B I N U

Biodiversity Indicators for National Use

Experience and Guidance

UNEP

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Philip Bubb, Martin Jenkins, Valerie Kapos

in collaboration with

Netherlands Environmental Assessment Agency
(MNP-RIVM)

ECUADOR
Ecociencia and the Ministry of the Environment

KENYA
Kenya Wildlife Service

THE PHILIPPINES
The Bureau of Fisheries and Aquatic Resources (BFAR) and
The Protected Areas and Wildlife Bureau (PAWB)

UKRAINE
The Ukrainian Land and Resource Management Center (ULRMC)
The State Statistics Committee of Ukraine
The Council for Studying the Productive Forces of Ukraine of
The National Academy of Sciences of Ukraine

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THE UNEP WORLD CONSERVATION MONITORING CENTRE is the biodiversity assessment and policy implementation arm of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organization. UNEP-WCMC aims to help decision makers recognize the value of biodiversity to people everywhere, and to apply this knowledge to all that they do. The Centre's challenge is to transform complex data into policy-relevant information, to build tools and systems for analysis and integration, and to support the needs of nations and the international community as they engage in joint programmes of action.

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Written by Philip Bubb, Martin Jenkins and Valerie Kapos in collaboration with MNP-RIVM and the national partners.

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Cover images (clockwise from top):
The first ever map of agricultural ecosystems in Ukraine was derived by the BINU team by combining data on land use with satellite derived landcover data. The resulting map shows that about 70% of the national territory is in agricultural ecosystems; Flamingo, Kenya (Emily Short/UNEP/Topham); *Fuchsia* sp., Andean rainforest (W. Ferwerda); Fish farm, Philippines (Victor T. Manausala/UNEP/Topham).

Preface

The BINU project team at UNEP-WCMC, Cambridge, UK in July 2003.

This booklet is based on the results of a project carried out between 2002 and 2005 on biodiversity indicators for national use, or BINU for short. The BINU project was funded by the Global Environment Facility (GEF), UNEP, the governments of the United Kingdom (Department for International Development (DFID) and Department for Environment, Food and Rural Affairs (DEFRA)), the Netherlands (the Dutch Ministry of Foreign Affairs), Switzerland (the Swiss Agency for Environment, Forests and Landscapes) and the participating countries.

The BINU project was developed as a collaboration between UNEP-WCMC, the Netherlands Environmental Assessment Agency (MNP-RIVM), Ecociencia and the Ministry of the Environment in Ecuador, Kenya Wildlife Service in Kenya, the Bureau of Fisheries and Aquatic Resources (BFAR) and the Protected Areas and Wildlife Bureau (PAWB) in the Philippines, and the Ukrainian Land and Resource Management Center (ULRMC), the State Statistics Committee of Ukraine and the Council for Studying the Productive Forces of Ukraine of the National Academy of Sciences of Ukraine.

More results and interim outputs of the project can be found on the CD-ROM included with this report. The final reports of the project will be available in the second half of 2005.

Further information can be obtained from:
www.unep-wcmc.org/collaborations/BINU
or from
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Further information on the Ukraine BINU results can be found at:
http://www.ulrmc.org.ua/services/binu/index.html

Further information on the Ecuador BINU results can be found at:
http://www.socioambientalecuador.info/

UNEP-WCMC, MNP-RIVM and the national BINU partner organisations wish to thank the many organisations that provided financial and in-kind support to the project, as well as the members of the project Steering Committee for their advice.

The authors would also like to thank the co-ordinators of the four BINU country teams – Vasyl Prydatko in Ukraine, Anderson Koyo in Kenya, Malki Saenz in Ecuador, and Noel Barut in the Philippines – for their collaboration in producing this report, as well as their commitment to producing biodiversity indicators for the conservation and wise management of their country's biodiversity. The results of each country are the product of extensive teams involving many types of institutions, which are acknowledged in the national reports on the CD-ROM which accompanies this document.

Equally, we would like to thank Ben ten Brink, Tonnie Tekelenburg, and Mireille de Heer of the Netherlands Environmental Assessment Agency (MNP-RIVM) for their great contribution to all stages of the BINU project, including this report. The BINU project originated from a proposal by Ben ten Brink.

Introduction

In the past few decades there has been growing understanding that human well-being is fundamentally linked to the state of the environment. One manifestation of this is the increasing acceptance of biological diversity ('biodiversity') as an important focus for human concerns. At international level this has perhaps been most clearly expressed by the entry into force and continuing implementation of the Convention on Biological Diversity (CBD). Through this and other mechanisms, biodiversity has become the subject of many national and international policies and regulations.

One result of this is a growing perception of the need for reliable ways to assess both the state of biodiversity in countries and the effectiveness of measures designed to help maintain it. Calls to meet this need have been voiced in many different arenas, particularly at international level under the CBD. One of the earlier decisions made by the Conference of the Parties to the CBD urged Parties to identify indicators of biological diversity as a high priority. It also called on Parties to collaborate on a voluntary pilot project to demonstrate the use of successful assessment and indicator methodologies.

Taking this as a starting point, four country partners, UNEP-WCMC and MNP-RIVM designed a project on biodiversity indicators for national use (BINU) at a workshop in Kenya in 2000, funded by the GEF. As part of the workshop the team reviewed work on biodiversity indicators to date and found that, although much had been written about them, most of this was from a theoretical standpoint and much of it lacked focus and clarity. Our first endeavour was therefore to try to ensure that everyone on the project team had a common understanding of what indicators were and what biodiversity might be. In our discussion on indicators we took our cue from other disciplines such as economics and medicine. We decided that we could describe indicators as: 'measures or metrics based on verifiable data that conveyed information about more than just themselves'. Examples from other disciplines included relatively simple measures such as body temperature and retail price indices, and more complex measures such as human development and quality of life indices.

Our understanding of biodiversity was based in broad terms on that given in the CBD, namely 'the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems'.

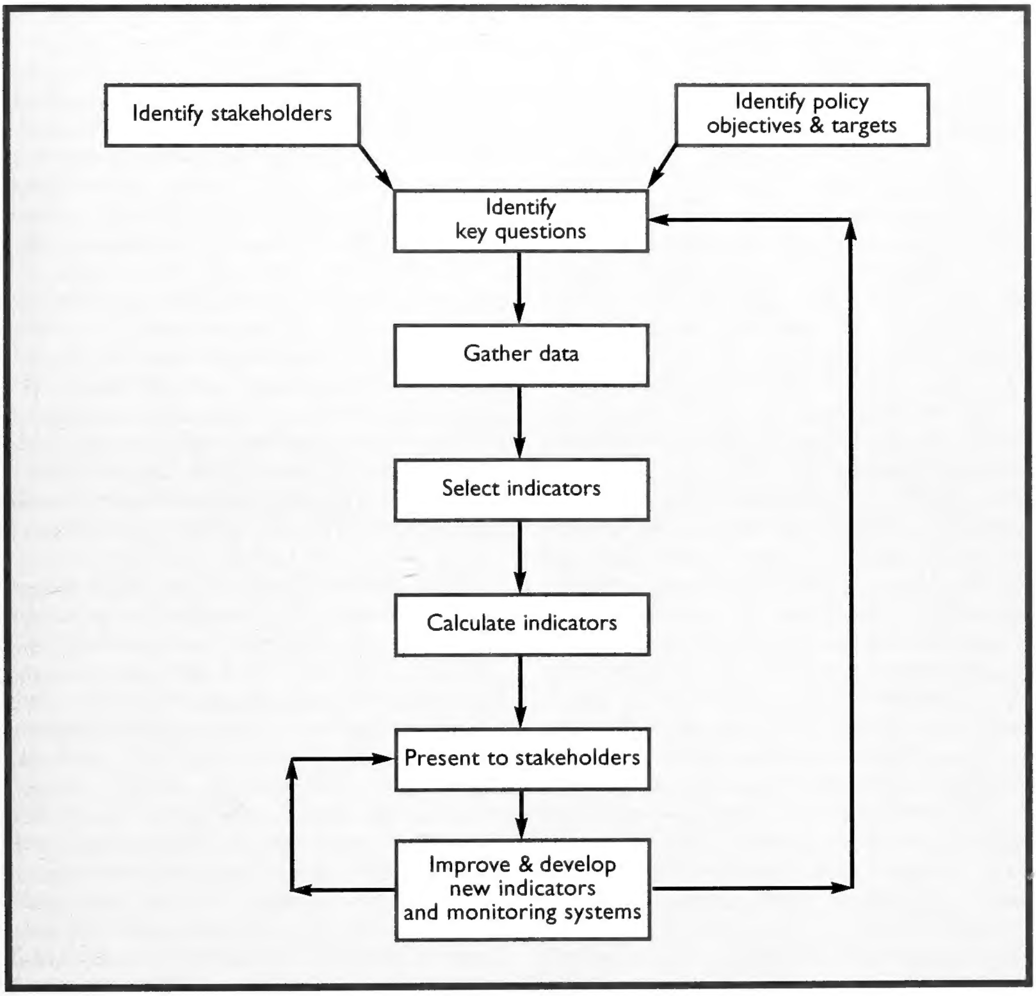
Having established this, the BINU team decided that the focus of the project should be on biodiversity indicators for use within countries, and particularly for use at **national level**. Very quickly we agreed on two fundamental aspects of indicators:

- They were only of any use if they addressed questions to which someone wanted to know the answer.
- They were only feasible if the data to generate them could be obtained.

From the first of these aspects we developed a question-led approach, in which stakeholders were to be identified and asked what their most important questions about biodiversity were. Armed with these questions, the national team would seek out relevant information from wherever it might be found. There would then follow an indicator development phase, in which attempts would be made to use the information gathered to generate indicators that would respond in a meaningful way to questions asked by the stakeholders. It was then intended to test these indicators by presenting them to the stakeholders, and to refine them further on the basis of any feedback obtained.

Because of the complexity of the issue, we also decided that each country partner would concentrate on one major biome: agricultural ecosystems in Ukraine; marine and coastal ecosystems in the Philippines; inland waters in Kenya; and forests in Ecuador (later expanded to include all terrestrial ecosystems). We also agreed that each country should have as much flexibility as possible in deciding the best way to implement the process.

Biodiversity indicators for national use: the process



While the primary aim of the project was the development of a tested core set of indicators for each country (and each biome), we also viewed it as an opportunity for learning about the indicator development and application process itself. In particular we considered the following questions as likely to be important:

- ❑ How useful is the indicator approach in communicating issues on biodiversity to a wide range of people?
- ❑ What are the major constraints on indicator development?
- ❑ What are the major constraints on indicator uptake?
- ❑ How helpful were conceptual frameworks in developing useful indicators?
- ❑ To what extent are experiences common to the different country partners and to what extent do they diverge?
- ❑ How far are the same approaches applicable at different scales and in different ecosystems?

This booklet draws on experiences gained in implementing the BINU project to attempt to answer some of these questions, in the hope that this will be useful to others intending to develop indicators of their own. For each major step in the process, we have set out how what happened in practice related to our original intentions and what conclusions and recommendations we can draw from this. We conclude with some general lessons and pointers to the future.

The process

Policies and targets

All countries have policies in place that have direct or indirect impact on biodiversity. Optimistically, it might be expected that these policies would have clearly stated objectives and explicit targets. Demonstrating progress towards these targets should, in theory, provide a major role for biodiversity indicators. In reality, biodiversity-relevant policies are scattered through a wide variety of sectors and many do not include clear objectives or targets. Often policies in different sectors are not well coordinated and may sometimes be contradictory or even antagonistic.

Because of the broad range of instruments and sectors concerned, we found during the BINU project that it was often difficult to identify and analyse relevant policies comprehensively. Obvious policies that were relatively accessible included national biodiversity strategies and action plans (NBSAP), protected areas systems plans and endangered species legislation. Relevant policies in natural resource management sectors included national forest plans, fisheries policies, water policies, land-use plans and environmental impact legislation. Even when the relevant policies could be found, their objectives were often framed very generally and no mechanisms for measuring progress were specified. In other instances the declared indicators did not match the policy objectives and targets.

To maximize the role of biodiversity indicators in supporting policies, we found it important to engage with policy makers across a wide range of sectors, including those falling outside the normal areas of expertise of the indicator development team.

Involving stakeholders

There are many different groups with interests in biodiversity. Some of these, such as government conservation agencies, conservation-focused non-governmental organizations (NGOs) and relevant departments in both universities and research institutions, are relatively obvious. Others, including government agencies responsible for management of natural resources and land-use planning, agencies with an interest in rural development and indigenous peoples groups, are less obvious. Many groups also have an important direct or indirect impact on biodiversity without necessarily having a conscious interest in it, such as those involved with road construction or agriculture. These are potentially some of the most important groups to reach in communicating information about biodiversity but are also some of the hardest to engage with. Some important groups may be surprising at first sight – in Ukraine, for example, military ecologists became engaged in the BINU process as they had responsibility for large areas of land whose management could have impacts on biodiversity.

We found that the indicator development teams had varied connections with other stakeholder groups, generally having closest links with those whose interests were most closely aligned with their own, usually natural resource management agencies, conservation NGOs and academics working in the area. It was important that the teams made particular efforts to engage those outside their normal spheres and that appropriate mechanisms for engagement were used. These varied greatly with circumstances and depended, for example, on whether such consultation was a common practice locally and whether different stakeholder groups were accustomed to engaging in discussions with each other – under some circumstances, it was evident that the presence of some stakeholder groups could inhibit the frank expression of views and concerns by others.

We also found that a major barrier to meaningful interaction with stakeholders proved to be the lack of common concepts and understanding of what biodiversity is and why it may be important. As a general rule it is evident that consultation processes need to include discussions of these issues from the beginning. This is to try to ensure that stakeholders, including members of the indicator development team, understand each other as clearly as possible. However, because of the multi-dimensional nature of the term biodiversity, and the different and sometimes irreconcilable value-sets of each group involved, ultimate agreement on terms and issues will never be reached. Instead, it is more important to acknowledge that there will be some areas where individuals and groups will have to agree to disagree. An example of this is the assessment of the intrinsic value of biodiversity. Conceptual frameworks such as the pressure-state-response framework can help to clarify issues and provide a relatively stable framework for discussion (see below).

Many stakeholders may not in the first instance be clear what questions they have regarding biodiversity-related policies and management. They may also differ widely in their awareness and understanding of the relationships between biodiversity and their own interests. Presentation of potential indicators can help to stimulate stakeholders' thinking and awareness of questions that may be important to them. This requires that teams leading the process play a proactive role, which inevitably means that their own values and interests are likely to come to the fore. This is not necessarily a problem provided that it is openly acknowledged, that teams make every effort to respond to outside ideas, and that it leads to fruitful results.

Identify key questions

After initial discussions regarding what is meant by 'biodiversity' and what are biodiversity-related issues (and policies), groups consulted typically came up with a hundred or more questions covering an enormous range of subjects. Many of these initial questions, however, proved not to be the kind that are amenable to being addressed through indicators. Sometimes it was apparent that the groups or individuals involved had a very different understanding of what they were being asked to do from that of the project team. This in itself was a valuable lesson. At the very least it showed what a complicated concept biodiversity is and how important it is to develop tools for communicating at least some aspects of it to non-specialists.

It became evident that the consultation process should be regarded, even in this initial stage, as iterative – that is a preliminary session of eliciting questions should lead to further discussion and explanation, led by the project teams, and further refinement of the questions. Here again it is important that teams are able and prepared to facilitate through keeping discussions constructive and moving forward without dominating or leading too much – there is a tendency to tell people that they have asked the 'wrong' questions if the questions concerned do not fit into the framework originally anticipated by the project team.

Even after such a process of clarification and refinement of questions asked, there would typically be 50 or more questions that were thought likely to be amenable to being addressed by biodiversity indicators. This was generally regarded as too large a number to be dealt with satisfactorily under the project, and likely to be unfeasibly large under most indicator processes. To deal with this, some questions were prioritized and groups of others synthesized into more general overarching questions. High-priority questions were generally those that were asked by the largest number or widest range of people. Grouping questions together was an analytical exercise generally carried out by the core project teams. As noted above, established conceptual frameworks, particularly pressure-state-response and its variants (e.g. driver-pressure-state-impact-response), were often helpful in organizing questions, although there was a risk of trying to assign all the key questions to this framework beyond the point of meaningful analysis. The GEF's biodiversity programme framework for assessing the impact of conservation programmes also proved useful in some instances.

The synthesized questions selected proved to be very general in most cases. All the countries had questions about the state of biodiversity of their focal ecosystems and what were the main factors causing pressures on this biodiversity. The pressure-related questions reflected the priorities of each country and the institutions conducting the work. For example, in Ecuador the questions included the effects of population increase, poverty levels and infrastructure on terrestrial biodiversity. Identification of ownership and users of wetlands was identified as an important issue in Kenya. Key questions on the impacts of land-use change on biodiversity were identified in Ecuador and Ukraine, and later in Kenya. Questions related to response measures included 'What agricultural lands could be returned to the natural state in the near future?' in Ukraine, and 'What is the contribution of protected areas to the conservation of terrestrial biodiversity?' in Ecuador.

It proved crucial to retain an understanding of the specific questions underlying the general ones, in order to ensure that the indicators selected produced answers that are applicable to as many as possible of the original questions. Thus, for example, several individual questions about trends in the status of particular ecosystems and of individual species might be combined into a single question on the 'status of biodiversity'. The indicators chosen to address this general question could be composite indices of species trends (see below), but strong interest by a particular stakeholder group in trends in one species or group (e.g. flamingos as important for ecotourism in Kenya) meant that trends in those individual species might be the most meaningful indicator for addressing the general question. It also proved important for teams to track who asked which questions as this information is key to subsequent effective communication of the indicators.

Gathering data

We found in all cases that the data readily available for answering key questions were far from complete or ideal. However, teams who thought outside the immediate sphere of conservation found many additional data that could be applied to answering biodiversity questions in a diverse range of locations and sources. Thus, for example, catch statistics collected by the fisheries department in Kenya were useful for providing information on wetland condition while national socio-economic statistics collected for agricultural and development purposes proved helpful in Ecuador.

Understandably, teams found it difficult to identify and gain access to data sets that were in sectors outside their normal realm of expertise. Similarly, individuals tended to think of data at the particular spatial scales that they tended to use in their other work. It became evident, therefore, that creative thinking and a broad approach were important in locating and gathering the maximum amount of potentially useful information. However, we also found that there was a danger of diluting effort by being uncritical about which data were likely to be of the greatest use. This could be solved through constant reference to the key questions and their component original questions, as well as logistic and technical considerations.

Relevant data came in many different forms, including spatially mapped data (these days usually in the form of digital geographic information systems (GIS)), statistical compendia and survey results. Statistics and survey results usually needed to be geographically referenced in some way to be useful.

Sometimes it was possible to make use of existing expertise and experience, as well as data sets *per se*, to generate information for building indicators. This was especially true where 'hard' data were lacking but researchers and managers had large amounts of accumulated experience of the ecosystems and species of interest. For example, the team from Ukraine asked a body of experts to estimate population levels of 128 indicator species in the agricultural landscape relative to a fixed baseline, and were able to combine the resulting data into a single species trend index (see below). While it is important to track the uncertainty in these kinds of data, such 'soft' approaches have the additional advantage of preserving knowledge that is often unrecorded in any formal sense and which may disappear as individuals move on or reach the end of their careers.

Generating indicators

Using the available data to produce indicators that respond to specific key questions requires a combination of creative thinking and scientific rigour. Creative thinking is required because the indicators with the greatest impact are often produced by applying and presenting data in novel ways and by combining different kinds of data in ways that may not seem immediately obvious.

Creative thinking is also required in developing methods for presenting data to non-specialists. Scientists and technicians used to dealing with large amounts of complex data may find it hard to understand the problems that non-specialists have in dealing with and understanding such data. Complicated graphs with a dozen different variables on them, or densely packed tables with rows of figures to six decimal places are difficult even for those with some technical expertise to interpret. For non-specialists they are often incomprehensible, not to say alienating.

For this reason, it is generally necessary to simplify in order to convey useful information to a wide audience. The art in developing indicators is to simplify without losing scientific credibility. This requires a thorough understanding of the concepts being dealt with, competence in handling data and the confidence to experiment and innovate. None of these is straightforward, and it is important not to underestimate the challenges in developing robust, resonant indicators. Whatever procedures are followed, and whatever indicators are produced, it is of fundamental importance that they remain scientifically defensible – many issues related to biodiversity are contentious and may involve conflict between different interest groups. Indicators that are pressed into service in such conflicts are likely to be subjected to close and sometimes hostile scrutiny. This has occurred, for example, with the global Living Planet Index of WWF–World Wide Fund for Nature, which has been attacked by those who wish to dispute that there is any kind of global biodiversity crisis. To counter these attacks it proved vital that the methods used to produce it, and the underlying data, were scientifically defensible. In general, procedures used in indicator generation must be transparent and testable, sources of data verifiable and any potential weaknesses or biases acknowledged.

Most of the indicators developed resolved themselves into two fundamental types: map-based or spatial indicators and graph or index-based indicators. Map-based indicators were often found to have considerable initial appeal, as end-users generally find maps intrinsically attractive. However, because much GIS work is relatively new, map-based data sets often do not exist as time series, but rather as single data sets. These may be useful for generating snapshots of a particular characteristic at one point in time, but cannot demonstrate change over time, which is one of the most important attributes normally looked for in indicators. However, reliable snapshot maps can be useful as baselines against which to monitor future change – because of the rapid advance of mapping techniques, and particularly those based on remote sensing, it may be expected that most map-based variables will be much more frequently monitored in future. However, some current GIS data sets incorporate information gathered at different times (e.g. national forest maps may be compilations of a number of local maps made at very different times, extending frequently over a period of years) and do not therefore even show a reliable snapshot at any one time.

The visual appeal of maps may mask the fact that they can be hard to interpret meaningfully. Graphs, on the other hand, particularly those showing simple changes over time (frequently as trend lines), are generally quite easy to interpret, although they may be less appealing. We found that the most effective forms of communication often combined the two approaches.

Where data were scanty and not directly amenable to mapping or graphing as trend lines, other approaches were investigated. For example, in Kenya the team looking at freshwater swamps worked on developing scorecards as a way of capturing information on a wide range of variables. This generated some interesting preliminary results, but also raised a number of issues, not least that of how to combine such an approach with other methods when trying to present a wider picture. This remains unresolved at present.

Although most teams tested similar indicator approaches, we found that some were most appropriate to particular ecosystem types. Indicators based on mapping and measures of extent proved most appropriate for quantifying land cover, particularly forests (including mangroves), and were not very helpful for aquatic or marine systems. Indicators and indices based on direct population measures were most useful in open ecosystems where population census is practical, for example birds in wetlands and nesting sea turtles. Indirect measures such as fish catch per unit effort were especially helpful in aquatic systems, both marine and freshwater.

EXAMPLES OF INDICATORS GENERATED BY NATIONAL TEAMS

The BINU teams produced a great many indicators. A few examples are presented here to illustrate some key points in generating and presenting indicators. Further detail is included on the CD-ROM accompanying this report. Final outputs will be available in the second half of 2005.

Map-based indicators

Previous work in Ecuador has resulted in a valuable series of ecosystem and land use maps. These are visually attractive and can be used in several different ways. For example, side-by-side presentation of maps of ecosystem distribution and land use intensity allow people to identify visually the ecosystems under pressure from intensification (Figs 1 and 2).

Fig 1: Potential distribution of native ecosystems in Ecuador

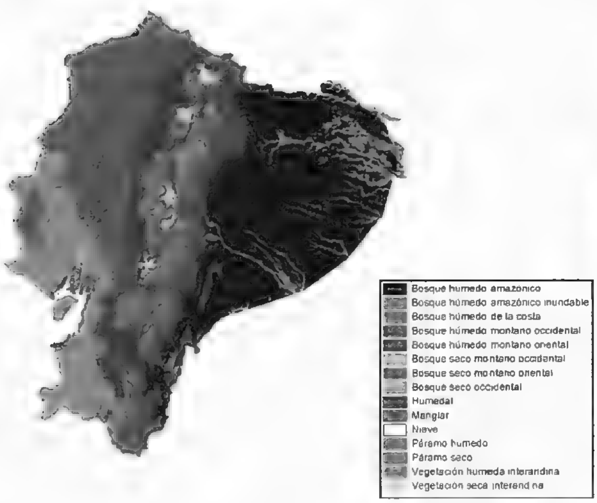
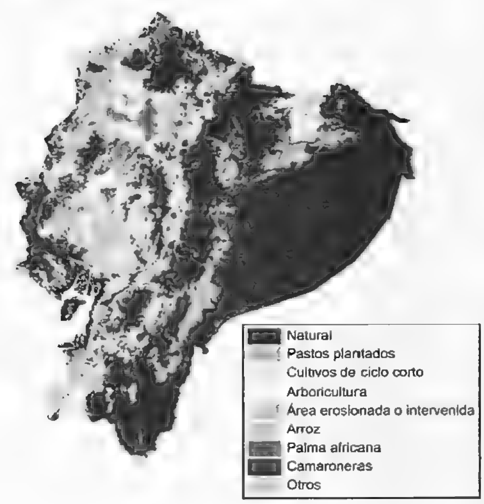
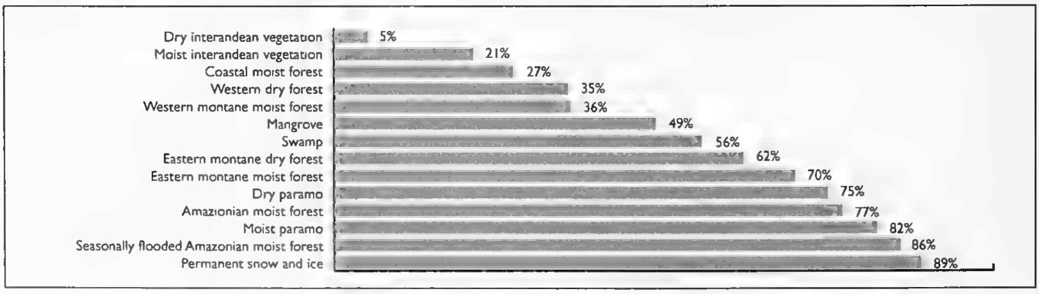


Fig 2 Distribution of current land use (2001) in Ecuador



However, the very complexity of the maps makes it difficult for users to extract much meaningful information, and a graphical summary of statistics derived from combining the maps is likely to be more useful. Such summaries make quantitative assessments feasible and enable users to make direct comparisons between categories (Fig 3).

Fig 3: Percentage remaining natural area of major terrestrial ecosystem types in Ecuador



On the other hand, simplified maps may be able to convey a very clear message, particularly where time series exist. The loss of forest cover in the catchment of lake Nakuru in Kenya is a cause of increasing pressure on the wetland resulting from siltation and changes in the surrounding hydrology.

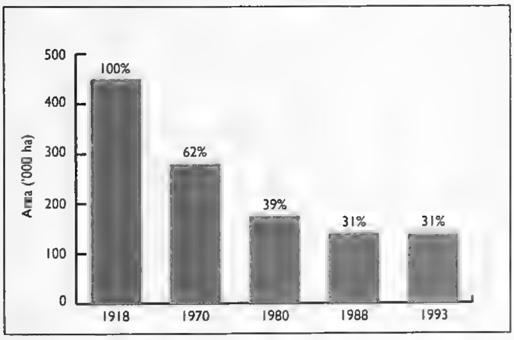
Fig 4: Lake Nakuru catchment basin: changes in forest cover 1930-1998

The maps (Fig 4) are a clear way to show how these pressures have increased over time. Time series data derived from maps can also be very useful without the accompanying map (Fig 5).

Species trend indicators

In many countries there are data on trends in the populations of species that are important because they are of economic value, because they are culturally significant or because they have been the subject of scientific study.

Fig 5: State of mangrove cover for all mangrove sites in the Philippines 1918-1993



For example, the Kenya Wildlife Services and various researchers have over the decades censused water birds on several lakes in Kenya. As a result many time series of population estimates (Fig 6A) are available. Though these data are too complex in their raw form to be interpreted by most people, they can be simplified into meaningful indicators in different ways to answer different questions.

Calculating a multi-species trend indicator using the method of the Living Planet Index (6B) provides an overview of the trend in species status over time in these wetlands and by implication of the trend in biodiversity status more generally.

Fig 6A: Population trends for eight bird species on Lake Naivasha, 1981-2000

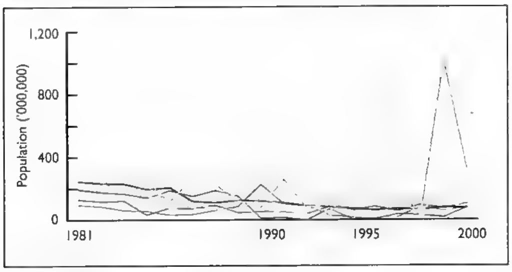


Fig 6B: Composite index for eight bird species on Lake Naivasha, 1981-2000

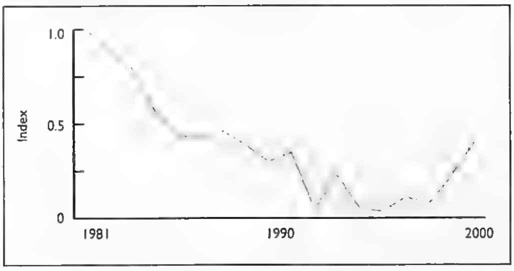


Fig 6C: Combined Lesser Flamingo populations on three Kenyan lakes, 1954-2003

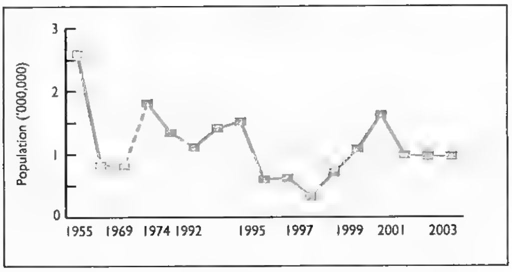
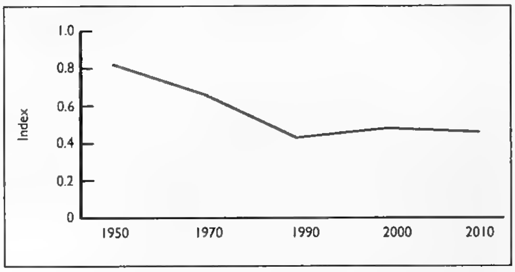


Fig 6D: Ukraine's changing agrobiodiversity 1950-2010



However, the Kenyan team found that a different approach was more appropriate for those primarily interested in the economic value and use of wetlands. In this case the trends in a single species key for ecotourism, the lesser flamingo (6C) proved more meaningful.

In other circumstances where species census data are lacking, the expertise and experience of researchers as well as conservation practitioners are a valuable source of information that can be harnessed in semi-quantitative form to provide similar indicators. For example, in Ukraine, experts were asked to provide estimates of the populations of species relative to a historical baseline (1950). These estimated tends were then combined using the LPI technique to show changing agrobiodiversity status (6D).

Indirect measures

Other sources of data also serve to provide information on the state of ecosystems and the causes of trends within them. In this case, fisheries data on landings in the Philippines (Fig 7) show how the magnitude of pressure on fish changes over time. Exploitation rate, the ratio of fisheries-induced mortality to total mortality, shown here for demersal species (Fig 8) both an indication of pressure over time and, when compared to a standard threshold value of 0.5, an instantaneous measure of species

Fig 7: Marine capture fisheries production in the Philippines, 1970-1994

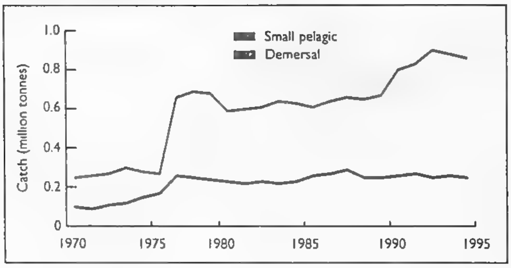
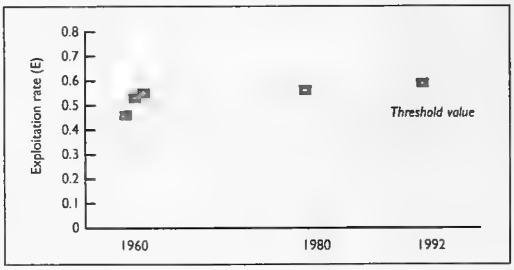
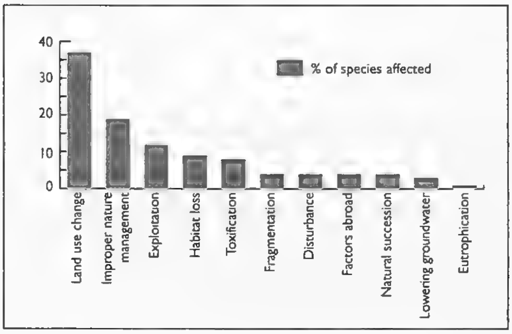


Fig 8: Average exploitation rate (E) of marine fish in the Philippines, 1955-1995



status (stable or over-exploited). Assessing the relative importance of different causes of biodiversity change is frequently problematic. The Ukraine team also assessed the principal causes of the changes in species populations. The resulting data (Fig 9) are expressed as the fraction of species for which the each cause of change is the principal one.

Fig 9: Causes of species population change in agroecosystems in Ukraine



Measures of Response

Many of the key questions called for indicators of how effective actions are in conserving biodiversity. These were some of the most problematic for the BINU teams to supply, but several options did emerge in the Philippines. A very effective one came from the statistics gathered by sea turtle protection programmes (Fig 10) which show increases in both the number of eggs produced and the proportion conserved over the time since the programme was implemented.

Important indicators of effectiveness can be generated from GIS overlays of protected areas and land cover, which were used in Ecuador to identify the degree of ecosystem conversion within protected areas.

Combining a map of the protected areas of Ecuador, with maps of both ecosystem distribution and land use intensity allowed the Ecuadorean team to assess the amount of the remaining 'natural' area (i.e. the area neither converted nor in a mosaic in the process of conversion) included in the national system of protected areas.

As before, the map (Fig 11) is attractive and informative, but a graphical representation of this analysis may be more easily understood (Fig 12). It shows that although approximately 25 per cent of the country's natural area is protected, some ecosystems are very poorly protected. The user can grasp immediately which ecosystems are best covered by the protected areas system in their natural state.

Fig 10: Sea turtle eggs conserved or expoited on the Philippine Turtle Islands

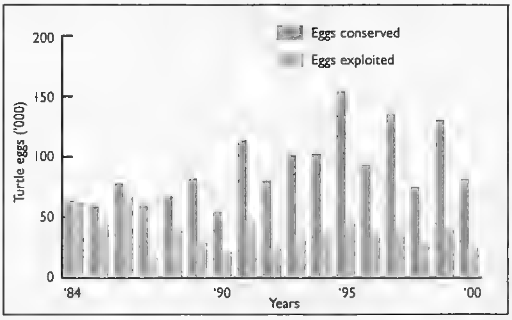


Fig 11: Location of continental terrestrial protected areas in the Ecuadorean National System of Protected Areas (SNAP) in 2003, in relation to ecosystem status in 2001 (converted, mosaic in the process of conversion, or natural).

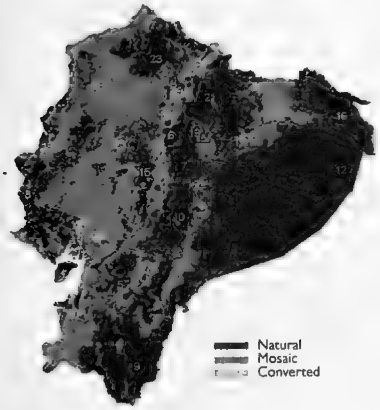
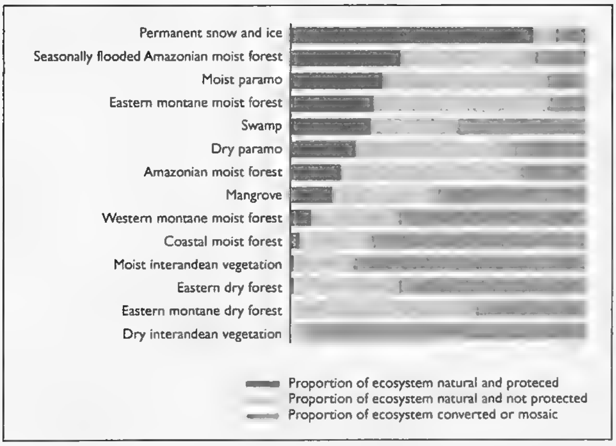


Fig 12: Protection of remaining natural area of major terrestrial ecosystems in Ecuador (2001)



Continued stakeholder input and review

As an integral part of the BINU project, it was envisaged that key stakeholders would be asked to review the indicators produced and give feedback on which ones were the most understandable and useful for answering their questions about biodiversity, and therefore appropriate for supporting decision making. A key first step was the critical review of indicators by the teams themselves and others directly involved in indicator development. In this process it was important to refer both to the original questions, remembering who asked them, and to the synthesized key questions.

All the teams found it difficult to conduct a wider review of the indicators within the time frame of the initial indicator development process (two years), which made meticulous internal review even more important. They recognized that ultimately they would need feedback from both the stakeholders involved in the initial consultations and from a broad range of end-users of the indicators. Establishing meaningful contact with the latter group may be more problematic than continuing to interact with the more familiar stakeholders.

We learned that workshops may not be the best format for this review, but that more valuable feedback might be obtained from informal interactions between members of the development teams and single or small groups of individuals, especially if they have been provided in advance with indicator examples. This approach has the added advantage of effectively marketing the indicators and building support for them, which is vital to ensure their uptake and continued use.

Countries also found that different groups had greatly differing expectations of the degree to which they expected to be involved in indicator review as an ongoing process. In Kenya, for example, four different general categories of stakeholder had distinct expectations of their involvement. Local communities and resource users were mainly interested in the end results of the process to the extent to which these could empower them in decision making and resource use. Policy makers and regulators were also mainly interested in the end results of the process, to provide them with background information on the state of the resource. Resource management and research institutions, on the other hand, often became actively involved in the indicator development process, using it to build their own capacity and understanding. Non-governmental organizations were also often interested in the process as much as in the end-product, seeing it as a possible way of enhancing the participation of the wider community in decision making.

Whatever the perspectives of different stakeholders and end-users, it became evident that continuing to seek guidance from them beyond the initial stages of development is fundamental to ensuring that the indicators are appropriate and to promoting their uptake and continued use. This consultation should be regarded as an ongoing, iterative process.

Organization and sustainability

Being a relatively new subject, biodiversity indicators require capacity and new ways of thinking that may not exist within a single agency. We found that both NGOs and government agencies were able to work in successful partnerships to generate indicators, and that such partnerships helped to resolve problems of capacity. The need for additional capacity was not solely in technical areas but also for some teams in such areas as communication and writing skills. Therefore, teams made up of several individuals with diverse backgrounds and training were found likely to be most effective in generating and communicating indicators.

The ways that indicator development teams organized their work varied widely, from very centralized work by a few individuals (Ecuador), to work by specialized task forces focusing on particular subsets of the ecosystem or issue (Kenya), to outsourcing of large amounts of the work (Philippines). Each approach was found to have its advantages and disadvantages. A team that is limited in numbers and scope is likely to have a more consistent overview of the resources available and the materials it has generated. However, it loses some opportunities for cross-fertilization between disciplines and for mutual motivation among team members. There may also be less perceived incentive for careful documentation in this case. Sub-groups focused on subsets of the ecosystem or issue allow energies to be concentrated on the most relevant areas for each subset, but can then present problems in generalizing the indicators chosen to broader scales. Outsourcing to specialists has the advantage of harnessing advanced skills and knowledge, but can be difficult to manage in a coordinated fashion.

Working in partnerships and different

organizational configurations makes even more important the need to document carefully the work that is done, and especially the data that are collated. Careful management of data and their associated metadata is vital. Drafting a fact sheet for each indicator is an important means of documentation to ensure clarity and continuity in its future use. We found that this process was also an important step in clarifying both the design and the use of the indicator within the team, and that the drafting process sometimes highlighted methodological problems that needed to be resolved.

The existence of such clear documentation is a major factor in ensuring the uptake and sustainability of the indicators. Involving representatives of national statistical agencies as stakeholders early in the indicator development process provided one effective way to promote uptake. Both Ecuador and Ukraine did this and report that inclusion of biodiversity indicators in national statistical summaries is now officially planned.

The greatest utility of the indicators will arise from their sustained use and repeated calculation to show trends and progress (monitoring). This monitoring can itself foster further continuity and raise awareness of new issues that need to be addressed both by policy and indicators. Therefore, the establishment of monitoring systems is vital to ensure that subsequent biodiversity-related decisions are based on appropriate and timely information.

General conclusions

Concepts of biodiversity in general and biodiversity indicators in particular are new. Certainly biodiversity is a concept that appears to have become ever more difficult to define as the term itself has gained currency. With little fundamental agreement as to what it actually means, it is not surprising that it is hard to gain consensus on what makes a good indicator for it.

Our way of trying to deal with this was to turn the process round and allow a range of people to determine what questions they wanted answered about biodiversity, however they understood the term. Members of the BINU teams quickly grasped the value of this approach. It did represent, however, a major departure from the way most people were accustomed to carry out their work and proved difficult to sustain through later phases of the process. That is, when data were being assembled and indicators developed, it was easy to lose sight of the key questions and those who had asked them. Different stakeholders want indicators for different purposes and will use them in different ways; the scientific teams who develop indicators have to make special efforts to understand these different needs and uses. Identifying the users of indicators and involving them throughout the development process is key to ensuring both the usefulness and use of the indicators.

Indicators could be used, for example, for raising awareness and stimulating policy development, for monitoring progress towards targets, or as analytic tools for trying to understand particular processes. It is very easy to confuse these different roles when carrying out indicator development.

Most importantly, it became increasingly evident that indicators were likely to be of only very limited use to most stakeholders unless they could be directly linked to actions – that is responses – of some kind. The main interest, for example, of users of renewable natural resources such as fishers was in ensuring that their resource base was maintained and could continue to deliver benefits to them into the future. That is, their main concern was that effective management should be in place. Without an existing responsive management or policy framework for indicators to feed into, their role will continue to be highly compromised. Having said that, there are examples where development of effective indicators can itself apparently drive policy and management decisions: in the United Kingdom, the national adoption of an indicator based on the population status of farmland and woodland birds has led to the development of policies and targets aimed at reversing declines in these, which should ultimately lead to changed management practices on the ground.

In the BINU process it proved difficult within the 30-month project period to develop a finely honed suite of biodiversity indicators that were widely taken up by stakeholder groups. Nevertheless, the project process itself generally helped to raise the profile of biodiversity as an issue within the country concerned, stimulating discussion of the subject in sectors that had previously given it little consideration. In addition, participants in the project enhanced their individual capacities substantially both through implementing the process and through interacting with other teams and international partners.

Overall, considerable interest in biodiversity indicators was generated in the countries that took part in the project. However, it was evident that, given the generally limited resources available for activities related to biodiversity in these and other developing countries, external support will still be needed if substantial further progress is to be made.

The future

The BINU project was begun at a time when few had any understanding of what biodiversity indicators were. We believe that the project has shown that, even from a very basic starting point and with limited resources, it is possible to make great strides in the development of biodiversity indicators in a relatively short space of time. In all the participating countries we have shown that there is a potential user-base for such indicators, and that data already exist to enable at least some useful indicators to be developed.

The international profile of biodiversity indicators has increased considerably while the BINU project has been in progress. Most importantly, they are closely linked to the 2010 biodiversity target, agreed by the Parties to the Convention on Biological Diversity at their 6th meeting in April 2002 and by the participants at the World Summit on Sustainable Development in the autumn of that year. This target is to achieve, by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and national levels. The work done under the BINU project makes a notable contribution to efforts to measure progress towards the target, particularly at the national level. There is a strong relationship between many of the indicators developed under BINU and the list of indicators agreed by the CBD Conference of the Parties (in February 2004) for assessing and communicating progress towards the 2010 biodiversity target at the global level (Table 1). This means that national and global level indicators can be mutually reinforcing and this in turn should help ensure that coherent messages about biodiversity are conveyed to a wide range of audiences.

It is important therefore that momentum in biodiversity indicator development is maintained in the countries already involved but equally important that as many other countries as possible begin their own processes. Encouragingly, some have already started out – Uganda, for example, is beginning to use indicators of the kind discussed above in its state of the environment reporting. The partners in the BINU project are very keen to share their experiences and to support other countries' efforts to develop biodiversity indicators for their own national needs, including tracking progress towards the 2010 target.

Table 1: Indicators proposed by CBD COP7 for monitoring progress towards the 2010 target

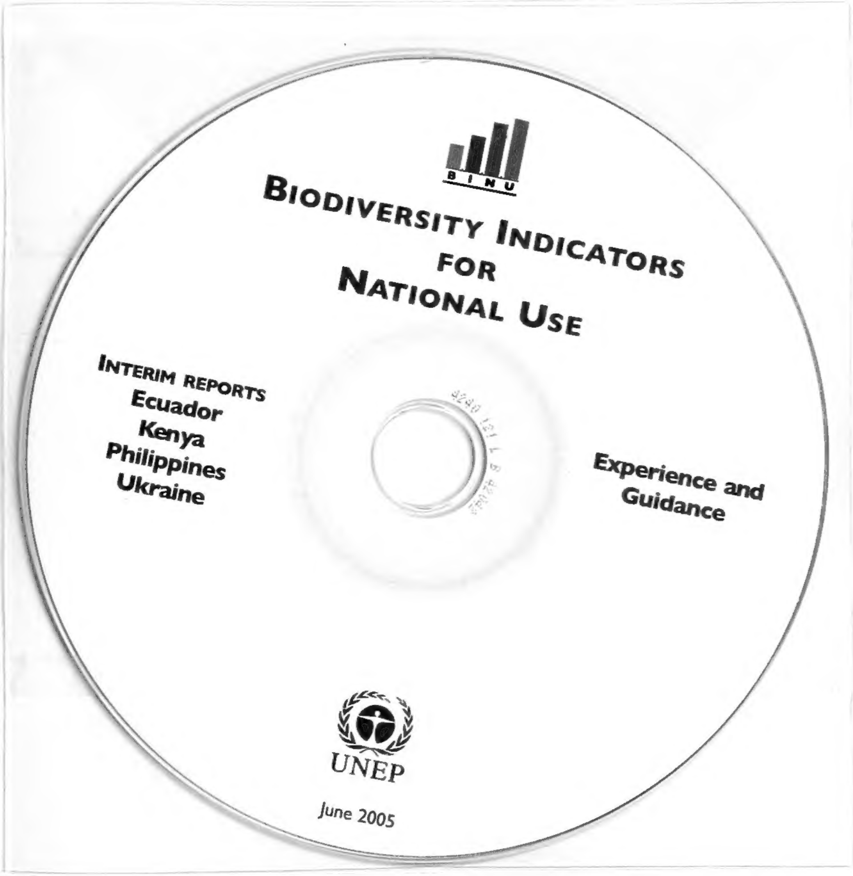
	Occurrence among BINU teams' indicators			
	Ecuador	Kenya	Philippines	Ukraine
Change in extent of selected biomes, ecosystems & habitats	✓✓	✓✓	✓	✓
Change in species abundance and distribution		✓✓	✓✓	✓✓
Coverage of protected areas	✓✓	✓	✓	✓
Change in status of threatened species			✓	✓
Marine trophic index				
Trends in genetic diversity of domesticated plants & animals				✓
Water quality in inland waters		✓		
Nitrogen deposition; numbers and costs of alien invasions	*	*	*	*
Connectivity and fragmentation of ecosystems	✓			✓
Health and well-being of people in biodiversity-dependent communities	✓	✓		

* Other pressure indicators were developed by the BINU countries.

CD-ROM of the BINU project interim reports

This CD-ROM presents the interim reports of the four national teams of the 'Biodiversity Indicators for National Use' (or BINU for short) project, as of December 2004. The final reports will be available in the second half of 2005.

The aims and formats of each national team's reports vary according to the needs and audiences of their country, as the project's outputs are firstly for national use. The structure of the reports also reflects the different ways in which the project was organised in each country. The CD-ROM contains an introduction to the reports.



Biodiversity Indicators for National Use

Experience and Guidance

This booklet gives a summary of the experience of a GEF-funded project carried out between 2002 and 2005 on biodiversity indicators for national use, or BINU for short. The overall aim of the project was to develop operational national-level biodiversity indicators to support planning and decision-making in the four participating countries: Kenya, Ecuador, Ukraine and Philippines. The project includes dissemination of the approaches it has developed, so as to support the production of biodiversity indicators by other countries and at global level under the CBD.

The BINU project developed a process, or series of steps, in producing biodiversity indicators for national use. This report presents our experience and lessons learned so far at each stage, although it is not intended to be a detailed manual on how to undertake this work. Some examples are given of the indicators that have been developed, and copies of interim reports of the national partners are included on the CD-ROM with this booklet. The final results of the project will be available in the second half of 2005.

The project has shown that even from a very basic starting point and with limited resources, it is possible to make great strides in the development of biodiversity indicators in a relatively short space of time. In all the participating countries we have shown that there is a potential user-base for such indicators, and that data already exist to enable at least some useful indicators to be developed. The partners in the BINU project are very keen to share their experiences and to support other countries' efforts to develop biodiversity indicators for their own national needs, including reporting on the tracking of progress towards the '2010 biodiversity target'.

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