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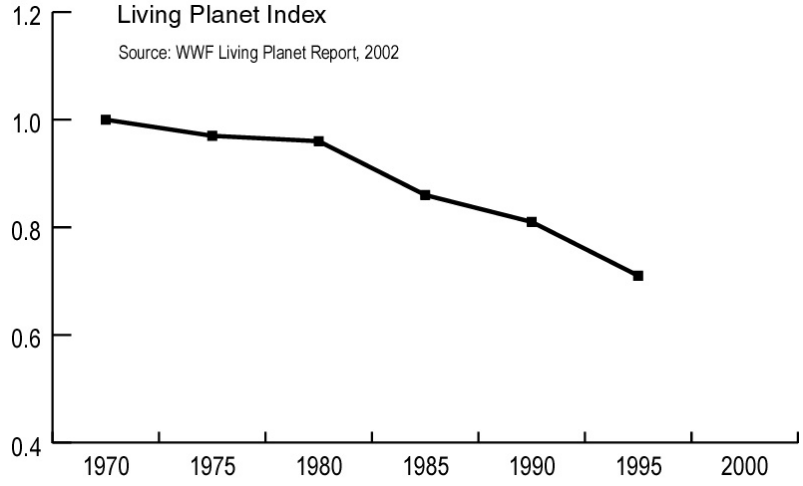
INDICATORS FOR ASSESSING PROGRESS TOWARDS THE 2010 TARGET: TRENDS IN ABUNDANCE AND DISTRIBUTION OF SELECTED SPECIES

Note by the Executive Secretary

I. SUMMARY

1. Species population trend indices such as the Living Planet Index are valuable ways for monitoring and communicating biodiversity change at global, regional and (sub-) national scales or within biogeographic units. These indices can be built using existing biological data to show clearly understandable trends in species abundance and, by implication, the condition of the ecosystems in which they occur. Since the 1970s the Living Planet Index, which reflects a change in population size of more than 700 species of vertebrates, has dropped by over 30 per cent (Figure 1).

Figure 1. The Living Planet Index (LPI) is derived from trends in populations of hundreds of species of birds, mammals, reptiles, amphibians and fish.



* UNEP/CBD/AHTEG-2010-Ind/1/1.

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II. RELATION OF INDICATOR TO FOCAL AREA

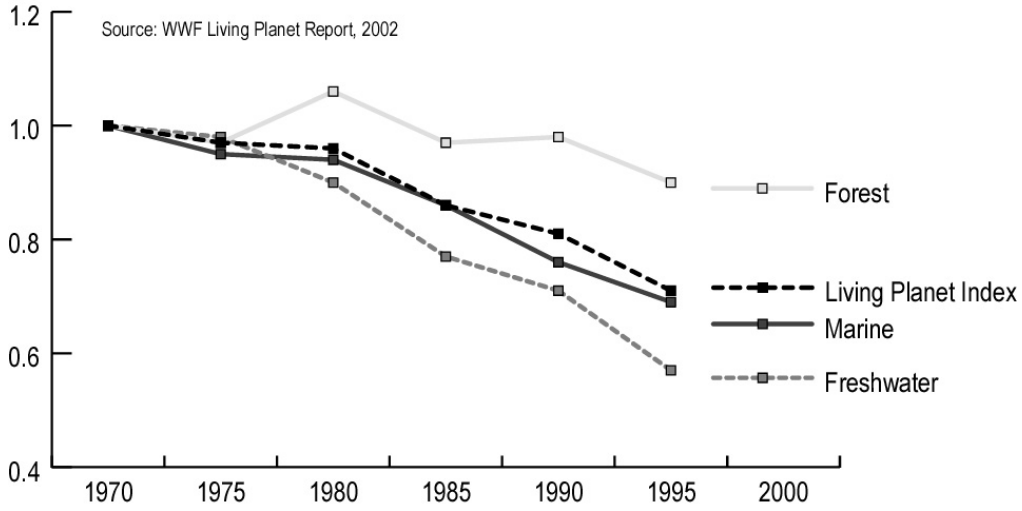
2. The indicator on *trends in abundance and distribution of selected species* provides a direct measure of changes of species status for well-monitored taxonomic groups. Biome-specific data also provide an indicator of ecosystem quality, complementing the indicators under *trends in ecosystem area*. Species assemblage population indices are available for marine, freshwater and forest systems (aggregated as the Living Planet Index). Bird population indices also cover agricultural ecosystems. Data are more complete for developed country regions.

3. Each species reacts differently to the various anthropogenic pressures that potentially impact the population size. By monitoring a large enough number of populations from different taxonomic groups, different biogeographic regions and areas subjected to different types and levels of pressures, this indicator has a potential to alert decision makers of the decline of populations in relation to environmental and geographic factors.

III. GENERAL DESCRIPTION

4. The Living Planet Index (LPI) is derived from trends over the past 30 years in populations of hundreds of species of birds, mammals, reptiles, amphibians and fish. The LPI is the average of three ecosystem-based indices. The forest species population index declined by about 15 per cent, the marine species population index fell by about 35 per cent, while the freshwater species population index dropped 55 per cent over the 30-year period (figure 2). 1/

Figure 2. Living planet index for species groups

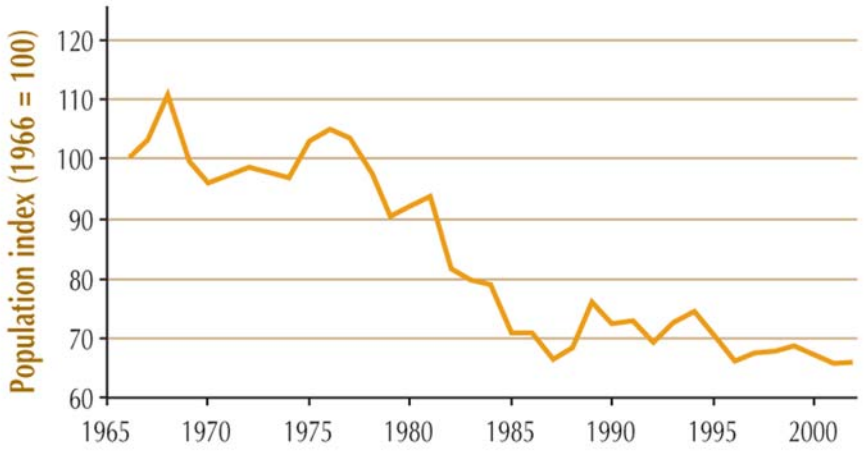


5. Similar trends have been observed for abundant and widespread bird species breeding on farmland throughout Europe (figure 3). Through the Pan-European Common Bird Monitoring Scheme, initiated by the BirdLife Partnership in Europe and the European Bird Census Council regional indicators for common bird populations in Europe are being provided. Annual breeding bird survey data collated from 18 European countries are used to calculate regional indices for species, taking into account the proportion of the population occurring in each country. One such indicator has been produced by combining data for 23 abundant and widespread bird species breeding in, and characteristic of, farmland. The results show that the European farmland bird index declined by 34 per cent between 1966 and 2002,

1/ Loh, J., et.al. 2002. Living Planet Report, WWF International, Gland; http://www.panda.org/news_facts/publications/general/livingplanet/lpr02.cfm

with decline rates greatest in the late 1970s and early 1980s (figure 3) 2/. It is widely accepted that these declines have been driven by agricultural intensification and the resulting deterioration of farmland habitats, and it is likely that the trends observed are mirrored by other farmland taxa.

Figure 3. European farmland bird index (Birdlife International 2004)



6. In the United Kingdom, butterfly species have disappeared from 13 per cent of their previously occupied 10-kilometre squares and over 70 per cent have declined in population size in the last 20 years. Declines in birds and plants were less pronounced but insect populations typically respond more rapidly to adverse environmental change. 3/

7. Monitoring trends in population size of species from different taxonomic groups and with different ecological requirements (specialists, generalists, opportunists; different trophic levels; from different biomes and biogeographic regions) allows correlating, within certain confidence limits, species population trends with changes in anthropogenic pressures. The main drawback of this indicator is the limited number of species or populations for which time-series data exist and which have ongoing monitoring programmes. Relying to a large extent on charismatic species (elephants, rhinos, tigers etc.), for which such data exist, would insert an unhelpful bias as many of these species are subject of active conservation programmes.

IV. POLICY RELEVANCE

8. Species population trend indices complement and reinforce several other indicators. Habitat degradation and loss are the main causes of changes in population sizes of species and of shifts in species composition. This indicator therefore complements the indicator on trends in extent of selected biomes, ecosystems and habitats.

9. *Trends in abundance and distribution of selected species* are indicators to assess the achievement of target 2.1 (Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups) set out in the framework of goals and sub-targets adopted in decision VII/30. Since data on population trends are the basis of monitoring the status of threatened species this indicator also links to target 2.2 (Status of threatened species improved) and target 4.3 (No species of wild flora or fauna

2/ BirdLife International 2004. State of the world's birds 2004: indicators for our changing world. Cambridge, UK: BirdLife International.

3/ Thomas, J. A., M. G. Telfer, D. B. Roy, C. D. Preston, J. J. D. Greenwood, J. Asher, R. Fox, R. T. Clarke, and J. H. Lawton. 2004. Comparative Losses of British Butterflies, Birds, and Plants and the Global Extinction Crisis. Science 19 (303): 1879-1881.

endangered by international trade). Habitat degradation and loss being the main causes of changes in population sizes of species and of shifts in species composition, this indicator is also relevant to targets 1.1 (At least 10 per cent of each of the world's ecological regions effectively conserved) and 1.2 (Areas of particular importance to biodiversity protected).

10. The 2002 World Summit on Sustainable Development acknowledged the loss of biodiversity as one of the major problems facing humanity at the start of the 21st century. Its Plan of Implementation called on action at all levels so that by 2010 measures would have been put in place to halt biodiversity loss and a significant reduction in the rate of biodiversity loss would have been achieved.

11. The following factors underline the relevance of the indicator for decision making and communication:

(a) Strong public support for saving endangered species or groups of species;

(b) Concept easily understood;

(c) Understanding species habitat requirements allows us to determine potential reasons for population declines and to formulate management recommendations that enable us to maintain viable populations;

(d) Allows the general public to participate, e.g. in bird counts, which each year unites thousands of volunteers in different countries;

(e) Transnational effort where migratory species are concerned;

(f) Draws attention to less charismatic animal and plant species;

(g) Important to design efficient monitoring programmes from which policy relevant statistics can be produced;

(h) Monitoring population trends in order to grasp dynamic and seasonal component of biodiversity;

(i) Assembly indicators to make best use of what is available;

(j) Use of common standards.

12. A representative set of species or a group of sensitive habitat-specific (indicator) species with narrow ecological amplitude can also provide a measure of ecosystem quality.

13. Even the best-case scenario indicates that at least 11.5 per cent (31,195 out of an estimated 270,000 species) of the world's vascular flora is under threat. However it must be recognized that irrespective of the figures used, the situation in reality is much worse due to the major gaps of knowledge about plants, from different regions or taxonomic groups, as well as a conservation point of view. This is particularly accentuated in the tropics. 4/

14. No international targets have been established for this specific indicator. Targets exist for selected taxa.

15. Where migratory and/or endangered species are used to calculate the index, the indicator relates to the Convention on the Conservation of Migratory Species of which animals (CMS) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

4/ http://www.unep-wcmc.org/index.html?http://www.unep-wcmc.org/species/plants/species_counts.htm~main.

V. TECHNICAL INFORMATION 5/

16. The Living Planet Index (LPI) is derived from trends over the past 30 years. It uses data on 730 separate populations of species of birds, mammals, reptiles, amphibians and fish from forest, freshwater and marine ecosystems.

17. The Living Planet Index (LPI) was first developed in 1997 by the World Wide Fund for Nature (WWF) and the World Conservation Monitoring Centre of the United Nation Environment Programme (UNEP-WCMC) and published in 1998 in the Living Planet Report 6/, as a contribution to the WWF Living Planet Campaign. It was originally conceived as an attempt to answer the question, "how fast is nature disappearing?" The aim was not to design in the abstract the best possible indicator of biodiversity change, but to implement a system that makes effective and quantitative use of the imperfect data that are available. After several attempts to design an index that could shed some light on this question, the LPI was formulated. The LPI is an index based on an underlying dataset of population trends in a large number of animal species from all around the world. Although the LPI has gradually evolved since 1998, and the number of species in the underlying dataset has increased considerably, the basic methodology for producing the index has not changed very much.

18. In effect, the trend line represents the average change within the entire collection of population samples within the study period, giving equal weight to each species, whether common or rare, and to small and large populations. To generate the index, the geometric mean change in all populations is calculated by averaging the logarithm of all data points for each five-year interval and then finding the anti-logarithm. This approach avoids unequal weighting due to population size and the asymmetry associated with using per cent change (i.e. a change from 100 to 5 is a 95 per cent decrease, but change from 5 to 100 is a 2,000 per cent increase). An arbitrary baseline at the start of the period analysed is then set (in the case of the LPI the baseline is set at 100 for year 1970) and the population change calculated for each successive five-year interval.

19. For presentation of the LPI (figure 1 on page 1 above), a trend-line is drawn between the geometric mean population values for each period (despite the fact that the composition of the population sample is not entirely constant across periods). This graph illustrates trends in the population samples. If it is assumed that this sample is representative of trends in a significant proportion of the species in some given area or habitat, the graph becomes a powerful means of communicating information about trends in ecosystem condition.

20. The LPI itself is in fact an aggregation of three separate indices, each of which relates to a different biome - forest, freshwater and marine - and each of which is given equal weighting. The three biome-based indices show average changes in abundance of forest, freshwater and marine species over the period 1970 to 2000. In the most recent Living Planet Report, the forest species population index measures the average trends in populations of 282 bird, mammal and reptile species living in forest ecosystems around the world. The freshwater species population index comprises populations of 195 species of birds, mammals, reptiles, amphibians and fishes from lakes, rivers and wetland ecosystems. The marine species population index includes 217 bird, mammal, reptile and fish species found in marine and coastal ecosystems.

21. The main limitation of the Living Planet Index is the limited amount of reliable time-series data available to calculate trends and the limited taxonomic coverage. In addition to the calculation of trends by ecosystem type one could also analyse trends to taxonomic group and by species ecology.

5/ Based on: Jenkins, M, Kapos, V. and Loh, J. 2004. Rising to the Biodiversity Challenge. The role of Species Population Trend Indices such as the Living Planet Index in tracking progress towards global and national biodiversity targets. Draft discussion paper prepared for the seventh meeting of the Conference of the Parties, February 2004.

6/ Loh, J., et.al. 1998. Living Planet Report, WWF International, Gland.

22. While data for birds are generally more available than those for any other taxonomic group, no global farmland bird index can as yet be calculated. Several other indicators are available for birds alone but few of these can be applied to other taxonomic groups.

23. Data on changes in geographic distribution (presence/absence data mapped over time) are available for plants only in a few countries.

24. There are a number of constraints on the ability to generate species population trend indices owing to uneven coverage of the available data. The biases are geographical, taxonomic and ecological.

25. More population data are available for developed countries than developing countries. Some countries in Europe and North America have datasets of species populations going back many years based on annual censuses and surveys, but these are exceptional. For most of rest of the world, data availability is patchy (see below).

26. More population data are available for birds, mammals and some marine fish species than for other species groups. Species which have good time-series population data are those which have been subject to long-standing monitoring efforts, whether because they are commercially important, of conservation interest, or simply easier to count.

27. Among terrestrial ecosystems, more population data are available for grassland species than forest species (very largely because they are easier to count), and among aquatic ecosystems more data are available for marine than freshwater species, with the exception of water birds.

28. These data constraints have important implications for the application of species population trend indices in some of the most biodiverse regions of the world, particularly tropical moist forests, where high levels of diversity mean that almost every species is rare, and animals are hard to count.

29. Until now the Living Planet Index has been updated on an ad hoc basis, whereby with each iteration of the Living Planet Report any additional species population time-series data that were collected have been included in the underlying dataset. Any biases in the underlying dataset were then compensated for by weighting regions and biomes on an equal basis. However, for species population trend indices to be used as a tool for tracking progress towards the 2010 target, regular monitoring of a sufficiently large number of species must be undertaken or otherwise guaranteed in order to ensure the necessary data will be available in future years.

30. The advantages of species population trend indices such as the LPI are as follows:

(a) Population trend indices are easy to understand, easy to communicate and transparent. They simply show the average change in the abundance of a large number of species over time. They are easy to communicate to a non-scientific audience without a lengthy prior explanation of what they measure, and are analogous to well-known stock market indices like the FTSE or Dow Jones. It is also easy to make the indices transparent by listing the species populations included in them;

(b) Importantly, data exist going back to the 1970s for many species, and even earlier for some species. The dataset collected by WWF/WCMC now includes over 2,500 population time-series, and it is certainly not exhaustive. The existence of reasonably long time-series is crucial for monitoring progress towards the 2010 target;

(c) Species population trend indices can be indicators of more than just the state of the species in the index: they can also serve as proxies for the healthy functioning of the ecosystems the species live in. Therefore they can be used as biodiversity indices in a broader sense than a measure of the state of species only;

(d) Species population trend indices can be constructed as indicators of biodiversity at any level: national, regional or global; by biome or biogeographic realm; for any ecosystem large or small. The only constraint on the application of such indices is the availability of time-series population data;

(e) It is very easy to aggregate and disaggregate species population trend indices up into big-picture "headline" indicators or down into their component parts.

31. The European farmland bird index combines data for 23 abundant and widespread bird species breeding in, and characteristic of, farmland from 18 European countries.

VI. EXAMPLES OF USE OF INDICATOR AT NATIONAL/REGIONAL LEVEL 7/

32. Full-scale species population trend indices have already been applied to monitor changes in biodiversity and progress towards biodiversity targets at national level. Both the United Kingdom and the Netherlands have embraced these approaches for generating national level indicators. In the UK, the Department for Environment, Farming and Rural Affairs, which has responsibility for biodiversity issues at both national and international levels, has adopted an index of trends in bird populations as one of 15 headline indicators of sustainable development. This index, which is based on data from the Common Bird Census and other sources, applies essentially the same approach used in the Living Planet Index to population trends in 105 UK bird species since 1970. The resulting "headline indicator" is considered to reflect trends in UK biodiversity more generally. Although the overall trend appears to be reasonably stable, disaggregation to explore trends in particular groups of species shows marked long-term declines in both woodland and farmland species. Addressing these declines is now the basis for Government targets in countryside management.

33. The Netherlands has also applied similar approaches to data on bird, butterfly and reptile species to explore trends in biodiversity in a number of ecosystem types. A number of developed countries such as Finland use trends in individual bird species to highlight biodiversity trends without generating indices.

VII. SUGGESTIONS FOR IMPROVEMENT OF THE INDICATOR

34. While indices can be calculated on the basis of any number of populations it is evident that the results will be more reliable if one can draw from a greater number of population trend data and have a more representative sample. There are a number of ways in which this can be obtained. The most important are:

(a) Improving access to existing data, including those in academic and in grey literature and data held in site and project records;

(b) Making use of small data sets and employing expert-based approaches;

(c) Increasing monitoring activity by encouraging, and providing guidance for amateur networks, resource managers and project implementers to provide data, and by ensuring that adequate financial resources are available to support monitoring.

35. Secondly, mechanisms need to be established to ensure that the data are collected, maintained and analysed appropriately so that reliable and relevant indicators can be produced at regular intervals to monitor progress towards policy targets. This is as much an institutional problem as a technical one: it requires data-holders to be willing to share their data, and one or more institutions at whatever level

7/ Jenkins, M, Kapos, V. and Loh, J. 2004. Rising to the biodiversity challenge. The role of species population trend indices such as the Living Planet Index in tracking progress towards global and national biodiversity targets. Draft discussion paper prepared for the seventh meeting of the Conference of the Paties to the Convention on Biological Diversity, February 2004.

(national, regional, global) to be prepared to manage these data with the agreement of all data-providers. However, the successful production and dissemination of indicators should in itself provide a powerful incentive to existing data owners to generate and share their data for these purposes. Production of indicators should also serve to boost existing and planned monitoring efforts, by giving them a clear application. If the data are largely based on voluntary monitoring efforts (as is already sometimes the case), then this should also help to build constituencies for conservation at grass-roots level.

36. While establishing a worldwide monitoring network for biodiversity that comprehensively samples all biomes and ecosystems is clearly a daunting undertaking, experience with the global LPI and in a small number of individual countries has shown that basic but nevertheless useful indicators can be developed quite quickly and easily. If all countries, and indeed individual institutions involved in the conservation and management of natural resources, were to bring together their existing information to produce local or national indices and contribute to international efforts, a major start would have been achieved in monitoring progress towards the 2010 target. 8/

37. Because of the lag between collection and publication of census data, there are always relatively few data available for the most recent time interval.

VII. SUMMARY OF COMMENTS RECEIVED ON THIS DOCUMENT

38. This document was available for review and comments in a discussion forum established on indicators for assessing progress towards the 2010 biodiversity target. Key comments received can be summarized as follows:

(a) A big asset of the LPI (or similar index) is that it can be produced for different functional groups and species assemblages as well as ecosystem types;

(b) There should be consistency between the LPI and the Red List index regarding the calculation and some overlap in the species considered;

(c) Criteria for selection of species or populations included in the calculation of the index should be rationalized;

(d) International NGOs and their networks of experts hold time-series data for many additional populations, which could be used to increase the confidence level of the LPI;

(e) Plants are a major omission in the LPI;

(f) The document does not adequately address species distribution.

39. Comments are not reflected in this document. Registered participants in the discussion forum can access the https://www.biodiv.org/2010-target/forums/indicators-thread.shtml?postid=527.

8/ See also: Balmford, A., R.E. Green, M. Jenkins. in press. Measuring the changing state of nature. Trends in Ecology and Evolution.