USING BIRD DATA TO DEVELOP BIODIVERSITY INDICATORS FOR AGRICULTURE

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-- Parallel Session --

Group 2-A. Wild Species Dependent or Impacted by Agricultural Activities

Monday 5 November 2001

Paper presented to the:

OECD Expert Meeting on Agri-Biodiversity Indicators
5-8 November 2001
Zürich, Switzerland

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Using bird data to develop biodiversity indicators for agriculture

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Abstract

Agriculture impacts on wild species in different ways. Farmed habitats are affected by agricultural intensification and abandonment, while conversion of other habitats to agriculture also impacts on biodiversity. A wealth of bird conservation data is available for OECD countries, and offers opportunities to develop biodiversity indicators for agriculture. BirdLife believes that it is essential that biodiversity indicators cover trends in species populations as well as habitats. In this paper, we propose three approaches to indicator development, using data on important sites, widespread and common species and threatened species. The paper presents information and examples that could form the basis of further indicator development work, and identifies a series of actions that would aid the development of wild bird indicators for agriculture in OECD countries.

Keywords: biodiversity, indicators, bird data, monitoring, agriculture, policy relevance

Birds as indicators

The wealth and quality of data on birds, relative to other taxa, may be used to develop the thinking and lead the way in the development and application of biodiversity indicators at local, national, regional and global levels. It is important therefore that bird data are being put to best use in the development and application of such indicators. How effectively we are conserving the world's birds is a means of assessing how successful we are in conserving ecosystem functions and biodiversity as a whole.

Birds are good indicators of spatial biodiversity and sustainability, because:
- they are high in the food chain, thus integrating changes at other levels;
- they occupy a broad range of ecosystems and have varied natural histories;
- a wealth of data has been (or can be) collected by volunteers and professionals, and bird population sizes and trends, and conservation status, are often well known relative to other taxa;
- they are meaningful to a wide audience including the public.

There is therefore increasing interest in the use of ornithological data to indicate the effects of environmental change on biodiversity. Bird indicators are likely to form an important component of sets of indicators for biodiversity and habitats. Habitat indicators can be used to assess wider, “macro” level changes, while indicators for birds and other taxa can also be used to identify more subtle changes in biodiversity within habitats. By highlighting these changes, bird indicators can point to the need for more detailed research to identify the causes of change in populations of different species.

Further research into biodiversity change will help to establish whether birds are always the best group to use as indicators, and the extent to which indicators need to incorporate other taxa. At present, however, bird conservation data appear to offer the most promising opportunities for developing wild species indicators in agriculture.

Birds and agriculture

Changes in agricultural habitats are of concern in that they affect the overall level of biodiversity, including the populations of widespread and common species, as well as threatening rarer species.

Biodiversity has suffered severe declines in many OECD countries as a result of expansion and intensification of agricultural production. BirdLife International believes that reversing these declines, and achieving progress towards sustainable agriculture, currently represents one of the greatest environmental challenges facing policy makers in OECD countries. Indicators have a key role to play in assessing progress towards sustainable agriculture, and in evaluating the effectiveness of agri-environment policies.

Impacts of agriculture on birds include:

1. Changes in agricultural habitats as a result of agricultural development and intensification. Agriculture represents the dominant rural land use in many OECD countries, and many species have adapted to rely on farmed habitats. Increases in agricultural productivity have modified these habitats. Some of the trends of particular concern to BirdLife include:

- Specialisation of agriculture, and loss of mixed farming through conversion of arable to pasture and vice-versa;

- Intensification of arable production, with increased use of pesticides and fertilisers, with resultant impacts on agricultural habitats and food chains, and changes in cropping patterns;

- Intensification of livestock production, with increased fertiliser use depleting grassland biodiversity, and increased stocking rates effecting vegetation change;

- Loss of unfarmed features such as hedgerows, woodlands and ponds;

- Drainage of wetlands, marshes and pastures;

- Irrigation of dry agricultural habitats;

- Loss of traditional agricultural habitats such as hay meadows and orchards through conversion to more intensive systems;

In recent years, there have been efforts to reverse some of these changes – e.g. by re-creating features and habitats, and promoting organic farming.

2. Agricultural abandonment. This is a problem in many OECD countries, especially where farming finds it difficult to compete in an increasingly global market. Abandonment often threatens traditional farming systems that may be rich in wildlife.

3. Impacts of agriculture on other habitats. These include pollution e.g. eutrophication of watercourses, and conversion of semi-natural habitats such as wetlands and forests. Conversion of other habitats is a major issue at a global level.

Principles of indicator development

Qualities of environmental indicators

Biodiversity indicators should help policy makers to identify priorities for policy action, and help to monitor and communicate the impact of policy. More specifically indicators should have the qualities listed in Box 1.

Box 1. The qualities of biodiversity indicators

Indicators should have the following qualities (Bibby 1999):

- Quantitative - they should be formally measured;
- Simplifying information - the complexity of biodiversity knowledge has to be conveyed briefly if it is to have impact;
- User driven - the stakeholders involved will have to commit to plans and targets being monitored and will often collect the relevant data;
- Policy relevant - indicators should give signals to policy makers about their impact and effectiveness;
- Scientifically credible - methods should be sound and hold statistical validity;
- Easily understood - non expert policy makers and public should understand and have a sense of ownership and judge the success of policy-making;
- Realistic to collect - in terms of manpower and cost efficiency;
- Susceptible to analysis - it should be possible to disaggregate data to investigate possible causes of trends.

In addition, indicators should:

- address all of the key issues of policy relevance, e.g. populations of species within agriculture, impact of agriculture on other species, effects on both widespread and threatened species;
- be representative of wider trends - single species trends may be informative, but there is a danger that they are unrepresentative and misleading. It is preferable to use a wider group of species;
- present time series data to reveal medium term trends;
- utilise available data, without being excessively data-driven. There is a need to strike an appropriate balance between using what data we have, and improving monitoring systems to develop data for use in future indicators.

Ideally, indicators should also be included to measure a country's footprint outside its own boundaries. For example, agricultural policies in OECD countries can have a profound impact on biodiversity and the environment outside the OECD, by affecting patterns of trade and agricultural development.

Importantly, while indicators are valuable policy development and communication tools, they are not a substitute for the detailed knowledge needed to assess the causes of changes or to formulate strategies or plans in response.

Indicators should be scientifically valid but should be meaningful to a wide audience including the general public. BirdLife supports the development of headline indicators, which are a useful communication tool, as well as larger sets of more detailed indicators for use in policy analysis.

An ideal wildlife indicator should therefore be simple, show annual trends, be sensitive to environmental change, integrate data from many species, be representative, use data that are already available or feasible to collect and be capable of being disaggregated by policy sectors.

BirdLife believes that trends in wild species are a good indicator of agricultural practices and the effectiveness of agri-environment policy. Tackling wild species change usually requires targeted and well-

designed agri-environment schemes to be implemented, and thorough monitoring systems to be put in place. Trends in wildlife are a tangible and measurable outcome of these schemes. Species indicators are also important in assessing overall trends in biodiversity on farmland, as a result of wider changes in agricultural policy and practice.

Targets and indicators

Indicators do not make much sense without reference points against which the significance of change can be assessed. This includes the baseline, or starting point against which change can be measured. Indicators can also use thresholds to assess changes in species status (e.g. measuring changes in status from secure to threatened).

Indicators are designed to quantify and communicate these biodiversity trends and patterns in a simple way. Targets and indicators need to be linked. For example, the UK Government's 'Quality of Life' indicators include a wildlife indicator based on the population trends of breeding birds summarising the status of nearly 140 breeding species over the last 30 years. In the Biodiversity Action Plan, the Government has set targets for the most threatened and declining species. For example the species showing severe downward trends have targets set against them requiring a halt in decline and a return to 1990 levels by 2008.

The taxonomy of indicators

OECD indicator work has identified different frameworks for classifying indicators, including:

- The Driving Force – State – Response framework. This is particularly useful for considering the impacts of agricultural practices (driving forces) on the state of the environment, and considering policy responses to these;
- The "Sustainability" framework, which considers the trade-offs between different types of capital (natural, social, man-made and human capital; Pearce, 1998).

The Driving Force – State – Response framework is useful for the development and assessment of agri-environment indicators. For example, for biodiversity, it is essential to develop indicators to assess trends in wildlife populations (the state), as well as understanding the driving forces that affect farmland wildlife (e.g. pesticide use, water use, grassland management, length of hedgerows), and responses (e.g. agri-environment schemes, farm biodiversity plans).

While further progress is needed to develop indicators for the state of biodiversity in agriculture, many of the indicators developed already by the OECD have relevance for biodiversity conservation in agriculture in OECD countries, as driving force or response indicators. The Driving Force-State-Response framework is a useful for categorising these indicators.

The sustainability framework is also useful in addressing the conservation of biodiversity in agriculture. Wild species can be considered to constitute part of the stock of natural capital, and indicators therefore help to assess whether this capital stock is changing and why this might be the case.

Indicators at different spatial scales

Indicators can be developed at a range of scales. Ideally, data collected at local scale can be aggregated to provide national, regional and global data. The strengths of BirdLife's science programmes are very much based on large networks of many thousands of people gathering and compiling data at local and national levels. Common and agreed standards are applied to these data so they may be easily combined and synthesised at different geographical scales. This allows national and regional or global level indicators to be developed from data collected at a local level. These data allow cause-effect links to be investigated at a local or national scale.

Review of OECD progress to date

The OECD is to be congratulated on its work on developing agri-environment indicators. The OECD work programme has helped to provide a coherent framework and methodology for indicator development, and to promote a consistent approach between member countries.
The OECD indicators highlight many of the issues of concern to BirdLife, by including indicators of the state of biodiversity, wildlife and habitats; many of the driving forces that affect habitats and species; and some of the responses to these effects.

BirdLife acknowledges the difficulty of developing indicators for biodiversity and wildlife habitats that are applicable across OECD countries. These difficulties arise from differences in land use, species presence, conservation issues and priorities, and the relative importance of farmed and other habitats. In the light of these difficulties, we welcome the considerable progress made by the OECD in recent years.

Biodiversity Indicators
The OECD indicators report (OECD, 2001) presents a useful discussion of the issues surrounding the development of indicators for wild species, as well as numerous examples of how wild species indicators have been developed and used in OECD countries. The report rightly identifies the difficulties in developing wild species indicators that can be used across OECD countries, and notes that limited progress has been made in this area.

At least two possible approaches to developing biodiversity indicators can be identified:

- "Standardised" approaches, which seek to obtain and apply data in a standardised way across OECD countries. This has the advantage of promoting comparability and consistency in the development and use of indicators. It suffers from data problems, however, because of the variability of biodiversity monitoring between countries. As a result, there is a danger that resulting indicators will represent the "lowest common denominator" of available data, potentially reducing their usefulness and policy relevance. Nevertheless, some organisations, including BirdLife, collect international wildlife data in a standardised way, and we believe that there is potential to make progress in this area.
- "Country-led" approaches. The OECD report notes that many member countries have made considerable progress in developing wild species indicators at a country level. By grouping these indicators, the OECD is able to report trends in wild species diversity and abundance in several (but not yet all) OECD countries. Allowing member countries flexibility in developing and reporting wild species indicators helps to overcome some of the problems associated with data availability and differences in priorities and issues. Producing a set of generic principles and guidelines for member countries to follow in developing and submitting these indicators would help to promote the development of a more coherent, consistent and comparable set of wildlife indicators.

Habitat Matrix
This approach involves combining data on changes in the extent of different agricultural habitats with information on the species dependent on those habitats. This has some value in assessing the likely effects of changes in agricultural habitats on wild species. Bird conservation data could be used to develop matrices covering different agricultural habitats. This might include lists of species dependent on each habitat type, identifying which of these are threatened species.

However, as noted in the OECD report, great care needs to be taken in interpreting habitat matrices, since:

- Wild species abundance depends on the quality as well as the extent of farmed habitats. Developments in agriculture have had profound impacts on farmed habitats in many OECD countries, but these may not be identified by habitat indicators that focus on quantity rather than quality of habitats. For example, the substantial declines in farmland birds and other wildlife within agricultural habitats in Europe would be unlikely to be identified by the habitat matrix approach;

- It is important to consider the types of species dependent on different habitats, and their conservation status, as well as their number, in order to avoid undervaluing rarer species occurring in species poor habitats;
- Issues about spatial patterning of habitats, connectedness and fragmentation should be considered;
- Changes in agricultural landscapes and habitats over time may also pose difficulties for the matrix approach.

Therefore, while it is useful to have indicators that assess changes in the extent and quality of agricultural habitats, and the species that depend on them, the habitat matrix approach should not be seen as a substitute for indicators covering trends in populations of wild species.

Many of the factors affecting habitat quality (irrigation, chemical use, extent of landscape features etc.) are covered by other OECD agri-environment indicators. This highlights the importance of considering the links between habitat and wildlife indicators and the wider indicator set, rather than considering them in isolation.

BirdLife's approach to indicator development

BirdLife International is a global partnership of 60 organisations in over 100 countries concerned with the conservation of birds, habitats and biodiversity. Research and monitoring to assess the status and conservation needs of birds and their habitats are central to BirdLife's approach to priority-setting, and are used to inform policy makers at a national and international level. BirdLife is increasingly concerned about the effects of agriculture on birds and their habitats, and seeks to promote policies that encourage sustainable agriculture.

This section attempts to show how the data gathered through BirdLife's programme may be useful to the indicator development and implementation work of the OECD.

Indicator development and monitoring programmes

BirdLife regularly reports on the status of birds and the sites and habitats important for them.
These data are published in a wide-range of global, regional and national publications, inventories, reports and scientific papers and many data are available on the web. These programmes identify priorities that underpin and set the direction for conservation and management. Extensive networks of professional and amateur naturalists and ornithologists are central to these programmes of work.

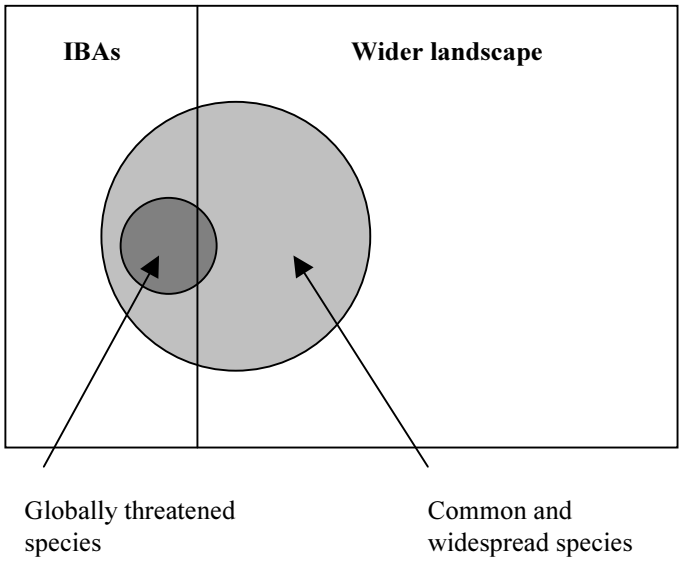
Common standards and methodology are important elements of the science work with information gathered being robust and sustainable. Scientific criteria, standard guidelines and databases have been established to maximize the scientific credibility and compatibility of datasets nationally, regionally and globally. Sharing expertise on data collection and maintenance through training and workshops are also important aspects of the programme. Data are peer reviewed and validated. The methodology and standardisation that have been applied when gathering these data allow their effective application to indicator-based reporting as monitoring programmes generate time-series data.

BirdLife is currently building on its priority-setting and assessment work through the development of monitoring programmes, indicators and indicator-based reporting. This encompasses three main strands:

- Important Bird Areas (IBAs)- to track changes in the conservation status of core areas for birds
- Widespread and common species - to track changes in the population sizes of widespread and common birds in the wider landscape
- Rare and restricted range species - to track and report on changes in the conservation status of globally threatened birds. These may require species specific monitoring schemes or be covered through monitoring IBAs - some species may be covered through broader scale monitoring of widespread species.

Each approach is essential for the effective conservation of a large number of species, and while different, the programmes are complementary and independent.

Figure 1. Monitoring of bird species at sites and in the wider landscape.



Indicators for each of these programmes provide important information on the status of bird populations, the pressures placed upon them, either directly or on the habitats and sites upon which they depend, and the effectiveness of policy and conservation responses. Table 1 describes these areas of work and outlines monitoring and indicator activities in each programme.

Table 1. Key elements of BirdLife's assessment, monitoring and indicator activities

Component	Major BirdLife Programme	Status of assessments	Assessments, monitoring and indicator activities
Sites	Important Bird Areas *A global network of internationally important sites for birds*	*Europe* - 3,619 sites identified *Americas* – 226 sites in Mexico, c.50% of states covered in US, 597 sites in Canada. *Africa* – 1,250 sites identified *Asia* – list in preparation for 2002 Middle East – 391 sites identified Pacific – programme starting	- Regional inventories - National inventories - Monitoring programmes - Indicator development initiated - Caretaker networks/support groups
Rare and restricted-range species	Globally Threatened Species *Species at risk of global extinction*	1,186 species (in year 2000). Published 1988, 1994 and 2000.	- Annual updates - Complete re-assessment of global threat status every 4 years - Monitoring of species - Action Plans - Recommended actions - Evaluation of targets - Indicator development
Common and widespread species	Species of conservation concern *Species of concern because of declining populations, small populations or highly localized. (can include some globally threatened species)*	To date regional assessment only complete for Europe. 278 Species of European Conservation Concern identified (SPECs) of which 195 have an unfavourable conservation status in Europe (1970-1990)	- National monitoring schemes - National indices (e.g. UK) - Development of pan-European indices - Support to new national schemes. - Habitats for Birds in Europe - Farmland bird monitoring schemes (in some countries)

Plans are advanced to bring together these three strands of work into a Pan-European Bird Monitoring Strategy as described in Box 2.

Box 2 - The development of a Pan-European Bird Monitoring Strategy

Goal

To develop good quality Pan-European monitoring and assessment of the state of birds and their critical sites in Europe, the pressures acting upon them and the actions being taken to conserve them

Objectives

- To research and define a set of core indicators and targets
- To strengthen, streamline and expand monitoring schemes and people networks
- To ensure efficient storage, analysis and reporting of data on core indicators

The Pan-European Bird Monitoring Strategy will be built through a participatory process of:

- linking people and organisations to work towards a shared goal
- using existing expertise and resources as fully as possible, including building on and investing in existing programmes
- dividing strategy tasks and responsibilities according to wishes, expertise and capabilities
- sharing skills, experience and information so as to develop overall capacity
- providing open access to data to enable better informed decision-making

It will monitor:

- Important Bird Areas - to track changes in the conservation status of core areas for birds
- Threatened species - to track changes in the conservation status of threatened birds
- Common species - to track changes in the population sizes of common birds

Table 2 summarises the numbers of globally threatened species, IBAs and the existence of national monitoring schemes functioning in each OECD country. Each of these programmes is described in more detail in the following sections, and the types of indicators being developed are outlined.

Table 2 – Summary of status of IBA, threatened species and common species work in OECD countries

Country	Important Bird Areas[1]	Threatened species[2] (no. in any season?)	National common species monitoring programmes[3]
Australia	Follow-up work planned to Australia Bird Atlas	21 species	
Austria	Published: 1989, 1995 (national), 2000. 55 sites (53)	4 species	
Belgium	Published: 1989, 2000. 48 sites (39)	3 species	
Canada	Published on www 2001 (597 sites)	6 species	Migration monitoring Programme
Cezch Republic	Published: 1989, 1992 (national), 2000. 16 sites (13)	4 species	National scheme
Denmark	Published: 1989, 2000. 127 sites (69)	1 species	National scheme
Finland	Published: 1989, 2000. 96 sites (15)	3 species	National scheme
France	Published: 1989, 1994 (national) 2000. 277 sites (209)	5 species	
Germany	Published: 1989, 2000. 285 sites (175)	4 species	National scheme
Greece	Published: 1989, 1994 (national) 2000. 196 sites (177)	7 species	
Hungary	Published: 1989, 1992 (national), 1998 (national), 2000. 43 sites (37)	7 species	National scheme started 1998
Iceland	Published: 1989, 2000. 61 sites (44)		
Ireland	Published: 1989, 1995 (national), 2000. 140 sites (78)	1 species	Countryside Bird Survey (started 1998)
Italy	Published: 1989, 1991 (national) 2000, 2000 (national). 192 sites (163)	7 species	National scheme recently started
Japan	Initial list to be completed end 2001	27 species	
Korea	Initial list to be completed end 2001	27 species	
Luxembourg	Published: 1989, 2000. 9 sites (9)	1 species	
Mexico	Inventory published 2000 (226 sites)	28 species	
The Netherlands	Published: 1989, 2000. 106 sites (60)	3 species	National scheme
New Zealand	Under discussion	9 species	
Norway	Published: 1989, 2000. 52 sites (16)	2 species	National scheme
Poland	Published: 1989, 1994 (national), 2000. 77 sites (64)	4 species	National scheme (started 2000)
Portugal	Published: 1989, 2000. 60 sites (41)	5 species	
Slovak Republic	Published: 1989, 1992 (national) 2000. 32 sites (28)	5 species	
Spain	Published: 1989, 1992 (national), 1998 (national), 2000. 391 sites (311)	10 species	National scheme (started 1996)
Sweden	Published: 1989, 2000. 63 sites (36)	2 species	National scheme
Switzerland	Published: 1989, 2000. 31 sites (28)	2 species	National scheme
Turkey	Published: 1989, 1989 (national), 1997 (national) 2000. 97 sites (66)	11 species	
United Kingdom	Published: 1989, 1992 (national), 2000. 295 sites (174)	2 species	National scheme
United States	Complete for c. 50% of states	33 species	Breeding bird survey

[1] Numbers relate to total number of IBAs in country and number with agricultural land-use e.g. Spain 391 IBAs (311 with agricultural land-use)
[2] The number of Globally Threatened Species (Critical, Endangered or Vulnerable) using agricultural habitats in each country
[3] Where known presence of systematic national monitoring scheme for breeding birds listed (not complete and needs further review)

Policy relevance of indicator and monitoring programmes

Developing links and collaboration with broader monitoring initiatives and end-users is extremely important. The data generated from these programmes aim to fulfil the monitoring requirements and obligations of key directives and conventions such as the Convention on Biological Diversity, Ramsar Convention, Bonn Convention, Africa Eurasia Waterbird Agreement (AEWA) and the OECD International Development Strategy. In Europe these also relate to a number of European Union initiatives such as the Birds and Habitats Directives, the 6th Environmental Action Programme, the Biodiversity Strategy and the Strategy for Sustainable Development as well as the Pan-European Biodiversity and Landscape Strategy.

Many different organisations and programmes are developing biodiversity indicators and collaboration in this field is increasing. The European Biodiversity Monitoring and Indicator Framework (EBMI-F) is one example. The Framework was initiated as part of the Pan-European Biodiversity and Landscape Strategy, in order to promote and facilitate collaboration on monitoring and indicators to report trends in Europe's biodiversity, using the objectives of the Convention on Biological Diversity as guidance. This framework

is being developed by the European Environment Agency and European Centre for Nature Conservation with input from BirdLife, CONNECT, NINA, UNEP-WCMC and Wetlands International.

These indicator sets will aim to characterise the trends and their causes to policy-makers and the wider public. Improved understanding of the impact that society and the economy have on biodiversity will help guide the development of more sustainable and targeted policies.

Using Important Bird Area data to develop indicators

Definition of Important Bird Areas

The BirdLife Partnership has initiated an Important Bird Area Programme to identify and protect a network of critical sites for the conservation of the world's birds. Important Bird Areas (IBAs) are sites of international importance for the conservation of birds, identified at a local level using a set of globally standardised scientific criteria based on the site's international importance for:

- Globally threatened bird species
- Congregatory bird species
- Assemblages of restricted-range bird species
- Assemblages of biome-restricted bird species
-

The programme initially comprises site identification using these criteria, followed by programmes of monitoring, policy development, advocacy for international and national legislation, public awareness and education, and practical conservation action and protection for a network of internationally important sites.

Since 1981, the BirdLife International Partnership has identified over 3,619 IBAs in 51 European countries/autonomous regions (Heath and Evans 2000), 1,250 in 58 Africa countries and associated islands (Fishpool and Evans 2001), and 391 sites within the 14 nation states of the Middle East (Evans 1994). Regional inventories of Important Bird Areas for Europe, the Middle East and Africa have all been published and widely distributed to government agencies, NGOs, the corporate sector, and others responsible for, or with an interest in, the conservation of species, sites and habitats. In addition, over 40 national IBA inventories have been published in the appropriate local language for nations in Europe, Asia, Africa, the Americas and the Middle East (Table 2).

Important Bird Area data are stored and analysed in an IBA module of BirdLife International's World Bird Database, enabling the data to be synthesised and presented in a variety of ways for a variety of audiences. The database also provides electronic links to non-BirdLife information and links to Geographical Information Systems for presentation purposes. For Europe alone the database currently includes information on bird populations at IBAs (>100,000 records), habitat type and extent at IBAs (>12,000), impacts (>12,000), protection status and management plans.

Large networks of ornithologists, birdwatchers and conservation experts are involved in the collation of data on IBAs. The BirdLife Partnership is at the core of this network, coordinating much of the work nationally and with substantial collaboration with governmental and non-governmental organisations and experts. Most partners have an IBA coordinator (or team), responsible for delivering this programme within the country concerned. Networks of local contacts (IBA Caretakers) form the foundation of community based networks active in the protection, management and monitoring of IBAs in several countries.

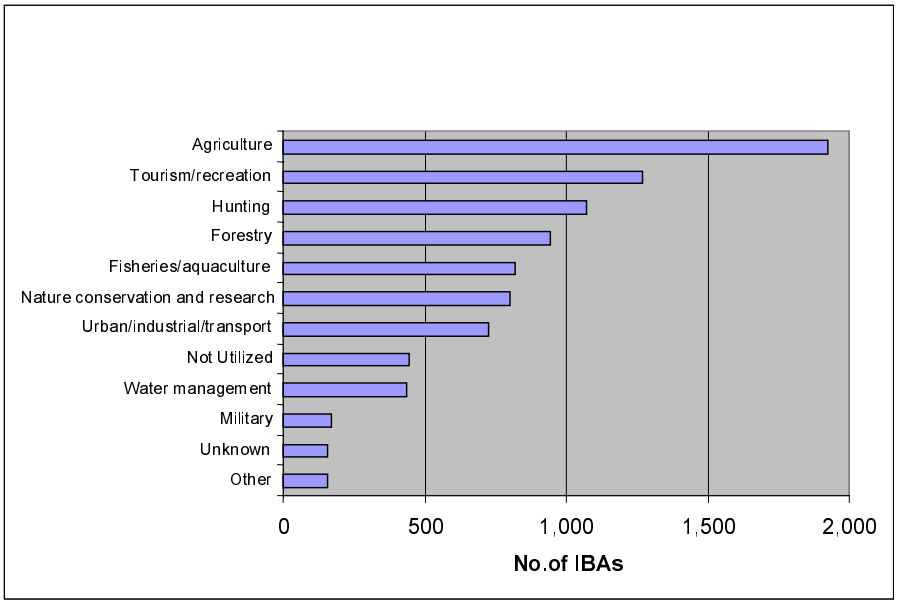
The importance of IBAs is increasingly recognised by authorities at a national level and globally. For example, the World Bank (in their Critical Natural Habitat Operational Policy) and the Global Environment Facility's Operational Strategy both refer specifically to IBAs as objective, internationally-recognised sites of biological importance for conservation and sustainable development.

The relevance of agricultural activity to Important Bird Areas

A great variety and often high intensity of land-uses are recorded within IBAs, reflecting the high human use of habitats in general. Across Europe, land-use activities have been recorded in 95% of IBAs, and in only 15% of these is part or all of the individual IBA area classified as 'not utilized'. As a result the conservation of habitats and birds within this key network of internationally important sites is very much dependent on the land-use practices, policies and programmes that affect these sites. Figure 2 shows that agricultural activity is the most frequent form of land-use recorded in IBAs in OECD countries in Europe. Such habitats, especially when extensively or traditionally managed, support important populations of many bird species. There are 2,837 IBAs in OECD countries in Europe, and, in 68% of these (1,923 sites), agriculture is a land use. Therefore the nature and management of agricultural activity in these sites is critical to the biodiversity contained within them.

Agricultural intensification and expansion is one of the most serious factors impacting on IBAs. In total, 51% of the IBAs where agriculture is a land-use in OECD countries in Europe are considered threatened by these. In 19 of the 23 OECD countries in Europe, more than 30% of the IBAs with agricultural landuse are threatened by agricultural intensification (Figure 3).

Figure 2. The number of IBAs in OECD countries affected by particular land-uses. (Source: BirdLife International World Bird Database)



One of the indirect effects of agricultural intensification is that remaining marginal land becomes less profitable to farm. Many bird species that have adapted to farmland require methods of non-intensive habitat management for their continued survival in such habitats. The abandonment of such practices is considered a threat to 418 IBAs in OECD countries in Europe where agriculture is a land-use. This particularly affects IBAs in many parts of central and Eastern Europe (Figure 3), as well as the Mediterranean region and Baltic States. In 15 of the OECD countries in Europe, more than 20% of IBAs with agricultural land-use are impacted by abandonment and reduction in land management.

Similar analysis will be possible for other OECD countries.

Indicators and the IBA Programme

The figures presented above have been compiled from data gathered at each of the IBAs in OECD countries in Europe. Through a standard approach, it is possible to combine such data at national, regional and global levels and report on trends of considerable relevance to the agricultural sector. Indicators that may be drawn from this programme include:

- Proportion of IBAs in country with agricultural land-use
- Number of IBAs in OECD countries with agricultural land-use

- Area of IBAs in OECD countries with agricultural land-use
- Trends in wild species populations at IBAs with agricultural land-use

With continued monitoring, the programme will generate key time-series data on bird population trends and the impacts and pressures they face.

BirdLife is building and implementing a comprehensive pan-European IBA monitoring programme. Workshops have been held within the European and African Partnerships to initiate the development of IBA monitoring strategies and papers are being prepared. For Europe, central to this are six proposed core indicators (Figure 4). They have been chosen to allow monitoring of the state of IBAs and their key bird species, pressures acting upon them and responses taken to conserve them. Monitoring this network is achievable on a regular basis, i.e. some annual, some every 4 years. For example, a comparison of data on the protection status of IBAs in Europe in 1989 and 2000 for Ramsar and Special Protected Area designations indicate an increase from 22% to 29% and 30% to 54% respectively in the proportion of sites protected by these designations.

Figure 3. IBAs in OECD countries in Europe (Source: BirdLife International World Bird Database)

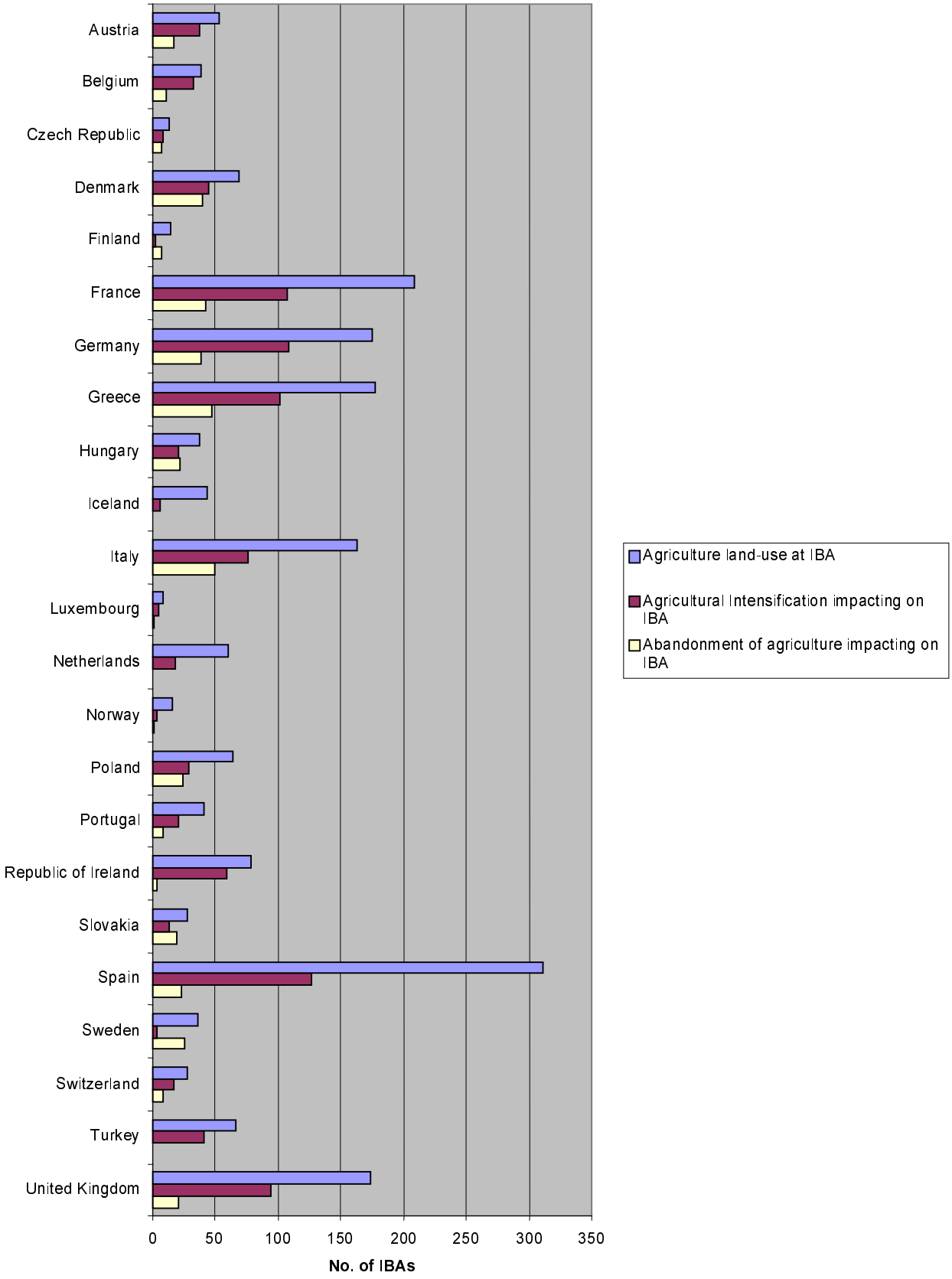


Figure 4. Core indicators on the status of Important Bird Areas and the bird populations they support

Indicator type	Indicator	Description
State	Habitat	Change in cover of habitat types (those relevant to agriculture include highly improved re-seeded grassland, arable land, perennial crops/orchards/groves, ruderal land, steppe/dry calcareous grassland, meosphile grassland etc.)
	Key bird populations	Trends in population sizes of: - globally threatened species using agricultural habitats - significant populations of Species of European Conservation Concern using agricultural habitats - significant populations of species listed on Annex 1 of the EU Birds Directive using agricultural habitats - waterbirds on wetlands impacted by agriculture e.g. irrigation, pollution - other common and widespread species
	Land-use	Change in cover of land-use types
Pressure	Impacts	Change in impact (importance score – high, medium, low) of 25 classes of impact to IBAs including agricultural intensification/ expansion, abandonment/reduction in land management, groundwater abstraction, shifting agriculture etc.
Response	Protection status	Change in overlap with national and international protected areas.
	Management plan	Change presence of management plan. Potential to extend to include implementation of actions in plan related to agricultural practices.

Source: Under development by BirdLife European Partnership

Policy relevance of data

Site networks are addressed under various international agreements, such as the Ramsar network (under the Ramsar Convention), the Natura 2000 network (under the EC Birds and Habitats Directives) and the Emerald Network (under the Bern Convention). For example in Europe 2,083 IBAs meet the Ramsar criteria and should therefore be considered for designation under this convention (BirdLife 2001). Similarly, 2,342 IBAs lie within the 15 countries of the European Union and a further 412 fall within the 10 accession countries. These sites comply with the criteria for identifying Special Protection Areas and therefore should fully overlap with the SPA network designated under the Birds Directive. The monitoring of the status of IBAs will therefore provide important information to test the effectiveness of EC nature conservation policy. In addition, in many cases a site will have multiple designations, each with their separate formal monitoring and surveillance requirements (e.g. in Europe Natura 2000 system, the Ramsar Convention and the Emerald Network). The IBA programme offers a well advanced platform from which an integrated system could be developed.

Using common and widespread species data to develop indicators

Background on common and widespread species

There have been widespread changes in land use in many OECD countries over the last 50 years. Site based conservation measures (including protected areas) have undoubtedly a very important role to play in biodiversity conservation. However there is growing recognition that biodiversity cannot be solely maintained through the conservation of sites. Maintaining biodiversity internationally means conserving the wider environment. Therefore, to maintain the abundance and distribution of species we also need to monitor and report on what is happening to more common and widespread species to ensure wise management of the environment as a whole through the integration of conservation objectives into all aspects of land-use activity and policy.

State of work on widespread species in each OECD country

A complete review of the state of national schemes for bird monitoring in all OECD countries has not been possible for this paper. However, a recent review of 80 bird monitoring schemes across Europe (Marchant et al 1997) (commissioned by the Royal Society for the Protection of Birds) shows that national schemes for monitoring common birds are established in 17 countries in Europe, 14 of which are within OECD countries (see Table 2). The great bulk of fieldwork for these surveys is undertaken by skilled volunteer ornithologists, co-ordinated by a small number of professionals working for national monitoring organisations, conservation agencies or universities

Between 1990 and 1994, BirdLife carried out a complete assessment of the conservation status of Europe's birds through the Dispersed Species Project. In order to assess status reliably and comprehensively it was necessary to obtain detailed population information on all species, in each European Country, for both breeding and mid-winter populations. To do this there was broad collaboration with ornithologists throughout Europe, utilising the BirdLife International network in conjunction with the European Ornithological Atlas Project. These data were published in 1994 (Tucker and Heath 1994) and about one third have since been updated and published (BirdLife/European Bird Census Council 2001).

Relevance of agricultural activities to widespread species

BirdLife used population and trend data to assess the conservation status of all bird species in Europe for the 1970-1990 period . A decline of 20% over 20 years is defined as the minimum for a significant decline, and 50% over 20 years as the minimum level of rapid decline. Results show widespread reductions of bird populations across many species and countries. Most striking has been the reduction of once common and widespread species, especially in Western Europe and primarily attributable to agricultural intensification. Lowland farmland provides breeding or wintering habitat for nearly 120 bird Species of European Conservation Concern, the largest number of such species supported by any habitat.

Further recent analysis of these data has modelled population and range changes in terms of a number of indices of agricultural intensity (data taken from the FAOSTAT database of the UN Food and Agriculture Organization) (Donald et al 2000). This shows that population declines and range contractions were significantly greater in countries with more intensive agriculture and significantly higher in the European Union than in former communist countries (Figure 5). Cereal yield alone explained over 30% of the variation in population trends. These results suggest that recent trends in agriculture have had deleterious and measurable affects on widespread and common bird populations on a continental scale.

Figure 5. Farmland bird declines in Europe (1970-1990)

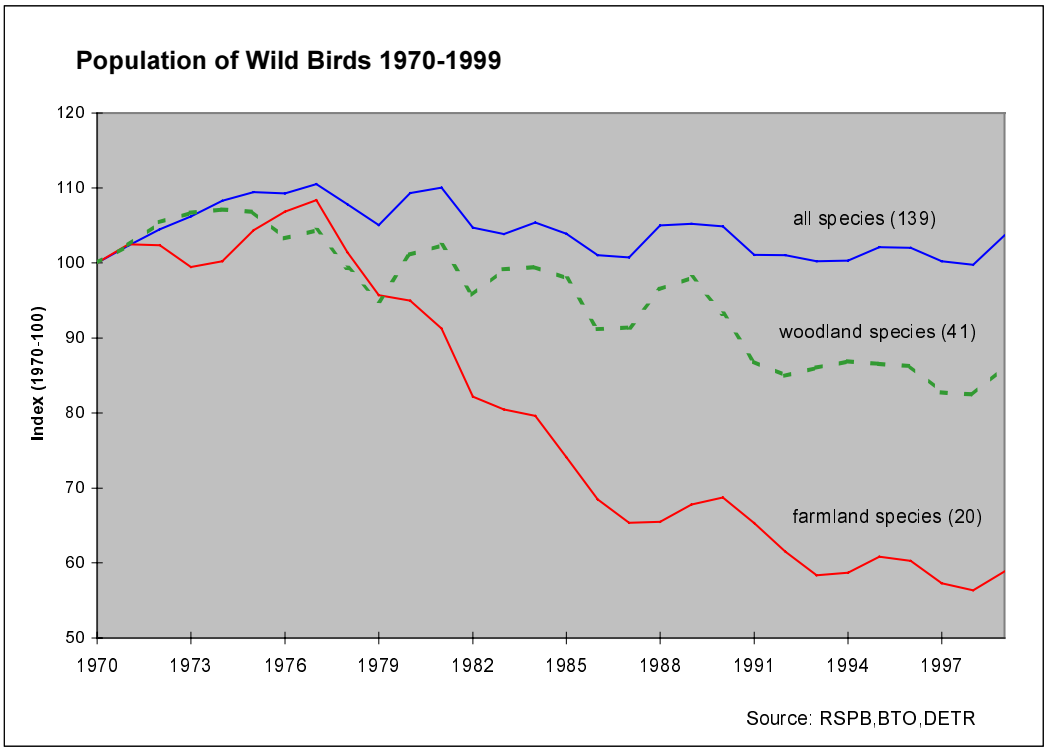
Source: Donald et al (2001) based on data for 40 farmland species from BirdLife/EBCC European Bird Database

Indicators and widespread species

Long running bird monitoring schemes for breeding landbirds is in the UK have been pivotal in demonstrating severe declines amongst farmland birds and their association with intensive agriculture. Using data from the Common Bird Census and Breeding Bird Survey the UK BirdLife partner, the RSPB, has developed an indicator of wild bird populations in the UK in conjunction with the British Trust for Ornithology and the Department for the Environment, Food and Rural Affairs.

A version of this mean index, representing the 139 commoner native bird species has been adopted by the UK Government as one of its 15 headline indicators, the so called Quality of Life Indicators, out of a set of 150 core indicators of sustainable development (Anon 1998, 1999). This indicator shows that on average farmland birds are in sharp decline (Figure 5). These declines in farmland bird populations have been mirrored by declines in populations of many specialised invertebrate and plants, mostly driven by similar changes in land-use.The UK Government is committed to publishing annual updates headline indicator. The goal is to reverse long-term trends: the Department for the Environment, Food and Rural Affairs has pledged to reverse the decline of farmland birds by 2020, using the headline indicator to measure their progress.

Figure 6. - The UK Government's Quality of Life Indictor: populations of common wild breeding birds. On average, the numbers of common birds have been stable in the UK, but, on average, woodland and farmland species have declined. These composite indices reduce trends for several species into a single average trend line.



Methodology used in the UK is based on an average index across all species (Gregory et al submitted). This approach treats all species equally, regardless of conservation status. There is therefore no subjectivity in the choice of species to be included or the relative importance they may have because it covers all species for which data are available. However, since all species are weighted equally, rare or vulnerable species are treated equally with common or even pest species. Indicator information needs careful thought and interpretation and disaggregating the trends is an important step to understanding the underlying problems (Gregory et al submitted).

The adoption of wild bird indicators in the UK illustrates the potential to use birds as indicators of sustainability. This index may also work in other data rich countries and it would be beneficial to explore this as a model.

In order for such an index to be developed, effective national monitoring schemes need to be in place. In Europe BirdLife is currently developing a programme focusing on monitoring common species, which will form sensitive indicators of the state of habitats in the wider environment. Integration of data from different national programmes across Europe will result in pan-European indices of bird trends. The programme has the following objectives:

- set in place common bird monitoring across Europe
- generate national bird indices in a standardized manner
- bring together national bird indices into a single European dataset
- generate European indices for individual species
- generate European composite indices for groups of species

A great deal of work has already been completed to integrate monitoring information. Preliminary work by Statistics Netherlands and the European Bird Census Council, funded by RSPB, has shown how breeding data from different countries can be brought together into pan-European indices for individual species (van Strien and Pannekoek 1998). These could be further developed to produce pan-European indicators for farmland birds (van Strien et al in press).

Alternative approaches may be to concentrate efforts on monitoring species indicative of wildlife-friendly agriculture. BirdLife Switzerland and the Swiss Ornithological Institute at Sempach are working on

management indicator species as part of a scheme to improve the 'ecological performance' of farms. Farmers are required to set aside 7% of their land for ecological compensation such as low intensity-use meadows, hedgerows, fruit tress wildflower strips etc. in order to receive public money. This will involve the monitoring of priority farmland species. In some regions it has already been shown that populations of several farmland species have increased due to ecological compensation areas (report in press).

In Denmark, population indices of widespread farmland birds have been used as agri-environment indicators since 1988. Data come from the nationwide point count programme where approximately 60 routes (1200 points) are placed in farmland (chiefly arable). Farmland population indices are calculated for several species, seven of which have been selected as indicators. This list includes granivorous as well as insectivorous species, long-distance migrants, short-distance migrants and sedentary species. Farmland population indices of the seven species are averaged to yield a "farmland bird index". Most years the index, or indices, are published in the official publication "Natur og miljø; udvalgte indikatorer" ("Nature and Environment; Selected Indicators") from the Ministry of Environment and Energy. Until now, the farmland part of the point count programme has been financed by the Ministry.

In the Netherlands three separate indices have been developed, termed the AMOEBA approach (Ten Brink 1991) the Red List Index and the Ecological Capital Index (van Strien 1997, 1999). The Ecological Capital Index (ECI) combines the quality and quantity of habitat into a single figure. Quality is taken to be the density of a number of habitat-specific species, and quantity is the area of that habitat. One of the difficulties with this approach is that it concentrates two fundamentally different but related processes; the loss of habitat area and the loss of biodiversity inhabiting that habitat. One could have the situation where the area of habitat declined rapidly but the biodiversity of the remaining patches was unaltered, or a situation where the habitat area remained constant but the biodiversity declined rapidly - yet both might have the same ECI (Gregory et al submitted). There are also difficulties in the choice of the reference period and the selection of habitat-specific species. Further editions of the ECI are likely to take a broader group of species thus increasing similarity with the UK index (Gregory et al submitted).

Also of relevance to developing indicators for common species is the International Waterfowl Census (IWC), covering Africa, Asia and Europe. The IWC is a standardised international scheme for annual monitoring of wintering waterbird populations and is coordinated by Wetlands International.

Using globally threatened species data to develop indicators

Background on globally threatened species

For over 20 years, BirdLife has published information on globally threatened bird species in Red Data Books and checklists, such that birds are recognized as the best-documented group of all species. BirdLife is the official Listing Authority for birds for the IUCN Red List and works closely with the IUCN/SSC Specialist Groups and a worldwide network of experts in this capacity.

The risk of extinction for all animal and plant species is evaluated against a comprehensive global standard developed by the IUCN Species Survival Commission. This standard sets thresholds by which species are identified as globally threatened, based on population and/or range sizes, and rates of decrease in these. This objectivity enables resources to be targeted at the most important sites, species and habitats for action.

In 2000, BirdLife published the third global checklist of threatened birds (BirdLife 2000). This reveals that one in eight (or c.12%) of all bird species have a real risk of becoming extinct in the next 100 years. This is a total of 1,186 species. Most worryingly, 182 are Critical, meaning that they have only a 50% chance of surviving over the next 10 years or three generations. A further 321 are Endangered and 680 are Vulnerable. A further 727 (Near Threatened) species are close to qualifying as threatened.

Relevance of agricultural activities to globally threatened species

There are 235 globally threatened species (classed as Critical, Endangered or Vulnerable) in OECD countries. Analysis shows that 54 of these (<25%) use agricultural habitats (Figure 7). For many of these species, agricultural habitat is considered to be of minor or insignificant importance. It is unlikely that these species can survive without adjacent unmodified habitats for breeding and or/feeding. However, for some species agricultural habitat is of major significance and certain practices may seriously impact on the species.

Assessment of the impacts on the 235 globally threatened species in OECD countries shows that agriculture is highly significant. Although there are not large numbers of globally threatened species dependent on agricultural habitats, much higher numbers present in other habitat types are affected by agricultural practices. 116 species (nearly 50% of all) in OECD countries are affected by habitat loss or degradation involving agricultural practices (Figure 8). In all countries apart from New Zealand, more than half of the globally threatened species are affected by agricultural practices. In New Zealand, invasive species constitute a more significant problem to species. The types of habitat loss or degradation are diverse (Figure 9), with loss of habitat to arable farming being the most significant and impacting on nearly 50 species.

Figure 7. Numbers of globally threatened bird species which use agricultural habitats in OECD countries. *Source: BirdLife International World Bird Database*

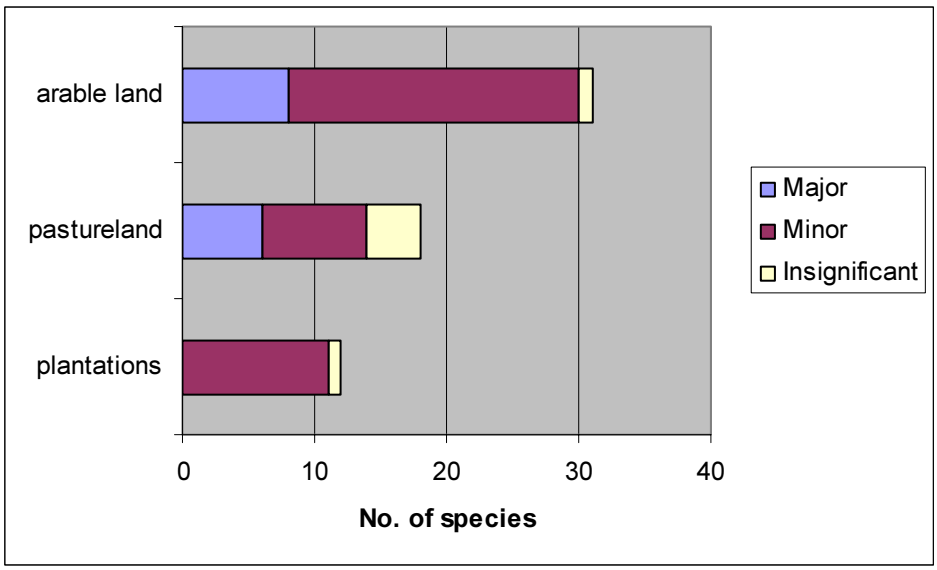


Figure 8. Number of globally threatened bird species affected by agricultural practices by OECD country/region. *Source: BirdLife International World Bird Database*

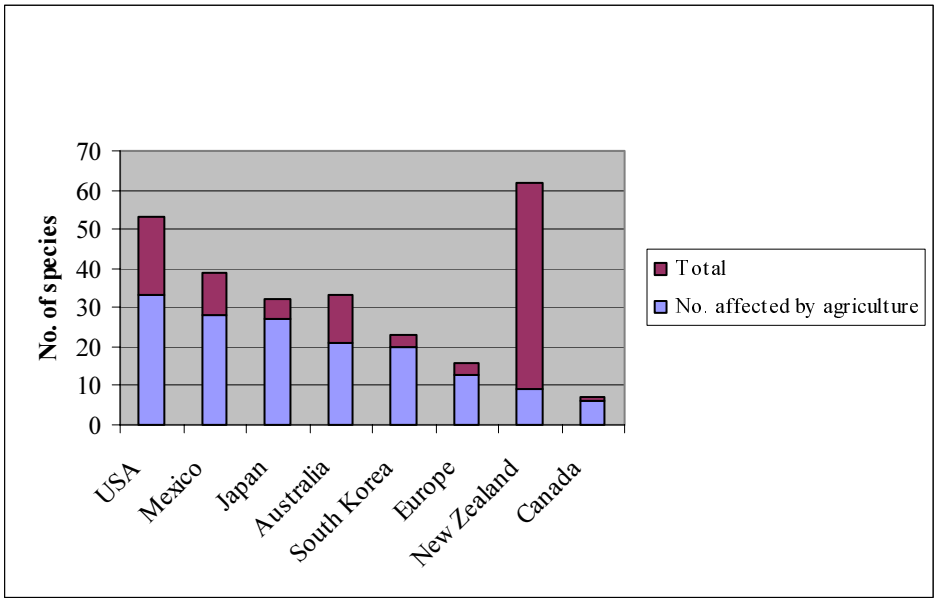
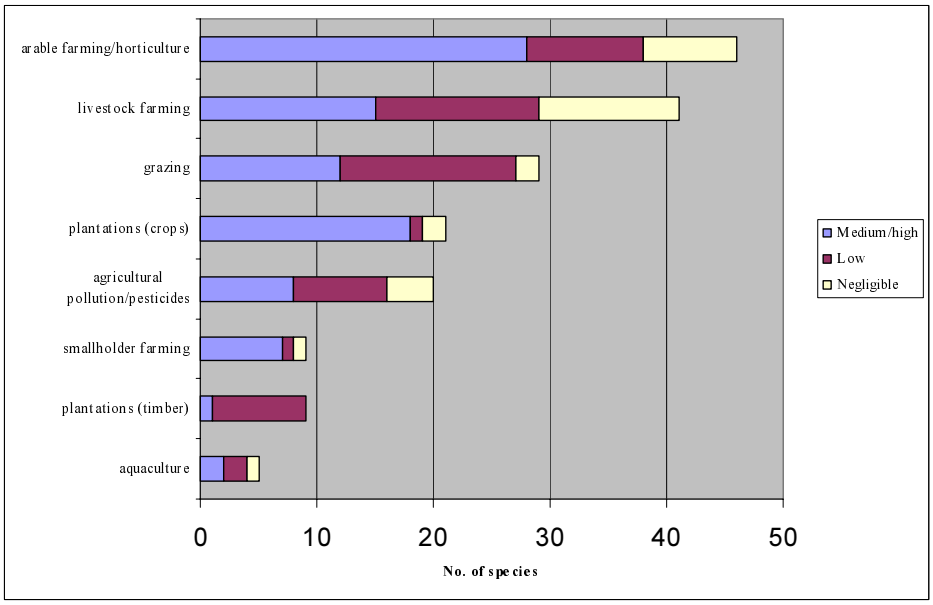


Figure 9. Numbers of globally threatened bird species affected by habitat loss or degradation involving agricultural practices in OECD countries. *Source: BirdLife International World Bird Database*



Indicators and globally threatened species

The IUCN Red List is emerging as an important tool for use in long-term monitoring of biodiversity. Undoubtedly monitoring globally threatened species will provide an important indication of the impact of agricultural practices on the most threatened group of birds globally. Complete threat assessments at the global level will be repeated every four years.

IUCN are currently developing a number of indices using Red List data (IUCN in prep.) to characterise globally threatened species. Proposed indices include:

Biodiversity Status Index - A measure of the extent to which biodiversity is threatened with extinction (this could address change in population size or change in threat status).
Biodiversity Knowledge Index - A measure of the extent to which sufficient information is available on species to determine their Red List Category.
Biodiversity Trend Index - A measure of the overall trends among species.
Cause of Threat Index - A measure of the different causal threats that impact on biodiversity.
Conservation Action Index - A measure of the extent to which conservation measures are in place for threatened species.

All these could be linked to species using agricultural habitats and impacted by agricultural practices. For example relevant indicators based on biodiversity status could include:

- The number of globally threatened species affected by agricultural practices in OECD countries
- The status of globally threatened species affected by agricultural practices in OECD countries
- The trends in population sizes of globally threatened species affected by agricultural practices in OECD countries
- The status of globally threatened species which use agricultural habitats in OECD countries
- The trends in population sizes of globally threatened species which use agricultural habitats in OECD countries

Extensive consultations are being led by IUCN to agree the means for developing such biodiversity indicators from the IUCN Red List. The first publication of these is planned in 2004. BirdLife plans to test a number of these indices using threat assessments and population data on globally threatened birds from 1988, 1994, and 2000, with a further re-assessment scheduled for 2004.

Indicator development issues

One problem with applying biodiversity indicators is that, although many data are available, there are relatively few complete national, regional or global biodiversity datasets that are available over long time periods. The indicators described in this paper for common and widespread and globally threatened birds, and the sites supporting internationally important numbers of them, are based on large, internationally standardised datasets that will make a significant contribution to measuring the effects of agriculture on biodiversity in OECD countries.

However, many of the indicators presented are largely in the development phase and undoubtedly further discussion is needed on how to take some of these ideas forward.

Areas that require further consideration include:

- Exploration of the value of setting targets for species population levels;
- Reviews of common bird monitoring schemes throughout OECD countries, and the data available from these schemes;
- Development of national monitoring programmes for common species, where none are currently in place;
- Production of guidelines on how to develop a widespread species indicator for OECD countries;
- Review and possible development of more limited monitoring of selected farmland bird species, whilst addressing concerns over pre-selecting species.
- Possibilities for back-calculating indices where historic data are incomplete;
- Putting bird data in the context of other data and indicators held by the OECD ;
- Further exploration of the links between agricultural pressures and biodiversity monitoring programmes gathering data on impacts;
- Further autoecological studies examining reasons for changes in species populations;
- The scope for collaboration between different organisations to improve monitoring programmes and indicator development;
- Trialling different approaches to the development of biodiversity indicators;

- Promotion of biodiversity monitoring systems in OECD countries.

Conclusions

- BirdLife strongly supports the development of 'wild species' indicators by the OECD as an essential component of the OECD's set of agri-environment indicators.

- BirdLife believes that trends in wildlife are a good indicator of the effectiveness of agri-environment policy.

- There is no substitute for time series of abundance of selected taxa as a way of detecting biodiversity trends. Measures of species diversity are often inadequate.

- Further research into biodiversity change will help to establish whether birds are always the best group to use as indicators, and the extent to which indicators need to incorporate other taxa. At present, however, the wealth of data available on birds from both governmental and non-governmental organisations throughout OECD countries appear to offer the most promising opportunities for developing wild species indicators in agriculture.

- There are different approaches to describe and assess the state and trends in populations of wild species associated with agriculture. The involvement of NGOs in governmental and institutional initiatives to progress biodiversity monitoring and indicator development is welcomed.

- We propose that it may be useful to divide 'Wild species' indicators into three separate indicator sets, resulting in indices for "wild species" drawn from the monitoring of widespread and common species, site networks for species and globally threatened species.

- Data are presented on the Important Bird Areas programme, a global network of sites of international importance for birds. Indicators that may be drawn from this programme include:
    - Proportion of IBAs in OECD countries with agricultural land-use
    - Number of IBAs in OECD countries with agricultural land-use
    - Area of IBAs in OECD countries with agricultural land-use
    - Trends in wild species populations at IBAs with agricultural land-use

- Examples of indicators for common wild bird species are presented. The adoption of wild bird indicators in the UK illustrates the potential to use common and widespread birds as indicators of sustainability. This index may also work in other data rich countries with effective national monitoring schemes and it would be beneficial to explore this as a model. Alternative approaches may be to concentrate efforts on monitoring groups of species indicative of certain agricultural practices/habitats.

- A number of indices using Red List data to characterise globally threatened species are under development by IUCN. BirdLife plans to test a number of these indices using threat assessments and population data on globally threatened birds from 1988, 1994, and 2000, with a further re-assessment scheduled for 2004. Relevant indicators based on biodiversity status include:
    - The number of globally threatened species affected by agricultural practices in OECD countries
    - The status of globally threatened species affected by agricultural practices in OECD countries
    - The trends in population sizes of globally threatened species affected by agricultural practices in OECD countries
    - The status of globally threatened species which use agricultural habitats in OECD countries
    - The trends in population sizes of globally threatened species which use agricultural habitats in OECD countries

- The indicators described in this paper for widespread and threatened birds, and the sites supporting internationally important numbers of them, are based on large, internationally standardised datasets that, if monitoring continues, will make a significant contribution to measuring the effects of agriculture on biodiversity in OECD countries.

- Producing a set of generic principles and guidelines for member countries to follow in developing and submitting indicators would help to promote the development of a more coherent, consistent and comparable set of wildlife indicators, particularly for widespread species.

- A spectrum of monitoring activities take place across OECD countries. One approach may be to set a minimum level of monitoring required in the short term to measure the impacts of agriculture on biodiversity. From this longer term comprehensive plans should be developed.

- Many of the factors affecting habitat quality (irrigation, chemical use, extent of landscape features etc.) are covered by other OECD agri-environment indicators. This highlights the importance of considering the links between wildlife and habitat indicators and the wider indicator set, rather than considering them in isolation.

Acknowledgements

The authors would like to especially thank Richard Gregory and Alison Stattersfield for very useful discussion and comments which improved the content of the paper. Much information and examples are drawn from the work of Richard Gregory on indicator development of widespread species, Des Callaghan on indicator development for European IBAs and Alison Stattersfield on globally threatened species. In addition, discussion and input from Nigel Collar, Paul Donald, John Fanshawe, Lincoln Fishpool and Colin Bibby were extremely helpful in scoping this work with examples supplied by Knud Flensted, Michael Grell and Urs Weibel.

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Further data and information can be found on www.birdlife.net