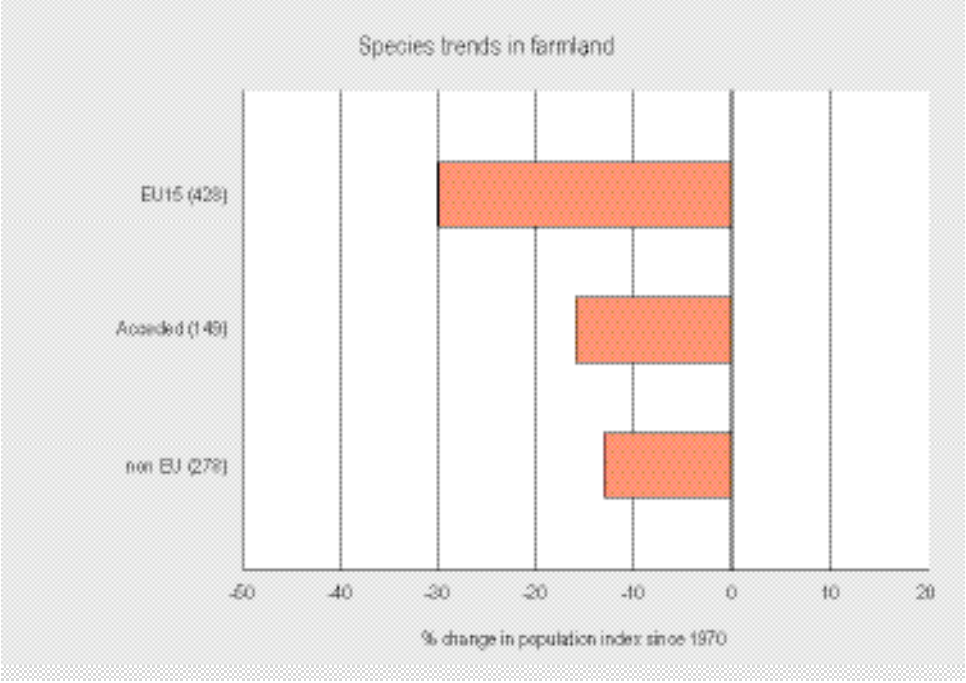

Figure 5. The percentage change in species population index of farmland species between 1970 and 2000, showing that declines were much larger in the 15 European Union Countries than in the 10 countries that acceded to the EU in May 2004 or the non-EU countries. Number of time series in brackets.

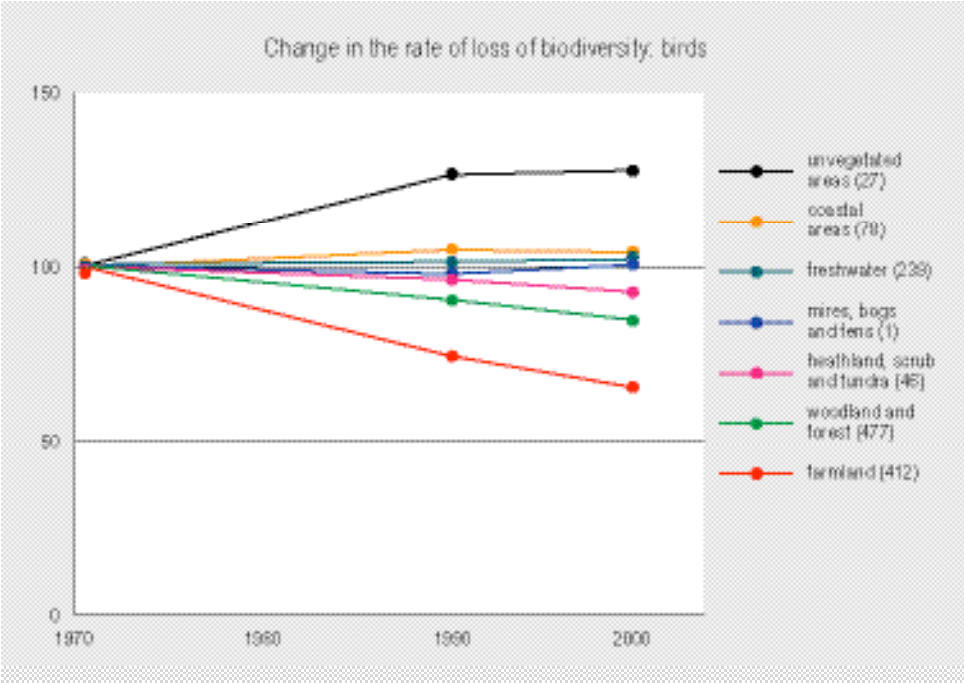

Figure6. The average percentage change in bird species population index between 1970, 1990 and 2000. Little evidence of change in the rate of decline is visible for most habitats. Number of time series for each habitat in brackets.

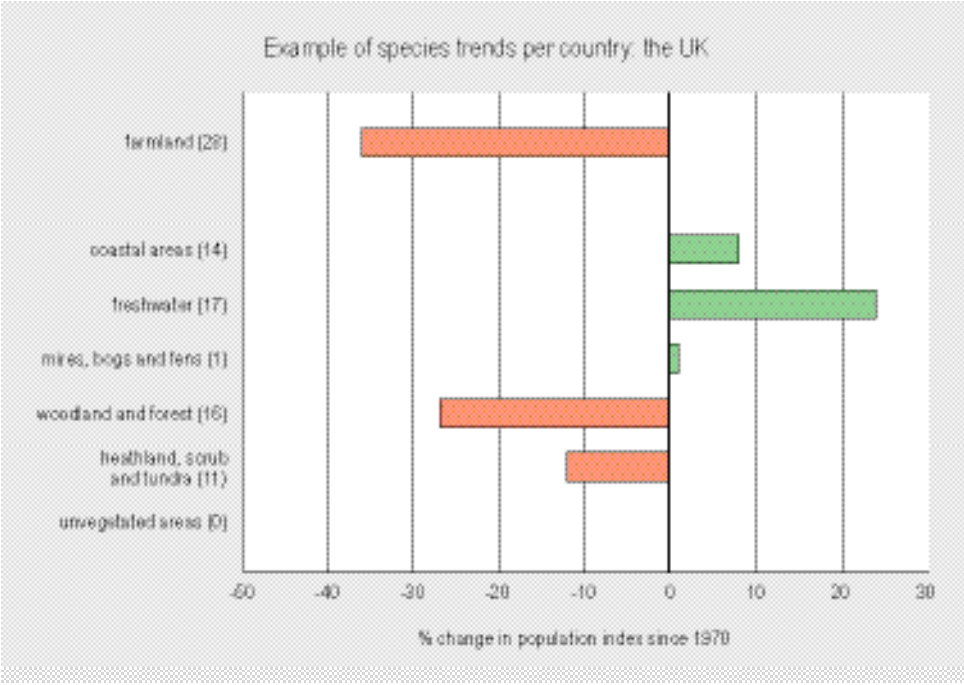

Figure7. Example of the indicator for a single country. The graph shows the percentage change in species population index per habitat, for the United Kingdom. Number of time series (in this case equal to the number of unique species) in brackets. For details on species, time series and sources for the UK indicator, see *Appendix 9*.

Given the strong decline in farmland species at Pan-European scale, it is of interest to examine the indicator in a form that may be more directly policy-relevant, for example in relation to the European Union's Common Agricultural Policy. *Figure 5* shows that farmland species have experienced much greater population declines over the past three decades in the fifteen member countries of the European Union than in the ten recently (May 2004) acceded countries or in the remaining 18 countries in Europe. The indicator can potentially be calculated for other policy-relevant clusters of countries.

This application shows one way in which the indicator can have strong policy relevance. However, in order for it to be useful in evaluating progress towards policy targets relating to rates of biodiversity loss (e.g. the 2010 target) it would be necessary to calculate average index changes over different time intervals. At a minimum, three points in time would be needed to determine whether the rates of loss of biodiversity were changing as needed. Within the scope of this project, birds were the only group for which data could be mobilised for an intermediate point in time. The addition of a 1990 data point for the birds (*Figure 6*) gives some indication of changes in the rate of species decline for some habitats, but with the data available it is difficult to say whether the changes in the rate of loss are significant.

Although this pilot project focused on testing the indicator at the European level, the indicator method has also been designed to be suitable for use on the national level, using the same types of data. For example, applying the method at national scale in the United Kingdom (*Figure 7, Appendix 8*) makes it possible to see clearly the national trends in species within particular habitats; the UK, like the rest of Europe, has experienced major declines in farmland species over the past three decades. Individual countries may find it useful to adopt this approach. Using consistent indicators at different scales can provide insights into trends that may require special attention at particular scales of policy and decision-making.

Last, policy-makers do not only need to know about the status and trends of biodiversity, but also about the causes of the indicated changes. Causes of change can best be analysed using ecological models which quantitatively relate species to pressures. At the moment on the European scale such models are available for some pressures (e.g. climate; Bakkenes et al. 2001), but models which calculate the overall impacts of all major pressures on species on this scale are still under development. Therefore, in this study we used an alternative approach to make a first, preliminary analysis of the causes of change in the indicator (*Appendix 9*). This analysis shows that causes of species decline vary per habitat, with habitat loss and land use being the most frequent factors across the habitats, followed by fragmentation and disturbance.

4. Discussion and recommendations*

In this study we have piloted a species trend indicator, which integrates trends of different species and species groups and can make use of data coming from different sources, collected with different methods. The indicator can be aggregated from its building blocks towards habitats on the European level, biogeographical regions and also towards (clusters of) countries. Thus, the indicator can deliver both headline messages for awareness raising and high-level decision making and detailed information for in-depth analysis. The method is potentially suitable for evaluating progress towards the 2010 target; the data compiled in this study make it possible to establish a first estimate of the rate of biodiversity loss in the period 1970-2000, with which subsequent estimates for later periods can be compared.

4.1 Data mobilisation

We have demonstrated that international, species-oriented NGOs, with their European-wide networks, are effective mechanisms for mobilising the substantial quantity of existing data on species trends, at least for breeding birds, butterflies and large mammals. Within the taxonomic groups and ecoregions covered in this trial, data are available for nearly all species, covering a broad range of ecological characteristics, and making it possible for the indicator to represent a broad cross-section of biodiversity in Europe. Targeted efforts are now needed to identify and mobilise historical trend data for other taxonomic groups, and for those ecoregions not included in this (pilot) study. Species groups that have not been covered in this pilot study but for which substantial amounts of data are probably available include vascular plants, freshwater and marine fish, water birds (Gilissen *et al.* 2002), and marine mammals. In addition, specific efforts are needed to obtain data from countries and regions, such as European Russia and the arctic region, which were not effectively targeted by the data mobilisation strategy of this study. Additional data from intermediate points in time (e.g. 1990) would increase the utility of the indicator for monitoring progress towards the 2010 target. International NGOs and national sources both have vital roles to play in mobilising existing data.

4.2 Habitats and biogeographical regions

The top-level of the EUNIS habitat classification, has generally proven to be a useful basis for stratifying the species trend indicator. We adopted the farmland category because it was difficult to link species data clearly to either of its component classes ('grassland' and 'cultivated area'). This category will continue to be useful for future work. Additional merging between EUNIS classes may be advisable in the future because some classes have few, if any, species strictly limited to them. This is especially the case for the class 'Mires, bogs and fens'. In addition, an improved approach is needed for handling habitat associations for those species, especially large mammals, which usually use more than one habitat.

* *Appendix 10* presents a summary of the recommendations made in this chapter

Further difficulties in aggregation arose because of the limited precision of habitat maps derived from landcover mapping, which made it difficult to obtain areas for relatively fragmented habitats and ecoregions such as mires, bogs and fens, and those which are less easily detected via remote sensing. The use of biogeographical regions, though ecologically and politically useful added to the demands on the data; working with only habitats and countries would be more straightforward and is recommended for future work.

4.3 Composition and aggregation

The degree to which the index is representative of overall biodiversity trends is obviously a function of the species composition and the way the data are aggregated. In this trial application the lack of inclusion of taxonomic groups other than mammals, birds and butterflies has implications that vary by major habitat type. For example, incorporating data on freshwater fish or amphibians would increase the validity of the indicator for inland surface water habitats. The addition of data on plants would potentially improve the representation of all habitats. Furthermore, at present the species are combined without regard to whether particular taxonomic groups are represented by greater numbers of time series than others. This could mean that a particular group dominates the indicator and leads decision-makers to draw conclusions that are more applicable to it than to other groups. A solution to this might be to adopt a staged aggregation procedure, whereby species are first averaged across their species groups (e.g. plants, invertebrates and vertebrates) and the groups are then combined with equal (or potentially other) weightings applied between the groups. However this approach is dependent on having sufficient data for each species group for each building block to produce a meaningful average. Problems of the same type are discussed by Loh *et al.* (2005).

The composition of the indicator with respect to the ecological characteristics of the species is also important. At present no quantitative criteria are applied to specify the balance among species with different characteristics, e.g. how many sedentary species versus how many migratory species and how many threatened (red list) species versus how many non-threatened species. The linking of species to habitat types may have in some cases effectively excluded habitat generalist species. Rare species are included alongside common ones and only species with widely fluctuating populations are excluded. The inclusion of data on rare species contrasts with the approach taken by others, for other purposes, for example in the UK bird indicator (Gregory *et al.* 2003a,b). Excluding data on fluctuating species is common practice. While reducing noise in the dataset, it risks failing to detect and incorporate any long-term trend in these species.

All of these factors suggest that it would be useful to devote more effort to developing further the criteria for building the set of species included in the indicator and to considering how best to combine species within the indicator. Such criteria could usefully include guidelines for the minimum number of species within a building block for which the indicator generally can be considered robust, and should also address alternative approaches for aggregation and weighting. We used area-weighted aggregation in this pilot because weighting building blocks by the proportion of the total population size within them is not feasible across all taxonomic groups. It is more rigorous than applying no weighting during aggregation from one spatial scale to another.

4.4 Reliability and sensitivity

The pilot indicator covers such a large number of species and time series over such a long period, that it is likely to be fairly robust. For the ecoregions covered by the pilot study, we do not believe that the patterns shown by the indicator would be altered significantly by the inclusion of additional species or time series from the same taxonomic groups. A statistical analysis of the reliability and sensitivity of the indicator has yet to be carried out. It should include the calculation of confidence intervals, which would best be done using bootstrapping.

The limited sensitivity of many of the data included limits the sensitivity of the indicator. Not only are many of the estimated trends relatively conservative (e.g. those derived from distribution changes), but they are provided in relatively coarse classes so that they will tend not to pick up changes less than 15%. This limitation can best be overcome by establishing monitoring programmes that will generate consistent quantitative data (see below).

The different categories of data quality have different implications for the different taxa. The exclusion of time series based on limited quantitative data without correction (data quality c) has eliminated the most uncertain data for butterflies, and also significantly reduced the quantity of carnivore data that could be included. It had little effect on the bird or herbivore data included. For these taxa, expert judgement contributed a significant proportion of the time series data, and the implications of this may need to be explored further.

4.5 Relation between the indicator and biodiversity loss

The basic assumption behind this indicator is that, in addition to telling the user something about the trends in the component species, it represents wider trends in biodiversity. These are of interest in the context of policy and decision-making that affect progress towards the 2010 target on biodiversity loss.

Biodiversity loss is characterised by the decrease in abundance of many species and the increase of some – often opportunistic – species, as a result of the environmental impacts of human activities (McKinney & Lockwood 1999; UNEP 2003a, 2003b). In this pilot indicator, increases in species populations since 1970 contribute to higher values of the indicator; and decreases to lower values. However, this simplistic approach raises two issues:

1. An increase in population of a species since 1970 cannot always be considered a biodiversity gain, and a decrease cannot always be considered a loss. This can even be the case for species that are considered characteristic of a certain habitat. Examples include the increase of freshwater birds due to eutrophication of their habitat, the increase of Molinia sp. due to eutrophication of heathlands and the increase of many bird species in marshes and dune areas which have become overgrown by shrubs due to nutrient enrichment. Thus, with the approach used, the message of the indicator is potentially ambiguous, which conflicts with the requirement of being meaningful and simple to understand.
2. Biodiversity changes before 1970 (often large losses) are not addressed by the indicator. Changes since 1970 might be very small in comparison to these losses (see also Hutchings & Baum 2005; Pauly *et al*. 2005), and may differ significantly among countries and habitats. Therefore, change relative to the year 1970 provides incomplete information that will not necessarily be appropriately interpreted by policymakers and the public.

Modelling species abundance under reference (e.g. low human impact) conditions could be used to help resolve ambiguity in the indicator and put recent changes into meaningful context. Building such a scenario would require information on historical and geographical trends and qualitative and quantitative ecological knowledge.

4.6 Potential for use at the national scale

As demonstrated using the United Kingdom as an example, the indicator method and the European database can potentially be used to calculate species trend indicators for individual countries. These may complement biodiversity data and indicators already in use at national level, which in turn could also contribute to European scale indicators. For example, in the UK several species (trend) indicators in use include: the UK headline indicator for wild bird populations (Gregory *et al.* 2003a); trends for butterflies (Asher *et al.* 2001); and trends for plants (Preston *et al.* 2003). Also, trend indicators are available on Biodiversity Action Plan (BAP) priority species. However, there is no indicator in use that combines the trends across species groups. Additional differences in approach, for example regarding habitat classification, species selection criteria (selecting all species vs. focusing on habitat-specialists) and different sources for species-habitat associations mean that no direct comparison of indicator results can be made. In some cases different data sources were used; in those cases usually the European project had access to less precise data. Working towards further harmonisation of indicator methodologies and exchange of data, would enhance the synergy between national and European work on indicators.

4.7 Thematic indicators

A further application of this indicator method and the data available is to generate trend indicators for different subsets of species that address particular issues. Such subsets can for example be based on taxonomy, policies, ecological characteristics, or related to particular pressures. Examples are:

- species of the Habitats and Birds Directives
- Red List species or Species of European Conservation Concern (SPEC)
- species for which species action plans are in place, e.g. large carnivores
- species which are hunted or otherwise exploited
- species with particular ecological characteristics, such as water birds with feeding strategies that might be related to their reaction to eutrophication of freshwaters, or sedentary versus migratory species.
- butterflies with northern distribution versus butterflies with a southern distribution, to explore a potential relation with climate change.

The analysis of the population trends of subsets of species, and comparison with the overall-trends or trends in contrasting groups, will have a value on its own for assessments and conservation planning, and will also help to obtain a better understanding of the overall-indicator and the causes of change.

4.8 Towards a European biodiversity monitoring framework

With the current level of ad hoc and structural data collection in Europe we estimate that it will be possible to update this indicator meaningfully and reliably only after approximately another 3 decades. This is due to the lack of sensitive and frequent data on species trends. To allow more frequent and reliable updating of the indicator, implementation of long-term monitoring will be needed under a common European biodiversity monitoring framework. Such a framework would provide guidelines and manuals to help countries implement national monitoring schemes that meet their own national needs. The only requirement would be that the design of the monitoring schemes would be such that the results (indices, not raw data) could feed into the European picture. The Pan-European Common Birds Monitoring Scheme (PECBMS) is a good example of such an approach (Gregory *et al.* 2005). The guidelines should for example consider stratification, suitable measuring methods, selection of species and dimensions of monitoring schemes (number of plots and frequency of recording).

The monitoring schemes should be built as far as possible on existing initiatives. They should preferably use direct measures of changes in population size rather than less sensitive proxies, such as changes in distribution area. Furthermore, the number of plots and frequency of measuring (dimensions of the scheme) should be high enough to allow the production of sensitive indices of change. The final decisions on the dimensions of monitoring programmes will of course be based on the balance between costs and benefits at both national and European scales. International, species-oriented NGOs, with their networks of experts and organisations in all European countries, can potentially play a unique and essential role in the design and implementation of European biodiversity monitoring.

Appendix 11 presents a summary of recommendations for the development of monitoring programmes per species groups, based on recommendations of the NGOs.

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Appendix 1 EUNIS habitat types

Descriptions are derived from Davies & Moss (2002)
An extensive description, including keys, of these and of the habitat types lower in the hierarchy, can be found on http://eunis.eea.eu.int/habitats.jsp

A Marine habitats

Marine habitats are directly connected to the oceans,i.e.part of the continuous body of water which covers the greater part of the earth 's surface and which surround its land masses. Marine waters may be fully saline,brackish or almost fresh. Marine habitats include those below spring high tide limit (or below mean water level in non-tidal waters)and enclosed coastal saline or brackish waters, without a permanent surface connection to the sea but either with intermittent surface or sub-surface connections (as in lagoons). Rockpools in the supralittoral zone are considered as enclaves of the marine zone. Includes marine littoral habitats which are subject to wet and dry periods on a tidal cycle including tidal saltmarshes;marine littoral habitats which are normally water-covered but intermittently exposed due to the action of wind or atmospheric pressure changes; freshly deposited marine strandlines characterised by marine invertebrates. Waterlogged littoral zones above the mean water level in non-tidal waters or above the spring high tide limit in tidal waters are included with marine habitats.Includes constructed marine saline habitats below water level as defined above (such as in marinas,harbours,etc)which support a semi-natural community of both plants and animals. The marine water column includes bodies of ice.

B Coastal habitats

Coastal habitats are those above spring high tide limit (or above mean water level in non-tidal waters) occupying coastal features and characterised by their proximity to the sea, including coastal dunes and wooded coastal dunes,beaches and cliffs. Includes free-draining supralittoral habitats adjacent to marine habitats which are normally only affected by spray or splash, strandlines characterised by terrestrial invertebrates and moist and wet coastal dune slacks. Excludes dune slack pools and rockpools.

C Inland surface water habitats

Inland surface water habitats are non-coastal above-ground open fresh or brackish water-bodies (e.g. rivers,streams,lakes and pools,springs), including their littoral zones. Also includes dune slack pools. Includes constructed inland freshwater, brackish or saline waterbodies (such as canals, ponds,etc)which support a semi-natural community of both plants and animals; normally wet habitats which may be dry seasonally (temporary or intermittent rivers and lakes and their littoral zones). Freshwater littoral zones include those parts of banks or shores which are sufficiently frequently inundated to prevent the formation of closed terrestrial vegetation. Excludes permanent snow and ice. Note that habitats which intimately combine waterlogged habitats with pools of open water are considered as complexes.

D Mire, bog and fen habitats

Habitats which are saturated, with the water table at or above ground level for at least half of the year, dominated by herbaceous or ericoïd vegetation e.g. bogs, marshes. Includes waterlogged habitats where the groundwater is frozen. Excludes waterlogged habitats dominated by trees or large shrubs.

Note that habitats which intimately combine waterlogged habitats with pools of open water are considered as complexes.

E Grassland and tall forb habitats

Non-coastal habitats which are dry or only seasonally wet (with the water table at or above ground level for less than half of the year) with greater than 30% vegetation cover. The dominant vegetation is grasses and other non-woody vegetation (including moss-, lichen-, fern- and sedge-dominated communities). Includes sparsely wooded grassland areas with canopy cover of 5 - 10%. Includes successional weedy communities and managed grasslands such as recreation fields and lawns. Does not include regularly tilled habitats dominated by cultivated herbaceous vegetation such as arable fields. Includes agricultural grasslands (Moss, pers comm).

F Heathland,scrub and tundra habitats

Non-coastal habitats which are dry or only seasonally wet (with the water table at or above ground level for less than half of the year) with greater than 30% vegetation cover. The dominant vegetation is shrubs or dwarf shrubs. Includes regularly tilled shrub orchards, hedges (which may have occasional tall trees) and habitats characterised by the presence of permafrost. Also includes dwarf trees and scrub (under 50cm, such as occur in extreme alpine conditions).

G Woodland and forest habitats and other wooded land

Habitats where the dominant vegetation is, or was until very recently, trees,typically single-stemmed, and with a canopy cover of at least 10%. Includes lines of trees, coppices,and very recently clear-felled areas with pre-existing ground cover, not yet re-stocked and with no succession to weedy vegetation. Trees are normally able to reach a height of 5m at maturity but this height may be lower at high latitudes or altitudes. Tall shrubs such as hazel (Corylus) and some willows (Salix) with a woodland-type structure are treated as woodland. Includes regularly tilled tree nurseries and tree-crop plantations. Excludes dwarf trees and scrub (under 50cm) such as occur in extreme alpine conditions and sparsely wooded grassland areas with canopy cover 5 -10%, including parkland.

H Inland unvegetated and sparsely vegetated habitats

Non-coastal habitats with less than 30% vegetation cover (other than where the vegetation is chasmophytic or on scree and or cliff) which are dry or only seasonally wet (with the water table at or above ground level for less than half of the year). Subterranean non-marine caves and passages including underground waters. Habitats characterised by the presence of permanent snow and surface ice other than marine ice bodies.

I Regularly or recently cultivated agricultural, horticultural and domestic habitats

Habitats maintained solely by frequent tilling or arising from recent abandonment of previously tilled ground such as arable land and gardens. Includes tilled ground subject to inundation. Excludes shrub orchards,tree nurseries and tree-crop plantations.

J Constructed,industrial and other artificial habitats

Primarily human settlements, buildings, industrial developments, the transport network, waste dump sites. Includes highly artificial saline and non-saline waters with wholly constructed beds or heavily contaminated water (such as industrial lagoons and saltworks) which are virtually devoid of plant and animal life.

Appendix 2 Species-oriented NGOs

BirdLife International is a global partnership of non-governmental organisations (NGOs) with a special focus on conservation and birds. The regional office in The Netherlands coordinates the European activities. In 1994 BirdLife International published 'Birds in Europe: Their Conservation Status', which was the first European assessment of bird conservation priorities. Bird population data from almost all European countries were assessed. The analysis has been one of the main foundations of bird conservation work in Europe. In 2004 the Birds in Europe II Project will fully update this prioritisation excercise. The analysis will be fed into two main global conservation assessments: (1) the 2004 IUCN Red List of Threatened Animals; and (2) the 2004 State of the World's Birds. The project is conducted in partnership with the European Bird Census Council (EBCC).

The European Bird Census Council (EBCC) is an indepent NGO with the aim of providing scientifically sound information on the status and trends of Europe's birds. In 1997 the EBCC published the European atlas of breeding birds (Hagemeijer & Blair 1997). Furthermore, the EBCC coordinates the Pan-European Common Bird Monitoring Scheme (PECBMS). Currently 18 countries participate in this scheme, and the number is still growing. Indicators based on data from the PECBMS, notably the European farmland birds indicator, are frequently used to inform European policy-makers on the trends in European birds.

Wetlands International (WI) is a global non-profit organisation working on wetland conservation and sustainable management. One of the strategic areas of work is 'Wetland inventory, monitoring and assessment'. With its headquarters in The Netherlands, activities are carried out in over 120 countries. Wetlands International maintains a network of experts (organised in Specialist Groups) and close partnerships with key organisations. Since 1967 WI runs the International Waterbirds Census, which started in Europe and is still developing to become a global monitoring scheme. Most of the observers are volunteers (11,000 individuals in the Western Palearctic census), with professional coordination at the national level.

Dutch Butterfly Conservation was founded in 1983, with conservation and restoration of the Dutch butterfly fauna as its chief aims. Since then, it has extended those aims to include dragonflies and day-flying moths. Monitoring activities became a very important way of raising awareness about the decline of the species groups. Furthermore, the area of activity has grown over the border, where Butterfly Conservation now works with sister organisations in Europe. A large network of national butterfly experts in all European countries has been built. As a first result of this cooperation the Red Data Book of European Butterflies was produced, together with British Butterfly Conservation. As a follow-up to this report the book Prime Butterfly Areas in Europe was published in 2003. In course of 2004 Dutch Butterfly Conservation, together with British Butterfly Conservation, will found a new organisation called Butterfly Conservation Europe.

In June 1995, WWF together with partner organisations and experts in 17 European countries, launched the **Large Carnivore Initiative for Europe (LCIE)**. The LCIE is an integral part of WWF's European Programme but it is independent and open to all interested parties. To date more than 100 individuals have joined from ca. 30 countries, including representatives from governments, the Bern Convention, international and national NGOs, together with scientists, land managers and other experts. The LCIE has identified four main areas of work to support large carnivore conservation:

- Protection of large carnivore populations and habitats
- Integration of large carnivores with local development

- Conservation of large carnivores through legislation, policies and economic instruments
- Public acceptance for the existence of large carnivores in Europe

Pan European Action plans have been developed and approved for the five large carnivore species. Through their activities LCIE researchers have collected and access to a large amount of data on the status and trends in the populations of their focal species.

The Large Herbivore Foundation (LHF) is an independent network organisation with the objective of conservation and restoration of large herbivore communities in the Eurasian nature. In the four years the initiative is operational, a network has been created of over 150 experts and interested parties from over 30 nationalities, including governments, NGOs, universities and research institutes. The LHF program involves over 45 species of large herbivores. Some 30 projects are addressed throughout Europe, Russia, Mongolia and Central Asia. Information on the distribution and status of the large herbivore species is considered a basis to meet LHF's objectives. A species database has been compiled with information on current and former distribution area, international conservation status, the total population size and the population trend (Cromsigt 2000).

Planta Europa is a network of Non Government and Government organisations in Europe, working to achieve the mission of conserving the wild plants, both higher and lower, of Europe and their habitats. The implementation of the Planta Europa programme and the coordination of its activities is executed by Plantlife International, a Non Government organisational legal entity in the UK. Planta Europa and the Council of Europe developed the European Plant Conservation Strategy (EPCS), a contribution to and part of the Global Strategy for Plant Conservation, to provide a framework for wild plant conservation in Europe. The strategy contains two targets which are relevant to monitoring and indicators:

- Manual of tried and tested (species and habitat) monitoring protocols for scientists and naturalists made available on the web (target 1.3)
- National programmes to identify and monitor non red-listed rapidly declining species promoted in 15 European countries (target 2.1)

Many of the Planta Europa members are involved in mapping and monitoring of the flora in their country.

Appendix 3 Remap tables land cover – ecosystems

Table a. Remap table CORINE Land Cover classification to EUNIS habitat classification

CORINE Code 1	CORINE Code 2	CORINE Label	EUNIS code	EUNIS label
1	1.1.1	Continuous urban fabric	J	Constructed, industrial and other artificial habitats
2	1.1.2	Discontinuous urban fabric	J	Constructed, industrial and other artificial habitats
3	1.2.1	Industrial or commercial units	J	Constructed, industrial and other artificial habitats
4	1.2.2	Road and rail networks and associated land	J	Constructed, industrial and other artificial habitats
5	1.2.3	Port areas	J	Constructed, industrial and other artificial habitats
6	1.2.4	Airports	J	Constructed, industrial and other artificial habitats
7	1.3.1	Mineral extraction sites	J	Constructed, industrial and other artificial habitats
8	1.3.2	Dump sites	J	Constructed, industrial and other artificial habitats
9	1.3.3	Construction sites	J	Constructed, industrial and other artificial habitats
10	1.4.1	Green urban areas	I	Regularly or recently cultivated agricultural, horticultural and domestic habitats
11	1.4.2	Sport and leisure facilities	IJ	CLC-class shared by I and J
12	2.1.1	Non-irrigated arable land	I	Regularly or recently cultivated agricultural, horticultural and domestic habitats
13	2.1.2	Permanently irrigated land	I	Regularly or recently cultivated agricultural, horticultural and domestic habitats
14	2.1.3	Rice fields	I	Regularly or recently cultivated agricultural, horticultural and domestic habitats
15	2.2.1	Vineyards	F	Heathland, scrub and tundra habitats
16	2.2.2	Fruit trees and berry plantations	G	Woodland and forest habitats and other wooded land
17	2.2.3	Olive groves	G	Woodland and forest habitats and other wooded land
18	2.3.1	Pastures	E	Grassland and tall forb habitats
19	2.4.1	Annual crops associated with permanent crops	I	Regularly or recently cultivated agricultural, horticultural and domestic habitats
20	2.4.2	Complex cultivation patterns	I	Regularly or recently cultivated agricultural, horticultural and domestic habitats
21	2.4.3	Land principally occupied by agriculture, with significant areas of natural vegetation	I	Regularly or recently cultivated agricultural, horticultural and domestic habitats
22	2.4.4	Agro-forestry areas	E	Grassland and tall forb habitats
23	3.3.1	Broad-leaved forest	G	Woodland and forest habitats and other wooded land
24	3.1.2	Coniferous forest	G	Woodland and forest habitats and other wooded land
25	3.1.3	Mixed forest	G	Woodland and forest habitats and other wooded land
26	3.2.1	Natural grassland	E	Grassland and tall forb habitats
27	3.2.2	Moors and heathland	F	Heathland, scrub and tundra habitats
28	3.2.3	Sclerophyllous vegetation	F	Heathland, scrub and tundra habitats
29	3.2.4	Transitional woodland/shrub	G	Woodland and forest habitats and other wooded land
30	3.3.1	Beaches, dunes and sand plains	B	Coastal habitats
31	3.3.2	Bare rock	H	Inland unvegetated and sparsely vegetated habitats
32	3.3.3	Sparsely vegetated areas	E	Grassland and tall forb habitats
33	3.3.4	Burnt areas	H	Inland unvegetated and sparsely vegetated habitats
34	3.3.5	Glaciers and perpetual snow	H	Inland unvegetated and sparsely vegetated habitats
35	4.1.1	Inland marshes	D	Mire, bog and fen habitats
36	4.1.2	Peatbogs	D	Mire, bog and fen habitats
37	4.2.1	Salt marshes	A	Marine habitats
38	4.2.2	Salines	A	Marine habitats
39	4.2.3	Intertidal flats	A	Marine habitats

Table a. Remap table CORINE Land Cover classification to EUNIS habitat classification

CORINE Code 1	CORINE Code 2	CORINE Label	EUNIS code	EUNIS label
40	5.1.1	Watercourses	C	Inland surface water habitats
41	5.1.2	Water bodies	C	Inland surface water habitats
42	5.2.1	Coastal lagoons	B	Coastal habitats
43	5.2.2	Estuaries	B	Coastal habitats
44	5.2.3	Sea and ocean	A	Marine habitats

Table b. Remap table Global Land Cover 2000 classification to EUNIS habitat classification

GLC code	GLC label	EUNIS code	EUNIS label	Comments
1	Tree cover, broadleaved, evergreen	G	Woodland and forest habitats and other wooded land	
2	Tree cover, broadleaved, deciduous, closed	G	Woodland and forest habitats and other wooded land	
3	Tree cover, broadleaved, deciduous, open	G	Woodland and forest habitats and other wooded land	
4	Tree cover, needle-leaved, evergreen	G	Woodland and forest habitats and other wooded land	
5	Tree cover, needle-leaved, deciduous	G	Woodland and forest habitats and other wooded land	
6	Tree cover, mixed leaf type	G	Woodland and forest habitats and other wooded land	
7	Tree cover, regularly flooded, fresh water (& brackish)	G	Woodland and forest habitats and other wooded land	
8	Tree cover, regularly flooded, saline water (daily variation of water level)	B	Coastal habitats	rare in Europe
9	Mosaic1: Tree cover/Other natural vegetation	G	Woodland and forest habitats and other wooded land	rare in Europe
10	Tree cover, burnt	H	Inland unvegetated and sparsely vegetated habitats	EUNIS sub-class H5.5
11	Shrub cover, closed-open, evergreen	F	Heathland, scrub & tundra habitats	
12	Shrub cover, closed-open, deciduous	F	Heathland, scrub & tundra habitats	
13	Herbaceous cover, closed-open	E	Grassland and tall forb habitats	
14	Sparse herbaceous or sparse shrub cover	H	Inland unvegetated and sparsely vegetated habitats	in GLC definition of 'sparse' is < 20% cover
15	Regularly flooded shrub and/or herbaceous cover	D	Mire, bog and fen habitats	small mistake to be accepted: vineyards = F orchards = G plantations = G
16	Cultivated and managed areas	I	Regularly or recently cultivated, agricultural, horticultural and domestic habitats	
17	Mosaic[1]: cropland/tree cover/ other natural vegetation	I	Regularly or recently cultivated, agricultural, horticultural and domestic habitats	
18	Mosaic[1]: cropland/shrub or grass cover	I	Regularly or recently cultivated, agricultural, horticultural and domestic habitats	
19	Bare areas	H	Inland unvegetated and sparsely vegetated habitats	
20	Water bodies (natural and artificial)	C	Inland surface water habitats	this GLC class relates to inland water
21	Snow and ice (natural and artificial)	H	Inland unvegetated and sparsely vegetated habitats	
22	Artificial surfaces and associated areas	J	Constructed, industrial and other artificial habitats	

[1] In the mosaics the first class is dominant, covering some 70-80%

Appendix 4 Calculation and aggregation example

An example is provided of how the indicator is calculated per building block and then can be aggregated towards a single value for Europe. Data are real data, as used in the project. The coloured circles in the tables indicate how the figures are carried forward from step to step.

Step 1 Calculation of the indicator for Atlantic Forests in the United Kingdom

Species	Group	Index 1970	Index 2000
Certhia familiaris	birds	100	100
Dendrocopos minor	birds	100	49
Parus cristatus	birds	100	100
Parus palustris	birds	100	50
Pernis apivorus	birds	100	168
Phoenicurus phoenicurus	birds	100	161
Phylloscopus sibilatrix	birds	100	39
Regulus ignicapillus	birds	100	89
Sitta europaea	birds	100	174
Tetrao urogallus	birds	100	25
Argynnis paphia	butterflies	100	51
Boloria euphrosyne	butterflies	100	2
Gonepteryx rhamni	butterflies	100	115
Limenitis camilla	butterflies	100	24
Pararge aegeria	butterflies	100	315
Polygonia c-album	butterflies	100	326
Index (geometric mean of {indices +1})		100	73

Step 2 Calculation of the indicator for Atlantic Forests in Europe

Country	Area (km^2)	Nr. of time series	Index 1970	Index 2000
Belgium	1655	20	100	45
Denmark	1293	3	100	68
United Kingdom	18184	16	100	73
France	49710	16	100	82
Netherlands	3103	19	100	90
Germany	9447	10	100	93
Spain	21199	8	100	96
Republic of Ireland	4189	1	100	101
Norway	22751	5	100	107
Index (area-weighted mean)			100	88

Step 3 Calculation of the indicator for Forests in Europe

Biogeographical region	Area (km^2)	Nr. of time series	Index 1970	Index 2000
Alpine	325725	170	100	108
Atlantic	131533	98	100	88
Boreal	668825	148	100	110
Continental	490081	280	100	92
Mediterranean	294340	65	100	82
Index (area-weighted mean)			100	99

Step 4 Calculation of the indicator for Europe

Habitat	Area (km^2)	Nr. of time series	Index 1970	Index 2000
unvegetated habitats	158801	61	100	95
heathland, scrub and tundra	202430	94	100	97
woodland and forest	1910504	761	100	99
mires, bogs and fens	4370	8	100	96
freshwater habitats	21863	251	100	100
coastal habitats	3698	135	100	101
Index natural habitats (non-weighted mean)			100	98
Index farmland			100	77

Appendix 5 Species sets

Bird species in brackets: these species can be linked to an ecoregion, but in none of the countries with the ecoregion trend data were available and therefore these species are not included in the indicator calculations.

Coastal habitats
Atlantic region

butterflies:
Thymelicus lineola
Pyrgus malvae
Polyommatus icarus
Lasiommata megera
Issoria lathonia
Hipparchia semele
Cupido minimus
Coenonympha pamphilus
Aricia agestis
Argynnis niobe

birds:
Anthus petrosus
Cepphus grylle
Charadrius alexandrinus
Fratercula arctica
Puffinus puffinus
Somateria mollissima
Sterna albifrons
Sterna dougallii
Sterna paradisaea
Sterna sandvicensis
Alca torda
Fulmarus glacialis
Hydrobates pelagicus
Morus bassanus
Phalacrocorax aristotelis
Rissa tridactyla
Uria aalge

Coastal habitats
Mediterranean region

butterflies:
Vanessa atalanta
Pontia daplidice complex
Papilio machaon
Gegenes pumilio
Gegenes nostrodamus
Colias croceus
Carcharodus stauderi
Carcharodus alceae

birds:
Calonectris diomedea
Falco eleonorae
Larus audouinii
Larus melanocephalus
Puffinus mauretanicus
Puffinus yelkouan
Hydrobates pelagicus
Phalacrocorax aristotelis

Farmland
Alpine region

butterflies:
Polyommatus icarus
Polyommatus eros
Plebeius orbitulus
Plebeius glandon
Melitæa varia
Maculinea arion
Erebia medusa
Colias phicomone
Coenonympha gardetta
Boloria titania
Boloria pales
Boloria napaea
Vanessa atalanta
Pieris rapae
Pieris brassicae
Papilio machaon
Issoria lathonia
Inachis io
Colias hyale
Aglais urticae

birds:
Anthus spinoletta
Pyrrhocorax graculus
Saxicola rubetra
Alauda arvensis
Emberiza citrinella
Passer montanus
Perdix perdix
(Coturnix coturnix)
(Vanellus vanellus)

Farmland
Alpine region

butterflies:
Polyommatus icarus
Polyommatus eros
Plebeius orbitulus
Plebeius glandon
Melitaea varia
Maculinea arion
Erebia medusa
Colias phicomone
Coenonympha gardetta
Boloria titania
Boloria pales
Boloria napaea
Vanessa atalanta
Pieris rapae
Pieris brassicae
Papilio machaon
Issoria lathonia
Inachis io
Colias hyale
Aglais urticae

birds:
Anthus spinoletta
Pyrrhocorax graculus
Saxicola rubetra
Alauda arvensis
Emberiza citrinella
Passer montanus
Perdix perdix
(Coturnix coturnix)
(Vanellus vanellus)

Farmland
Atlantic region

butterflies:
Aglais urticae
Anthocharis cardamines
Boloria selene
Celastrina argiolus
Erynnis tages
Euphydryas aurinia
Inachis io
Lasiommata megera
Maniola jurtina
Melanargia galathea
Melitaea cinxia
Papilio machaon
Pieris brassicae
Pieris rapae
Polygonia c-album
Polyommatus icarus
Thymelicus lineola
Vanessa atalanta

birds:
Alauda arvensis
Alectoris rufa
Athene noctua
Coturnix coturnix
Crex crex
Emberiza cirlus
Emberiza citrinella
Gallinago gallinago
Limosa limosa
Miliaria calandra
Motacilla flava
Passer montanus
Perdix perdix
Philomachus pugnax
Pyrrhocorax pyrrhocorax
Saxicola rubetra
Vanellus vanellus
(Tetrax tetrax)

Farmland
Boreal region

butterflies:
Aglais urticae
Inachis io
Lycaena phlaeas
Papilio machaon
Pieris brassicae
Pieris rapae
Vanessa atalanta

birds:
Alauda arvensis
Coturnix coturnix
Emberiza citrinella
Motacilla flava
Passer montanus
Perdix perdix
Vanellus vanellus

Farmland
Continental region

butterflies:
Aphantopus hyperantus
Carcharodus alceae
Coenonympha pamphilus
Colias alfacariensis
Colias hyale
Colias myrmidone
Euphydryas aurinia
Issoria lathonia
Lycaena hippothoe
Maculinea teleius
Maniola jurtina
Melanargia galathea
Minois dryas
Papilio machaon
Pieris brassicae
Pieris rapae
Polyommatus icarus
Polyommatus semiargus
Pontia daplidice complex
Thymelicus acteon
Vanessa atalanta

birds:
Alauda arvensis
Athene noctua
Coturnix coturnix
Crex crex
Emberiza citrinella
Emberiza hortulana
Gallinago gallinago
Limosa limosa
Miliaria calandra
Motacilla flava
Otis tarda
Passer montanus
Perdix perdix
Philomachus pugnax
Saxicola rubetra
Vanellus vanellus

Farmland
Mediterranean region

butterflies:
Arethusana arethusa
Cacyreus marshalli
Carcharodus alceae
Chazara briseis
Coenonympha pamphilus
Colias croceus
Glaucopsyche alexis
Leptotes pirithous
Maculinea arion
Melanargia occitanica
Papilio machaon
Pieris brassicae
Polyommatus icarus
Polyommatus thersites
Pyronia tithonus
Thymelicus acteon
Vanessa atalanta
Zerynthia polyxena
Zerynthia rumina
Zizeeria knysna

birds:
Alauda arvensis
Alectoris rufa
Athene noctua
Circus pygargus
Coracias garrulus
Coturnix coturnix
Emberiza hortulana
Falco naumanni
Melanocorypha calandra
Miliaria calandra
Motacilla flava
Otis tarda
Passer hispaniolensis
Passer montanus
Pterocles alchata
Pterocles orientalis
Tetrax tetrax
Vanellus vanellus

Farmland
Pannonian region

butterflies:
Carcharodus alceae
Colias hyale
Issoria lathonia
Papilio machaon
Pieris brassicae
Pieris rapae
Pontia daplidice complex
Vanessa atalanta

birds:
Circus pygargus
Alauda arvensis
Athene noctua
Coracias garrulus
Coturnix coturnix
Emberiza citrinella
Miliaria calandra
Motacilla flava
Otis tarda
Passer montanus
Perdix perdix
Vanellus vanellus

Farmland
Steppic region

birds:
Coracias garrulus
Melanocorypha calandra
Miliaria calandra
Otis tarda
Tetrax tetrax
(Alauda arvensis)
(Athene noctua)
(Circus pygargus)
(Coturnix coturnix)
(Motacilla flava)
(Passer montanus)
(Perdix perdix)
(Vanellus vanellus)

Inland surface water habitats
Atlantic region

birds:
Acrocephalus arundinaceus
Acrocephalus scirpaceus
Alcedo atthis
Anas crecca
Anas strepera
Ardea purpurea
Aythya ferina
Aythya fuligula
Botaurus stellaris
Cinclus cinclus
Fulica atra
Gallinula chloropus
Mergus merganser
Motacilla cinerea
Netta rufina
Pandion haliaetus
Podiceps cristatus
Podiceps nigricollis
Tachybaptus ruficollis
Tringa hypoleucos

Inland surface water habitats
Continental region

birds:
Acrocephalus arundinaceus
Acrocephalus scirpaceus
Alcedo atthis
Anas crecca
Anas strepera
Ardea purpurea
Aythya ferina
Aythya fuligula
Aythya nyroca
Botaurus stellaris
Cinclus cinclus
Fulica atra
Gallinula chloropus
Mergus merganser
Netta rufina
Pandion haliaetus
Podiceps cristatus
Podiceps grisegena
Podiceps nigricollis
Tachybaptus ruficollis
Tringa hypoleucos
(Motacilla cinerea)

Heathland, scrub and tundra habitats
Arctic region

birds:
Anser brachyrhynchus
Anser fabalis
Branta bernicla
Buteo lagopus
Calcarius lapponicus
Calidris alpina
Calidris maritima
Calidris minuta
Falco columbarius
Lagopus mutus
Pluvialis apricaria
Pluvialis squatarola
(Lagopus lagopus)

Heathland, scrub and tundra habitats
Atlantic region

butterflies:
Callophrys rubi
Coenonympha pamphilus
Hesperia comma
Hipparchia semele
Lycaena phlaeas
Maculinea alcon
Plebeius argus

birds:
Caprimulgus europaeus
Carduelis flavirostris
Circus cyaneus
Eudromias morinellus
Falco columbarius
Lagopus lagopus
Lullula arborea
Sylvia undata
Tetrao tetrix
Turdus torquatus

Heathland, scrub and tundra habitats
Mediterranean region

butterflies:
Anthocharis damone
Euphydryas aurinia
Glaucopsyche melanops
Hipparchia fidia
Lycaena ottomanus
Papilio alexanor
Pyronia bathseba
Satyrium esculi
Zerynthia rumina

birds:
Buteo rufinus
Emberiza cineracea
Sylvia cantillans
Sylvia conspicillata
Sylvia melanothorax
Sylvia rueppelli
Sylvia sarda
Sylvia undata

Mire, bog and fen habitats Atlantic region

butterflies:
Boloria aquilonaris
Callophrys rubi
Coenonympha tullia
Lycaena dispar
Plebeius optilete

birds:
Anas penelope

Inland unvegetated or sparsely vegetated habitats Alpine region

butterflies:
Erebia calcaria
Erebia christi
Erebia meolans
Erebia pluto
Lasiommata petropolitana
Oeneis glacialis
Parnassius apollo

mammals:
Capra ibex
Rupicapra rupicapra

birds:
Falco rusticolus
Gypaetus barbatus
Montifringilla nivalis
Pagophila eburnea
Phoenicurus erythrogaster
Plectrophenax nivalis

Inland unvegetated or sparsely vegetated habitats Arctic region

birds:
Prunella collaris
Tetraogallus caucasicus
Tichodroma muraria

Woodland & forest habitat and other wooded land Alpine region

butterflies:
Argynnis paphia
Boloria euphrosyne
Boloria thore
Erebia aethiops
Erebia ligea
Euphydryas intermedia
Limenitis camilla
Pararge aegeria

mammals:
Alces alces
Bison bonasus
Canis lupus
Gulo gulo
Lynx lynx
Rangifer tarandus
Ursus arctos

birds:
Bonasa bonasia
Certhia familiaris
Dendrocopos leucotos
Dendrocopos minor
Dryocopus martius
Nucifraga caryocatactes
Parus cristatus
Parus montanus
Parus palustris
Pernis apivorus
Phoenicurus phoenicurus
Phylloscopus sibilatrix
Picoides tridactylus
Regulus ignicapillus
Sitta europaea
Tetrao urogallus

Woodland & forest habitat and other wooded land Atlantic region

butterflies:
Apatura iris
Argynnis adippe
Argynnis paphia
Boloria euphrosyne
Carterocephalus palaemon
Gonepteryx rhamni
Limenitis camilla
Melitaea athalia
Neozephyrus quercus
Pararge aegeria
Polygonia c-album

mammals:
Cervus elaphus

birds:
Certhia familiaris
Dendrocopos minor
Dryocopus martius
Parus cristatus
Parus palustris
Pernis apivorus
Phoenicurus phoenicurus
Phylloscopus sibilatrix
Regulus ignicapillus
Sitta europaea
Tetrao urogallus

Woodland & forest habitat and other wooded land Boreal region

butterflies:
Carterocephalus silvicola
Erebia ligea
Euphydryas maturna
Gonepteryx rhamni
Leptidea sinapis complex
Limenitis populi
Lopinga achine
Melitæa athalia
Nymphalis antiopa
Pararge aegeria

mammals:
Alces alces
Canis lupus
Cervus elaphus
Lynx lynx
Rangifer tarandus
Ursus arctos

birds:
Bombycilla garrulus
Bonasa bonasia
Certhia familiaris
Dendrocopos leucotos
Dendrocopos minor
Dryocopus martius
Ficedula hypoleuca
Ficedula parva
Nucifraga caryocatactes
Parus cinctus
Parus cristatus
Parus palustris
Perisoreus infaustus
Pernis apivorus
Phoenicurus phoenicurus
Phylloscopus sibilatrix
Picoides tridactylus
Picus canus
Sitta europaea
Tetrao urogallus

Woodland & forest habitat and other wooded land Continental region

butterflies:
Apatura ilia
Apatura iris
Araschnia levana
Argynnis paphia
Carterocephalus palaemon
Coenonympha hero
Erebia ligea
Euphydryas maturna
Limenitis camilla
Lopinga achine
Melitaea diamina
Neptis rivularis
Satyrium ilicis

mammals:
Alces alces
Bison bonasus
Cervus elaphus
Dama dama

birds:
Certhia brachydactyla
Certhia familiaris
Dendrocopos leucotos
Dendrocopos medius
Dendrocopos minor
Dryocopus martius
Ficedula albicollis
Ficedula hypoleuca
Ficedula parva
Nucifraga caryocatactes
Parus cristatus
Parus palustris
Pernis apivorus
Phoenicurus phoenicurus
Phylloscopus sibilatrix
Picus canus
Regulus ignicapillus
Sitta europaea

Woodland & forest habitat and other wooded land Mediterranean region

butterflies:
Brenthis daphne
Brintesia circe
Charaxes jasius
Gonepteryx cleopatra
Hipparchia fagi
Laeosopis roboris
Libythea celtis
Limenitis reducta
Pararge aegeria

mammals:
Canis lupus
Lynx pardinus

birds:
Certhia brachydactyla
Dendrocopos minor
Ficedula semitorquata
Hieraaetus pennatus
Parus cristatus
Parus lugubris
Pernis apivorus
Phoenicurus phoenicurus
Regulus ignicapillus
Sitta europaea
Sitta krueperi
Sitta whiteheadi

Appendix 6 Distribution of time series

The distribution of time series data among habitats and countries. The numbers per building block are equal to the number of unique species in a building block. Note that some species have been used in more than one building block and therefore the subtotals do not necessarily equal the number of unique species. The division of the total time series per country among the three major species groups is also shown.

	Coastal		Coastal Total	Farmland							Farmland Total	Freshwater		Freshwater Total	Heathland, scrub & tundra			Heathland, scrub & tundra Total
	Atlantic	Mediterranean		Alpine	Atlantic	Boreal	Continental	Mediterranean	Pannonian	Steppic		Atlantic	Continental		Arctic	Atlantic	Mediterranean	
Albania		7	7	12				18			30						3	3
Andorra				6							6							
Austria				6			10				16		16	16				
Belarus						6	15				21		15	15				
Belgium	2		2		29		10				39	13	4	17		9		9
Bosnia and Herz.		1	1				2	1		3							1	1
Bulgaria				3			12				15		9	9				
Croatia		4	4	2			11	7			20		5	5			1	1
Cyprus		3	3					6			6						2	2
Czech Republic							10				10		14	14				
Denmark	4		4		12		8				20	6	11	17		3		3
Estonia						13					13							
Finland						14					14							
France	18	9	27	17	28		29	20			94	10	9	19		7	5	12
FYR Macedonia																		
Germany	11		11		13		16				29	6	19	25		4		4
Greece		14	14					28			28						8	8
Hungary									20		20							
Iceland															3			3
Italy		6	6	5			11	13			29		4	4			3	3
Latvia						14					14							
Liechtenstein				3							3							
Lithuania						10					10							
Luxembourg							22				22		6	6				
Malta		8	8					10			10						1	1
Moldova							25				25		9	9				
Netherlands	14		14		30						30	15		15		10		10
Norway	8		8	2	4	3					9				1	1		2
Poland				13			29				42		16	16				
Portugal		1	1					8			8					1	3	4
Republic of Ireland	17		17		9						9	8		8		6		6
Romania				14			30		8	2	54		8	8				
Russia				8		5	14			4	31				6			6
Slovakia				17					10		27							
Slovenia				2			11				13		9	9				
Spain	11	6	17	13	19			23			55					7	6	13
Svalbard															5			5
Sweden				2		5					7							
Switserland				26			8				34		6	6				
Turkey		4	4					10			10						1	1
Ukraine				4			33		7	4	48		16	16				
United Kingdom	14		14		28						28	17		17		11		11
Yugoslavia		1	1				2	1			3						1	1
Grand Total	**99**	**64**	**163**	**155**	**172**	**70**	**308**	**145**	**45**	**10**	**905**	**75**	**176**	**251**	**15**	**59**	**35**	**109**

	Mires, bogs & fens Atlantic	Mires, bogs & fens Total	Unvegetated Alpine	Unvegetated Arctic	Unvegetated Total	Woodland & forest Alpine	Woodland & forest Atlantic	Woodland & forest Boreal	Woodland & forest Continental	Woodland & forest Mediterranean	Woodland & forest Total	Grand Total	birds	butterflies	mammals
Albania			2		2	6				9	15	57	4	52	1
Andorra			1		1	5					5	12	12		
Austria			3		3	14			15		29	64	64		
Belarus								8	16		24	60	45	14	1
Belgium	1	1					20		12		32	100	64	35	1
Bosnia and Herzegovina						2					2	7		5	2
Bulgaria			3		3	9			10		19	46	43	1	2
Croatia			2		2	6			17	2	25	57	51	3	3
Cyprus										1	1	12	12		
Czech Republic									18		18	42	42		
Denmark							3		10		13	57	57		
Estonia								29			29	42	23	17	2
Finland								28			28	42	23	17	2
France	2	2	7		7	11	16		21	8	56	217	94	122	1
FYR Macedonia						2					2	2			2
Germany			2		2		10		20		30	101	92	5	4
Greece										19	19	69	32	36	1
Hungary												20	12	8	
Iceland				1	1							4	4		
Italy			4		4	10			6	4	20	66	53	9	4
Latvia								29			29	43	24	17	2
Liechtenstein			1		1	6					6	10	10		
Lithuania								28			28	38	23	13	2
Luxembourg									21		21	49	25	24	
Malta										2	2	21	7	14	
Moldova									16		16	50	29	21	
Netherlands	4	4					19				19	92	46	45	1
Norway			1		1	8	5	6			19	39	34	2	3
Poland			4		4	9			27		36	98	50	44	4
Portugal										7	7	20	19	1	
Republic of Ireland							1				1	41	37	4	
Romania			5		5	16			21		37	104	40	60	4
Russia			1	2	3	5		17	10		32	72	26	46	
Slovakia			5		5	18					18	50	21	26	3
Slovenia			3		3	7			9		16	41	41		
Spain			4		4	4	8			11	23	112	29	81	2
Svalbard				1	1							6	6		
Sweden			2		2	6		20			26	35	26	6	3
Switserland			10		10	18			14		32	82	47	35	
Turkey										5	5	20	1	19	
Ukraine			1		1	11			27		38	103	57	45	1
United Kingdom	1	1					16				16	87	64	23	
Yugoslavia						2					2	7		5	2
Grand Total	**8**	**8**	**61**	**4**	**65**	**175**	**98**	**165**	**290**	**68**	**796**	**2297**	**1389**	**855**	**53**

Appendix 7 Evaluation of species sets

Ecoregion:	atlantic coastal habitats									
total number of species included		27								
European endemic species		22%								
ecological characteristics										
species group	birds:	63%	butterflies:	37%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	37%	carnivores:	0%	omnivores:	4%	piscivores:	52%	insectivores:	11%
dispersal distance	0-3 km:	11%	3-15 km:	7%	> 15 km:	41%			unknown:	41%
minimum viable population area	0-100 ha:	33%	100-500 ha:	4%	500-2000 ha:	0%	> 2000 ha:	63%	unknown:	0%
migratory behaviour	sedentary:	52%	migratory:	22%	variable:	26%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		0%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		33%								

Ecoregion:	mediterranean coastal habitats									
total number of species included		16								
European endemic species		44%								
ecological characteristics										
species group	birds:	50%	butterflies:	50%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	50%	carnivores:	6%	omnivores:	0%	piscivores:	38%	insectivores:	13%
dispersal distance	0-3 km:	0%	3-15 km:	0%	> 15 km:	44%			unknown:	56%
minimum viable population area	0-100 ha:	6%	100-500 ha:	13%	500-2000 ha:	6%	> 2000 ha:	63%	unknown:	13%
migratory behaviour	sedentary:	19%	migratory:	31%	variable:	50%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		6%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		31%								

Ecoregion:	atlantic freshwater									
total number of species included		20								
European endemic species		0%								
ecological characteristics										
species group	birds:	100%	butterflies:	0%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	10%	carnivores:	0%	omnivores:	25%	piscivores:	30%	insectivores:	35%
dispersal distance	0-3 km:	0%	3-15 km:	10%	>15km:	25%			unknown:	65%
minimum viable population area	0-100 ha:	0%	100-500 ha:	0%	500-2000 ha:	0%	> 2000 ha:	100%	unknown:	0%
migratory behaviour	sedentary:	5%	migratory:	30%	variable:	65%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		0%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		30%								

Ecoregion:	continental freshwater									
total number of species included		21								
European endemic species		0%								
ecological characteristics										
species group	birds:	100%	butterflies:	0%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	14%	carnivores:	0%	omnivores:	24%	piscivores:	29%	insectivores:	33%
dispersal distance	0-3 km:	0%	3-15 km:	10%	> 15 km:	24%			unknown:	67%
minimum viable population area	0-100 ha:	0%	100-500 ha:	0%	500-2000 ha:	0%	> 2000 ha:	100%	unknown:	0%
migratory behaviour	sedentary:	5%	migratory:	38%	variable:	57%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		0%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		33%								

Ecoregion:	atlantic mires, bogs & fens									
total number of species included		21								
European endemic species		0%								
ecological characteristics										
species group	birds:	17%	butterflies:	83%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	100%	carnivores:	0%	omnivores:	0%	piscivores:	0%	insectivores:	0%
dispersal distance	0-3 km:	0%	3-15 km:	17%	>15km:	17%			unknown:	67%
minimum viable population area	0-100 ha:	67%	100-500 ha:	17%	500-2000 ha:	0%	>2000 ha:	17%	unknown:	0%
migratory behaviour	sedentary:	83%	migratory:	17%	variable:	0%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		17%								
European Red Data Book butterflies		17%								
SPEC status 1-3 birds, butterflies		17%								

Ecoregion:	arctic heathland, scrub & tundra									
total number of species included		12								
European endemic species		8%								
ecological characteristics										
species group	birds:	100%	butterflies:	0%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	33%	carnivores:	17%	omnivores:	0%	piscivores:	0%	insectivores:	50%
dispersal distance	0-3 km:	0%	3-15 km:	0%	>15km:	8%			unknown:	92%
minimum viable population area	0-100 ha:	0%	100-500 ha:	0%	500-2000 ha:	0%	>2000 ha:	100%	unknown:	0%
migratory behaviour	sedentary:	8%	migratory:	75%	variable:	17%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		0%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		8%								

Ecoregion:	atlantic heathland, scrub & tundra									
total number of species included		17								
European endemic species		12%								
ecological characteristics										
species group	birds:	59%	butterflies:	41%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	53%	carnivores:	18%	omnivores:	6%	piscivores:	0%	insectivores:	29%
dispersal distance	0-3 km:	18%	3-15 km:	6%	>15km:	18%			unknown:	59%
minimum viable population area	0-100 ha:	41%	100-500 ha:	0%	500-2000 ha:	0%	>2000 ha:	59%	unknown:	0%
migratory behaviour	sedentary:	53%	migratory:	12%	variable:	35%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		6%								
European Red Data Book butterflies		6%								
SPEC status 1-3 birds, butterflies		35%								

Ecoregion:	mediterranean heathland and scrub									
total number of species included		17								
European endemic species		35%								
ecological characteristics										
species group	birds:	47%	butterflies:	53%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	53%	carnivores:	6%	omnivores:	6%	piscivores:	0%	insectivores:	35%
dispersal distance	0-3 km:	6%	3-15 km:	0%	>15km:	0%			unknown:	94%
minimum viable population area	0-100 ha:	47%	100-500 ha:	0%	500-2000 ha:	0%	>2000 ha:	47%	unknown:	6%
migratory behaviour	sedentary:	53%	migratory:	12%	variable:	35%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		6%								
European Red Data Book butterflies		18%								
SPEC status 1-3 birds, butterflies		41%								

Ecoregion:	alpine woodland & forest									
total number of species included		31								
European endemic species		6%								
ecological characteristics										
species group	birds:	52%	butterflies:	26%	mammals:	23%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	42%	carnivores:	13%	omnivores:	13%	piscivores:	0%	insectivores:	35%
dispersal distance	0-3 km:	6%	3-15 km:	13%	>15km:	26%			unknown:	55%
minimum viable population area	0-100 ha:	23%	100-500 ha:	3%	500-2000 ha:	0%	>2000 ha:	74%	unknown:	0%
migratory behaviour	sedentary:	55%	migratory:	13%	variable:	32%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		19%								
European Red Data Book butterflies		13%								
SPEC status 1-3 birds, butterflies		13%								

Ecoregion:	atlantic woodland & forest									
total number of species included		23								
European endemic species		9%								
ecological characteristics										
species group	birds:	48%	butterflies:	48%	mammals:	4%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	57%	carnivores:	0%	omnivores:	9%	piscivores:	0%	insectivores:	35%
dispersal distance	0-3 km:	26%	3-15 km:	17%	>15km:	17%			unknown:	39%
minimum viable population area	0-100 ha:	35%	100-500 ha:	4%	500-2000 ha:	4%	>2000 ha:	57%	unknown:	0%
migratory behaviour	sedentary:	61%	migratory:	13%	variable:	26%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		0%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		4%								

Ecoregion:	boreal woodland & forest									
total number of species included		36								
European endemic species		3%								
ecological characteristics										
species group	birds:	56%	butterflies:	28%	mammals:	17%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	42%	carnivores:	8%	omnivores:	17%	piscivores:	0%	insectivores:	36%
dispersal distance	0-3 km:	6%	3-15 km:	11%	>15km:	22%			unknown:	61%
minimum viable population area	0-100 ha:	19%	100-500 ha:	3%	500-2000 ha:	3%	>2000 ha:	75%	unknown:	0%
migratory behaviour	sedentary:	56%	migratory:	17%	variable:	28%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		11%								
European Red Data Book butterflies		8%								
SPEC status 1-3 birds, butterflies		17%								

Ecoregion:	continental woodland & forest									
total number of species included		35								
European endemic species		14%								
ecological characteristics										
species group	birds:	51%	butterflies:	37%	mammals:	11%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	49%	carnivores:	0%	omnivores:	9%	piscivores:	0%	insectivores:	43%
dispersal distance	0-3 km:	17%	3-15 km:	9%	>15km:	17%			unknown:	57%
minimum viable population area	0-100 ha:	29%	100-500 ha:	9%	500-2000 ha:	0%	>2000 ha:	63%	unknown:	0%
migratory behaviour	sedentary:	60%	migratory:	17%	variable:	23%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		11%								
European Red Data Book butterflies		11%								
SPEC status 1-3 birds, butterflies		14%								

Ecoregion:	mediterranean woodland & forest									
total number of species included		23								
European endemic species		30%								
ecological characteristics										
species group	birds:	52%	butterflies:	39%	mammals:	9%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	39%	carnivores:	13%	omnivores:	17%	piscivores:	0%	insectivores:	30%
dispersal distance	0-3 km:	0%	3-15 km:	9%	>15km:	22%			unknown:	70%
minimum viable population area	0-100 ha:	30%	100-500 ha:	4%	500-2000 ha:	4%	>2000 ha:	61%	unknown:	0%
migratory behaviour	sedentary:	61%	migratory:	17%	variable:	22%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		9%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		17%								

Ecoregion:	alpine unvegetated area									
total number of species included		15								
European endemic species		40%								
ecological characteristics										
species group	birds:	40%	butterflies:	47%	mammals:	13%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	67%	carnivores:	7%	omnivores:	7%	piscivores:	0%	insectivores:	20%
dispersal distance	0-3 km:	0%	3-15 km:	20%	>15km:	0%			unknown:	80%
minimum viable population area	0-100 ha:	40%	100-500 ha:	0%	500-2000 ha:	0%	>2000 ha:	53%	unknown:	7%
migratory behaviour	sedentary:	80%	migratory:	0%	variable:	20%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		20%								
European Red Data Book butterflies		20%								
SPEC status 1-3 birds, butterflies		27%								

Ecoregion:	arctic unvegetated areas									
total number of species included		3								
European endemic species		0%								
ecological characteristics										
species group	birds:	100%	butterflies:	0%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	0%	carnivores:	33%	omnivores:	33%	piscivores:	33%	insectivores:	33%
dispersal distance	0-3 km:	0%	3-15 km:	0%	>15km:	0%			unknown:	100%
minimum viable population area	0-100 ha:	0%	100-500 ha:	0%	500-2000 ha:	0%	>2000 ha:	100%	unknown:	0%
migratory behaviour	sedentary:	0%	migratory:	0%	variable:	100%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		0%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		67%								

Ecoregion:	alpine farmland									
total number of species included		27								
European endemic species		15%								
ecological characteristics										
species group	birds:	26%	butterflies:	74%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	78%	carnivores:	4%	omnivores:	11%	piscivores:	0%	insectivores:	11%
dispersal distance	0-3 km:	7%	3-15 km:	15%	>15km:	30%			unknown:	48%
minimum viable population area	0-100 ha:	44%	100-500 ha:	11%	500-2000 ha:	7%	>2000 ha:	37%	unknown:	0%
migratory behaviour	sedentary:	56%	migratory:	11%	variable:	33%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		11%								
European Red Data Book butterflies		11%								
SPEC status 1-3 birds, butterflies		19%								

Ecoregion:	atlantic farmland									
total number of species included		35								
European endemic species		3%								
ecological characteristics										
species group	birds:	49%	butterflies:	51%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	57%	carnivores:	3%	omnivores:	23%	piscivores:	0%	insectivores:	17%
dispersal distance	0-3 km:	11%	3-15 km:	31%	>15km:	29%			unknown:	29%
minimum viable population area	0-100 ha:	29%	100-500 ha:	9%	500-2000 ha:	3%	>2000 ha:	60%	unknown:	0%
migratory behaviour	sedentary:	46%	migratory:	20%	variable:	34%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		3%								
European Red Data Book butterflies		3%								
SPEC status 1-3 birds, butterflies		26%								

Ecoregion:	continental farmland									
total number of species included		37								
European endemic species		0%								
ecological characteristics										
species group	birds:	43%	butterflies:	57%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	59%	carnivores:	5%	omnivores:	19%	piscivores:	0%	insectivores:	19%
dispersal distance	0-3 km:	22%	3-15 km:	24%	>15km:	22%			unknown:	32%
minimum viable population area	0-100 ha:	35%	100-500 ha:	11%	500-2000 ha:	5%	>2000 ha:	49%	unknown:	0%
migratory behaviour	sedentary:	43%	migratory:	22%	variable:	35%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		14%								
European Red Data Book butterflies		11%								
SPEC status 1-3 birds, butterflies		32%								

Ecoregion:	pannonian farmland									
total number of species included		20								
European endemic species		0%								
ecological characteristics										
species group	birds:	60%	butterflies:	40%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	45%	carnivores:	10%	omnivores:	30%	piscivores:	0%	insectivores:	15%
dispersal distance	0-3 km:	5%	3-15 km:	25%	>15km:	40%			unknown:	30%
minimum viable population area	0-100 ha:	0%	100-500 ha:	20%	500-2000 ha:	10%	>2000 ha:	70%	unknown:	0%
migratory behaviour	sedentary:	15%	migratory:	25%	variable:	60%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		5%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		30%								

Ecoregion:	steppic farmland									
total number of species included		5								
European endemic species		0%								
ecological characteristics										
species group	birds:	100%	butterflies:	0%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	0%	carnivores:	0%	omnivores:	60%	piscivores:	0%	insectivores:	40%
dispersal distance	0-3 km:	0%	3-15 km:	0%	>15km:	0%			unknown:	100%
minimum viable population area	0-100 ha:	0%	100-500 ha:	0%	500-2000 ha:	0%	>2000 ha:	100%	unknown:	0%
migratory behaviour	sedentary:	0%	migratory:	20%	variable:	80%			unknown:	0%
structure (plants)	woody:	0%	herbaceous:	0%						
abiotic preferences (plants)	moist:	0%	dry:	0%	aquatic:	0%	intermediate:	0%		
	acid:	0%	basic:	0%	intermediate:	0%				
	nutrient rich:	0%	nutrient poor:	0%	intermediate:	0%				
	fresh:	0%	salt:	0%	brackish:	0%				
vulnerability										
IUCN Red List (threatened)		20%								
European Red Data Book butterflies		0%								
SPEC status 1-3 birds, butterflies		80%								

Ecoregion:	mediterranean farmland									
total number of species included	38									
European endemic species	3%									
ecological characteristics										
species group	birds:	47%	butterflies:	53%	mammals:	0%	plants:	0%		
trophic level	producers:	0%	consumers:	100%	reducers:	0%				
guild	herbivores:	61%	carnivores:	8%	omnivores:	18%	piscivores:	0	insectivores:	16%
dispersal distance	0-3 km:	8%	3-15 km:	13%	>15km:	18%			unknown:	6%
minimum viable population area	0-100 ha:	34%	100-500 ha:	8%	500-2000 ha:	0%	>2000 ha:	58%	unknown:	0%
migratory behaviour	sedentary:	47%	migratory:	21%	variable:	32%			unknown:	0%
structure (plants)	woody:	0	herbaceous:	0						
abiotic preferences (plants)	moist:	0	dry:	0	aquatic:	0	intermediate:	0		
	acid:	0	basic:	0	intermediate:	0				
	nutrient rich:	0	nutrient poor:	0	intermediate:	0				
	fresh:	0	salt:	0	brackish:	0				
vulnerability										
IUCN Red List (threatened)	13%									
European Red Data Book butterflies	8%									
SPEC status 1-3 birds, butterflies	39%									

Appendix 8 Details on the UK index

For all relevant UK habitats species are listed for which time series were obtained and which were used in the indicator. Datasources are:

birds: BirdLife International/European Bird Census Council (2000) and BirdLife International (2004); explanation and species habitat associations in Burfield et al. (2004)

butterflies: Greatorex-Davies & Roy (2002), explanation and species habitat associations in Van Swaay (2004)

Behind the species names data quality codes are given (see *Table 6* for explanation of codes).

Coastal habitats Atlantic region	
birds:	
Alca torda	a
Cepphus grylle	b
Fratercula arctica	a
Fulmarus glacialis	b
Morus bassanus	a
Phalacrocorax aristotelis	a
Rissa tridactyla	a
Somateria mollissima	b
Sterna albifrons	a
Sterna dougallii	a
Sterna paradisaea	a
Sterna sandvicensis	a
Uria aalge	a
butterflies:	
Hipparchia semele	a

Woodland and forest habitats and other wooded land Atlantic region	
birds:	
Certhia familiaris	b
Dendrocopos minor	b
Parus cristatus	b
Parus palustris	b
Pernis apivorus	b
Phoenicurus phoenicurus	b
Phylloscopus sibilatrix	a
Regulus ignicapillus	a
Sitta europaea	b
Tetrao urogallus	b
butterflies:	
Argynnis paphia	a
Boloria euphrosyne	a
Gonepteryx rhamni	a
Limenitis camilla	a
Pararge aegeria	a
Polygonia c-album	a

Inland surface water habitats Atlantic region	
birds:	
Anas crecca	b
Anas strepera	b
Fulica atra	b
Gallinula chloropus	a
Podiceps cristatus	a
Botaurus stellaris	a
Acrocephalus scirpaceus	b
Alcedo atthis	b
Aythya ferina	a
Aythya fuligula	b
Cinclus cinclus	b
Mergus merganser	b
Motacilla cinerea	b
Pandion haliaetus	a
Podiceps nigricollis	a
Tachybaptus ruficollis	b
Tringa hypoleucos	b

Heathland, scrub and tundra habitats
Atlantic region

birds:	
Caprimulgus europaeus	a
Carduelis flavirostris	d
Circus cyaneus	b
Eudromias morinellus	a
Falco columbarius	b
Lagopus lagopus	b
Sylvia undata	a
Tetrao tetrix	b
Turdus torquatus	c
butterflies:	
Callophrys rubi	a
Coenonympha pamphilus	a

Mire, bog and fen habitats
Atlantic region

birds:	
Anas penelope	b

Farmland
Atlantic region

birds:	
Alauda arvensis	b
Alectoris rufa	b
Athene noctua	b
Coturnix coturnix	b
Crex crex	a
Emberiza citrinella	b
Gallinago gallinago	b
Miliaria calandra	b
Motacilla flava	b
Passer montanus	b
Perdix perdix	b
Pyrrhocorax pyrrhocorax	a
Saxicola rubetra	c
Vanellus vanellus	a
butterflies:	
Aglais urticae	a
Celastrina argiolus	a
Inachis io	a
Pieris brassicae	a
Pieris rapae	a
Polygonia c-album	a
Vanessa atalanta	a
Anthocharis cardamines	a
Boloria selene	a
Erynnis tages	a
Lasiommata megera	a
Maniola jurtina	a
Melanargia galathea	a
Polyommatus icarus	a

Appendix 9 Causes of change

Method and data

The NGOs listed the major causes of decline for each of the species in the trend database. For butterflies the causes of change were given per species per ecoregion. For birds and mammals the causes of change were species-specific, but not ecoregion specific. For each species a maximum of 5 causes was listed. The information was partly derived from already published studies and partly based on expert judgement, generated in the context of this project. The information was then aggregated by calculating the total number or percentage of species for which a certain pressure is a major cause of decline.

Results

Table a and Figure a present the causes of species decline, respectively per habitat type and for Europe as a whole. The causes of species decline vary per habitat, with habitat loss and land use being the most frequent factors, followed by fragmentation and disturbance.

Table a. The most important causes of decline per habitat (species-based) as indicated by published studies and expert judgement (Burfield *et al.* 2004, Van Swaay 2004, LCIE 2004, LHF 2004).

Habitat	Causes of decline
Coastal areas	Toxification, disturbance, sedimentation, over fishing
Inland surface water habitats	Habitat loss, lowering groundwater tables, disturbance
Mire, bog and fen habitats	Habitat loss, fragmentation, lowering groundwater tables
Heathland, scrub and tundra habitats	Habitat loss, land use, fragmentation
Woodland and forest habitats and other wooded land	Habitat loss, land use, fragmentation
Inland unvegetated and sparsely vegetated habitats	Land use, disturbance, unknown factors
Farmland	Habitat loss, land use

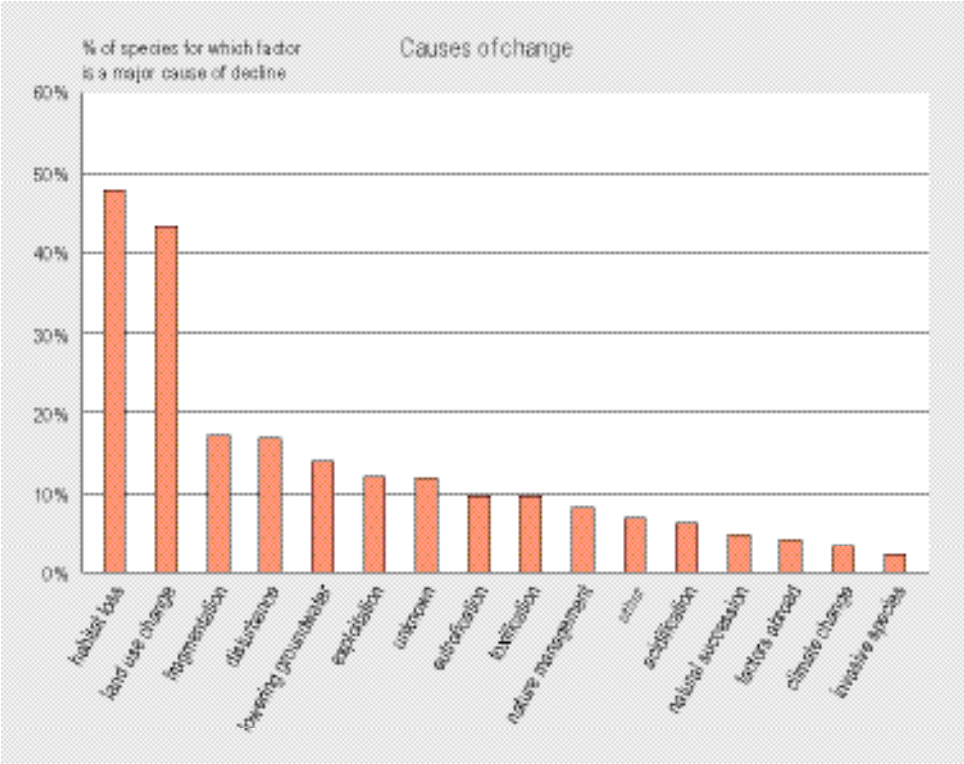

Figure a. Relative importance of pressures on species (in the ecoregions as investigated in this test), expressed as the percentage of species populations (i.e. a species in a building block) declining due to each of the pressures. The category 'other' includes increased sedimentation, fire, over fishing, loss of old buildings. These factors were found relevant for birds. Based on all species included in the indicator.

Appendix 10 Recommended actions

Summary of the recommendations as described in Chapter 4.

1. Mobilisation of historical data

1a. to mobilise data for ecoregions not covered in this pilot study;

1b. to mobilise data for additional species groups, specifically vascular plants, fish (freshwater and marine), waterbirds and marine mammals;

1c. to explore possibilities for additional data mobilisation for countries and biogeographical regions which were not effectively targeted by the data mobilisation of this pilot study, such as European Russia and the arctic region;

1d. to explore possibilities to collect data for intermediate points in time, e.g. 1990;

1e. with the help of national partners to mobilise data on species and species groups which are not covered by international NGOs.

2. Habitats and biogeographical regions

2a. to further explore merging of some EUNIS classes with other classes, especially class D: 'Mires, bogs and fens';

2b. to further improve species-habitat associations for all species groups, with specific attention for those species which use more than one habitat;

2c. to investigate how data on area of the EUNIS habitats in Europe can be further improved.

3. Composition and aggregation

3a. to further develop and quantify the species criteria, to make the species evaluation and selection as objective as possible, given the purpose of the indicator;

3b. to develop a guideline for the minimum number of species within a building block by which the indicator generally can be considered robust.

4. Reliability and sensitivity

4a. to explore the sensitivity and reliability of the indicator by using statistical techniques;

4b. to further explore the implications of the use of expert judgement alongside quantitative data.

5. Relation between the indicator and biodiversity loss

5a. to develop a reference scenario for the indicator to help resolve ambiguity in the indicator and put recent changes into meaningful context.

6. Potential for use at the national scale

6a. to further harmonise indicator methodologies and exchange of data, to enhance the synergy between national and European work on indicators.

7. Thematic indicators

7a. to develop thematic indicators, using the available (and new) data.

8. Towards a European biodiversity monitoring framework

8a. to (further) develop and implement long-term national monitoring programmes in all countries across Pan-Europe, under a common European biodiversity monitoring framework. See also Appendix 11.

Appendix 11 Potential for European Biodiversity Monitoring

Summary of the most important recommendations to further develop species monitoring in Europe as made by the NGOs.

Opportunities for European bird monitoring (Burfield *et al*. 2004)

- to continue the Pan-European Common Bird Monitoring Scheme (site-based monitoring) and the updating of the European Bird Database (national level trend estimates) once per decade. The coordination of and communication between existing bird monitoring schemes needs further strenghtening;
- to specifically build and strengthen the bird monitoring capacity and participation in the PECBMS in a number of southern and eastern European countries;
- to specifically strengthen the monitoring in some poorly covered habitats and biogeographical regions, esp. in some Alpine, Arctic and Mediterranean habitats;
- to specifically strengthen the monitoring of a number of species with high indicator potential;
- to look for synergies between monitoring for the EU Birds Directives and generic species trends monitoring;
- to support and streamline the production of national bird atlasses across Europe.

Opportunities for European butterfly monitoring (Van Swaay 2004)

- to collate and analyse the data from the existing five national monitoring schemes (The Netherlands, UK, Belgium/Flanders, Finland and Spain/Catalonia);
- to (continue to) produce national butterfly atlasses and underlying databases. This is often the first step in compiling the knowledge on butterflies on the national level;
- to perform trend analyses based on national atlas data from all European countries, with application of techniques to correct for changes in recording intensity;
- to implement monitoring schemes in other countries. Especially single-species monitoring sites, which are to be counted during the species' flight period only, seem to be a highly effective approach.

Opportunities for European large carnivore monitoring (LCIE 2004)

In most of the European countries there is no continuous monitoring system of large carnivores. However, there is usually a system of 'official population estimates', whereby local forestry or hunting units report annually on the estimated numbers of individuals of a range of species present in their unit. The following opportunities are identified:

- To continue the present 'official population estimates', as they provide a foundation for local management and are well established. Strong improvements can and should be made with regard to (standardisation of) methodology and registration (using standardised forms and GIS maps). Data should be entered into national level databases and can then be used to monitor gross changes in population size;

- To complement this total distribution area monitoring with more detailed data collection from a network of sampling sites (fixed transects) that represent the diversity of habitats within the ecoregions. Different observation methods are available for different species. Some one-off small-scale more fundamental studies could aid the interpretation of the data.

Opportunities for European large herbivore monitoring (Van de Vlasakker Eisenga 2004)

- to set up pilot projects to test and compare the different monitoring methods currently in use;

- for each country to designate one national, independent organisation (e.g. a university or the national forest and wildlife research institute) to gather the monitoring data from the regions, hunting units, protected areas etc. Furthermore to mandate an organisation to collect the data from the countries in a European database;

- for each country to set up a national large herbivore database to store data on distribution and abundance in space and time. Data should be collected using special (uniform throughout the EU) data-sheets;

- for each country to produce atlases on the distribution and population size and trends every ten years. This would be a first step in combining the knowledge of large herbivores. The atlases should be standardised on an European scale.