Support to Building the Inter-American Biodiversity Information Network

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Linking Biodiversity Information with Non-biological Networks

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Support to Building IABIN (Inter-American Biodiversity Information Network) Project

Linking Biodiversity Information with Non-biological Networks

Project Background

The World Bank has financed this work under a trust fund from the Government of Japan. The objective is to assist the World Bank in the completion of project preparation for the proposed project Building IABIN (Inter-American Biodiversity Information Network), and for assistance in supervision of the project. The work undertaken covers three areas: background studies on key aspects of biodiversity informatics; direct assistance to the World Bank in project preparation; and assistance to the World Bank in project supervision. The current document is one of the background studies.

The work has been carried out by Nippon Koei UK, in association with the UNEP World Conservation Monitoring Centre.

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Report Summary

Linking biodiversity information with other key elements such as socio-economic information is essential for answering questions concerning sustainable development and connections to human health and poverty alleviation. Apart from national statistical and socio-economic databanks in the countries of the IABIN region, the most relevant sources of non-biological information are the Center for International Earth Science Information Network (CIESIN), FAO Statistics Division (FAOSTAT), UN Commission for Sustainable Development (UN-CSD), United Nations Statistical Division, Organisation for Economic Cooperation and Development (OECD), GEO Data Portal, the World Bank, and the Global Observing Systems.

These principal non-biological networks and information services are relatively consistent in the way that information can be obtained. Essentially, they provide data "tables" (usually downloadable) in which aggregated statistics are presented against an administrative or political unit (usually country) and a time-period (often one year). Most commonly these are presented as a simple text file, or a Microsoft compatible table or spreadsheet that can be easily integrated into user databases, provided there is an appropriate link to the administrative unit.

Where graphic interfaces and mapped output are provided, these are usually simple and mainly consist of national or regional boundaries in common formats. Interactive geo-spatial processing is not generally provided. As far as can be determined, all significant non-biological information services are supported by relational database technology, and use common Web-based interface methods, but there is no consistent standard.

The two most active global programmes that are utilizing linked biological and non-biological data are the UNEP-led GEO process, and the Millennium Ecosystem Assessment (MA). Both have found that it is essential to categorise and summarise biological data using standardised ecosystem frameworks, so that it can be effectively linked to the socio-economic data based on administrative units. Once this standardisation of ecosystem information is obtained, the use of GIS functionality to link between the administrative and biological frameworks is an important tool.

Key recommendations for how IABIN can assist in the effective linkage include:

- Encourage and facilitate the preparation and wide availability of ecosystem mapping frameworks for the region, including, a consistent ecosystem map of the Americas that extends the existing North American map, boundary mapping of the 10 MA Ecosystem categories, and other internationally recognised mapping frameworks.
- Assemble, standardise and make available a consistent GIS coverage of administrative boundaries within the Americas, at least to the first sub-national level, suitable for use to overlay with the ecosystem mapping. Such a coverage should be made compatible with the national and regional designations used by the principal non-biological networks, particularly the UN Statistical Division and the GEO process;
- Provide guidance and standards for using the analytical capability of GIS to integrate information from administrative and natural spatial frameworks;
- Facilitate the development of harmonisation tools for biodiversity information management, including agreed classification systems for habitats and ecosystems, core datasets for major biodiversity information categories, standardised species nomenclature, standardised vocabulary (multi-lingual), and so on, thus enabling consistent linkage with non-biological networks;
- Maintain links to the web sites of the key international and regional sources of non-biological data and maintain metadata, and provide guidance information on best uses of these sources;
- Work to define the indicators suitable to the region and the resulting needs for biodiversity and non-biological data in order to develop a systematic long-term monitoring system. This should be suitable for supporting the 2010 targets and MDGs, in structures that facilitate linkage with national and regional socio-economic data.
- Clearly define the roles and responsibilities of the Thematic Networks and their Coordinating Institutions in the development of indicators and the implementation of long-term monitoring programmes. These should provide consistent time-series using standardised IABIN ecosystem and administrative mapping units – and hence could be linked to non-biological data regionally and internationally.

CHAPTER 1 INTRODUCTION

1.1 Background

The ultimate success of IABIN will not only be in its use and organisation of biological information, but also in how well this information can be combined with social and economic information to increase its value and usability. Without an ability to link biodiversity information to its social, economic and technical consequences, "biodiversity" information is not particularly useful to the non-specialist wishing to answer questions concerning sustainable development, human health and poverty alleviation. The purpose of this report is to review the lessons learned from what has been done elsewhere in linking these elements, and to recommend how IABIN can benefit from these experiences.

The principal author of this report was Ian K. Crain.

The report should be read in conjunction with Document 1 - *IABIN in the Context of Key International Programmes and Initiatives in Biodiversity Information Sharing* and Document 2 - *Biodiversity Information for Decision Making – International Experiences.*

1.2 Scope of non-biological information for IABIN

As discussed in Document 1, several extracts from key documents of the Building the Inter-American Biodiversity Network project (abbreviated as B-IABIN to distinguish the **project** from the **network** IABIN) are indicative of the intended scope of IABIN.

From the GEF Project Brief for B-IABIN:

"The project development objective is to:

(i) develop an Internet-based, decentralized network to provide access to scientifically credible biodiversity information currently existing in individual institutions and agencies in the Americas;

(ii) provide the tools necessary to draw knowledge from that wealth of resources, which in turn will support sound decision-making concerning the conservation and sustainable use of biodiversity."

From the B-IABIN Project Implementation Plan (PIP):

"The objective of IABIN is to promote sustainable development and the conservation and sustainable use of biological diversity in the Americas through better management of biological information and better decision-making."

It is clear from the above that supporting decisions on sustainable development and sustainable use form part of the intent of IABIN. Therefore, effective decision-making will require cognisance of Agenda 21, the goals and targets of the WSSD Plan of Implementation, and the Millennium Development Goals, as well as the important objective of the Convention on Biological Diversity (CBD) "equitable sharing of the benefits" and the integration with other sectors anticipated by Article 6(b).

While the direct intent of IABIN is to foster the exchange of biodiversity (biological) information, the need to support decision making requires **linkages** to non-biological information and the tools that permit their integration and use – for instance in indicators and assessments of progress towards sustainability.

The required linkages are to networks and sources that provide information on:

- Economic activities and status, including: income levels; domestic productivity; sector economics and productivity; and trade economics;
- Social information, such as: population and demographics; health statistics; education levels; and infrastructure.

1.3 Driving Forces and Needs

1.3.1 Millennium Development Goals

In September 2000, the UN Millennium Summit adopted the Millennium Development Goals (MDGs), setting targets for, *inter alia*, eradicating extreme poverty and hunger, achieving universal primary education, promoting gender equality, reducing child mortality, combating disease, and ensuring environmental sustainability. The eight MDGs comprise 18 targets and 48 indicators and are considered to be the framework for measuring development progress. To support the MDGs, the UN launched the Millennium Project in 2002. Over a period of three years, the Millennium Project intends to devise a recommended plan of implementation to assist developing countries to meet the MDG targets by 2015.

The 8 MDGs and associated targets are shown in Table 1. While MDG 7 is the most closely tied to biodiversity, there is clear relevance to MDGs 4, 5 and 6 in the context of biodiversity and human health, and with MDG 8 in the context of biodiversity food supply and sustainable use. MDGs 2 and 3 are crosscutting.

Table 1 Millennium Development Goals and Targets

Goal	Targets	Indicators
Goal 1: Eradicate extreme poverty and hunger	**Target 1**: Halve, between 1990 and 2015, the proportion of people whose income is less than $1 a day **Target 2**: Halve, between 1990 and 2015, the proportion of people who suffer from hunger	1a. Proportion of population below $1 a day 1b. National poverty headcount ratio* 2. Poverty gap ratio at $1 a day (incidence x depth of poverty) 3. Share of poorest quintile in national consumption 4. Prevalence of underweight in children (under five years of age) 5. Proportion of population below minimum level of dietary energy consumption
Goal 2: Achieve universal primary education	**Target 3**: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	6. Net enrolment ratio in primary education 7a. Proportion of pupils starting grade 1 who reach grade 5 7b. Primary completion rate 8. Literacy rate of 15 to 24-year-olds
Goal 3: Promote gender equality and empower women	**Target 4**: Eliminate gender disparity in primary and secondary education preferably by 2005 and in all levels of education no later than 2015.	9. Ratio of girls to boys in primary, secondary, and tertiary education 10. Ratio of literate females to males among 15- to 24-year-olds 11. Share of women in wage employment in the non-agricultural sector 12. Proportion of seats held by women in national parliament
Goal 4: Reduce child mortality	**Target 5**: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate	13. Under-five mortality rate 14. Infant mortality rate 15. Proportion of one-year-old children immunized against measles
Goal 5: Improve maternal health	**Target 6**: Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio	16. Maternal mortality ratio 17. Proportion of births attended by skilled health personnel
Goal 6: Combat HIV/AIDS, malaria, and other diseases	**Target 7**: Have halted by 2015 and begun to reverse the spread of HIV/AIDS Target 8: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	18. HIV prevalence among 15- to 24-year-old pregnant women 19. Condom use rate of the contraceptive prevalence rate 19a.Condom use at last high-risk sex 19b.Percentage of population aged 15-24 with comprehensive correct knowledge of HIV/AIDS 19c.Contraceptive prevalence rate 20. Ratio of school attendance of orphans to school attendance on non-orphans aged 10-14 21. Prevalence and death rates associated with malaria 22. Proportion of population in malaria-risk areas using effective malaria prevention and treatment measures 23. Prevalence and death rates associated with tuberculosis 24. Proportion of tuberculosis cases detected and cured under directly observed treatment short course (DOTS)
Goal 7: Ensure environmental sustainability	**Target 9**: Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources **Target 10**: Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation **Target 11**: Have achieved, by 2020, a significant improvement in the lives of at least 100 million slum dwellers	25. Proportion of land area covered by forest 26. Ratio of area protected to maintain biological diversity to surface area 27. Energy use per unit of GDP 28. Carbon dioxide emissions (per capita) and consumption of ozone-depleting chlorofluorocarbons 29. Proportion of population using solid fuels 30. Proportion of population with sustainable access to an improved water source, urban and rural 31. Proportion of population with access to improved sanitation 32. Proportion of households with access to secure tenure

Goal 8: Develop a global partnership for development	**Target 12**: Develop further an open, rule-based, predictable, non-discriminatory trading and financial system (includes a commitment to good governance, development, and poverty reduction—both nationally and internationally) (Some of the indicators listed will be monitored separately for the least developed countries, Africa, landlocked countries, and small island developing states.) **Target 13**: Address the special needs of the least developed countries (includes tariff- and quota-free access for exports enhanced program of debt relief for HIPC and cancellation of official bilateral debt, and more generous ODA for countries committed to poverty reduction) **Target 14**: Address the special needs of landlocked countries and small island developing states (through the Program of Action for the Sustainable Development of Small Island Developing States and 22nd General Assembly provisions) **Target 15**: Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term **Target 16**: In cooperation with developing countries, develop and implement strategies for decent and productive work for youth **Target 17**: In cooperation with pharmaceutical companies, provide access to affordable, essential drugs in developing countries **Target 18**: In cooperation with the private sector, make available the benefits of new technologies, especially information and communications	33. Net ODA total and to least developed countries, as a percentage of OECD/DAC donors' gross income 34. Proportion of bilateral, sector-allocable ODA of OECD/DAC donors for basic social services (basic education, primary health care, nutrition, safe water, and sanitation) 35. Proportion of bilateral ODA of OECD/DAC donors that is untied 36. ODA received in landlocked countries as proportion of their GNI 37. ODA received in small island developing states as proportion of their GNI 38. Proportion of total developed country imports (excluding arms) from developing countries and least developed countries admitted free of duties 39. Average tariffs imposed by developed countries on agricultural products and clothing from developing countries 40. Agricultural support estimate for OECD countries as a percentage of their GDP 41. Proportion of ODA provided to help build trade capacity 42. Total number of countries that have reached their HIPC decision points and completion points (cumulative) 43. Debt relief committed under HIPC initiative, US$ 44. Debt service as a percentage of exports of goods and services 45. Unemployment rate of 15- to 24-year-olds, male and female and total 46. Proportion of population with access to affordable, essential drugs on a sustainable basis 47. Telephone lines and cellular subscribers per 100 population 48a.Personal computers in use per 100 population 48b.Internet users per 100 population

The relationship between the MDGs and biodiversity were discussed at a high-level meeting in London in March 2003, "Biodiversity after Johannesburg: The critical role of biodiversity and ecosystem services in achieving the United Nations Millennium Development Goals".

Particularly with regard to how biodiversity can contribute to MDG 7, aiming to "ensure environmental sustainability", it was recognized that achieving this rests, *inter alia*, upon the two key aspects of water supply: quantity and quality. There was an identified need to consider the interaction between hydrological systems and biodiversity, including: effective watershed management to ensure continuous flows of water and avoid erosion, sedimentation and flooding; sustainable management of alluvial plains to preserve groundwater purity; and coastal protection by mangrove ecosystems. It was stressed that biodiversity provides additional services to those provided by human-made infrastructures.

Information gaps relating to the mapping and ecological characterisation of watersheds were recognised. Participants agreed that governments and institutions

could use watersheds as a spatial framework for monitoring and management to facilitate data exchange and comprehensive management.

In summary discussions, Peter Schei, of the Norwegian Directorate of Nature Management, spoke on the need for integrating the MDGs into the international biodiversity policy process, emphasising linkages among the different resource frameworks. He suggested that, considering the limited power of environment ministries, the participation of business and financial actors in the biodiversity process is vital, and stressed the need for consistency between actions at the national and international levels.

Clare Short, then the UK's Secretary of State for International Development, noted that the objectives of the environmental movement in developed countries are not always consistent with those of developing countries, and lauded the commitment of developed country environment ministers to the MDGs. She said biodiversity loss results from, *inter alia*, increasing poverty, corruption, mismanagement, and illegal logging. She stressed the need to manage, rather than just conserve, biodiversity to promote economic growth and improve livelihoods of the poor, and the importance of addressing the MDGs as an integrated whole.

(The above two paragraphs are paraphrased from the already paraphrased meeting summary prepared by the International Institute for Sustainable Development.)

1.3.2 The 2010 Biodiversity Target

As noted above, the UN Millennium Summit adopted the MDGs in 2000. In 2002, various international fora acknowledged the important relationship between biodiversity and the MDGs. The 6th Conference of the Parties (COP) to the CBD, recognising that biodiversity underpins sustainable development, established 2010 as the target year for halting biodiversity loss. In September, the World Summit on Sustainable Development (WSSD) consolidated many internationally agreed goals relating to sustainable development into its Plan of Implementation, including biodiversity, and called for concerted action from all sectors of society to meet these goals. Specifically, the WSSD called for "significantly reducing biodiversity loss by 2010" and this target was endorsed by the participating nations.

This target is now in the process of being interpreted and articulated into indicators. A second "*Biodiversity after Johannesburg*" meeting was held in London in May 2003 "*2010 - The Global Biodiversity Challenge*".

A key issue for the meeting was how to translate the political commitment to the 2010 Target into tangible and quantifiable results and to find ways of achieving

and measuring progress in meeting the target. In general, it will require the engagement of all sectors of society and full integration of biodiversity into countries' social and economic programmes.

Mark Collins of UNEP-WCMC suggested that achieving the 2010 target was "fraught with difficulties", including the need to communicate and explain the importance of biodiversity more effectively and convincingly. He cited the need for high-level communicators to make information relevant to sectors such as fisheries and agriculture, and the need for biodiversity indicators that can be widely understood, and for information that is both relevant and accessible.

Of particular relevance to IABIN, Jorge Soberon, Executive Secretary of the Mexican National Commission on Biodiversity, described the schism that separates the language, objectives and activities used at the international and country levels. Recalling negative trends highlighted by the Living Planet Index, he explained how immediate causes (habitat loss and fragmentation, over-exploitation of wild living resources, invasive species, and pollution of soil, water and atmosphere) and not root causes (democratic growth, failure of institutions, market failures, policy failures, lack of information, unsustainable cultural and consumption patterns) are addressed by numerous conventions and strategies. He suggested that conventions should more strongly address root causes, while measurement programmes continue to focus on immediate causes.

Among the conclusions drawn was that changes in the rate of biodiversity loss can only be measured if there are comparable, multiple observations over time, and that baselines are necessary as starting points for observations. There was also agreement on the need to develop and apply practical methods in assessing trends in the economic and social valuation of biodiversity. In summary, there was a need to identify a small number of achievable and reliable indicators that will be useful in policy development, and the need to link the biodiversity goal with other development goals, such as reducing hunger, poverty and disease.

CHAPTER 2 PRINCIPAL NON-BIOLOGICAL INFORMATION SOURCES

2.1 Overview

From the preceding discussion it is clear that information is required from sources beyond the mainstream "biodiversity" institutions (e.g. wildlife and national park managers, biological scientific and research centres, museums and herbaria, environment departments, nature conservation NGOs), i.e. from national institutions related to health, census, resource economics and culture. The institutions involved will differ from country to country.

Internationally, there are a number of information sources that provide relevant socio-economic data in integrated and accessible form. These sources overlap in coverage of subject matter content. Most include basic population and economic statistics and some deal further with various standard indicators of economic and social status or development. As "integrated" sources, none can truly be considered as primary sources. Most of them refer to each other as sources, and so it is difficult to assess which have modified what information from which (primary) source, and for what reason. Some of the most important of these are described in the following sections, particularly those with some connection to environmental data and issues.

2.2 Center for International Earth Science Information Network (CIESIN)

CIESIN was established in 1989 as an independent non-governmental organization to provide information that would help scientists, decision-makers, and the public better understand the changing relationship between human beings and the environment. It is a centre within Columbia University's Earth Institute (USA).

CIESIN's stated mission is to "provide access to and enhance the use of information worldwide, advancing understanding of human interactions in the environment and serving the needs of science and public and private decision-making".

It provides downloadable data tables on the following topics:

- Agriculture;
- Biodiversity & Ecosystems;
- Climate Change;
- Environmental Assessment & Modelling;
- Environmental Health;

- Environmental Treaties;
- Indicators;
- Land Use/Land Cover Change;
- Population;
- Remote Sensing for Human Dimensions Research.

One part of CIESIN is the Environmental Treaties and Resource Indicators (ENTRI) system. Supported by NASA, this can be used to obtain texts of conventions and tables of parties. Both UNEP and IUCN are acknowledged as sources, but it is not clear what the relationship is with ECOLEX - which one updates the other, or why two separate services are needed.

The associated Socio Economic Data and Application Centre (SEDAC) provides socio-economic data on a national basis, summarised from a range of sources. Included are several population datasets including a global gridded coverage. The CIESIN service emphasises "global change" as interpreted from remotely sensed data, and provides tools for displaying information in mapped GIS form.

CIESIN is a collaborator with the Millennium Ecosystem Assessment (MA), particularly with regard to the "Ecosystem condition and human well-being" chapter. No access to the MA data or information on methodology seems to be available from the CIESIN site (URL: //www.ciesin.org).

2.3 FAO Statistics Division (FAOSTAT)

For many years the UN Food and Agriculture Organisation (FAO) has maintained national statistics and published data books on water, food, energy, and agricultural resources, as well as useful demographic and social indicators. All these data tables can now be accessed through FAOSTAT, an on-line and multilingual database currently holding over 1 million time-series records covering international statistics in the following areas:

- Food Balance Sheets;
- Fertilizer and Pesticides;
- Land Use and Irrigation;
- Forest Products;
- Forestry Activities;
- Fishery Products;
- Fisheries Activities;
- Population;

- Agricultural Machinery;
- Food Aid Shipments;
- Agricultural Production;
- Food Aid;
- Agricultural Trade;
- Agricultural Machinery, Fertilizer and Pesticides.

The information mainly comes from standardised questionnaires provided by official national government sources. The population data tables given refer to the UN Statistics Division. The principal strong point of these datasets is the historical time-series of data gathered in a standard way. The figures are posted mainly as reported by the "official" sources. Forest cover information, for instance, is notoriously at variance with remotely sensed observations (URL: currently //apps.fao.org but in the process of moving to //faostat.fao.org).

2.4 UN Commission for Sustainable Development (UN-CSD)

The CSD information is maintained and made available through the UN Department of Economic and Social Affairs, Division for Sustainable Development. Most of the information is maintained and provided in structured narratives derived from national reports, and consists of descriptions of national activities and responses under four main headings: Social, Natural Resource, Economic, Institutional. Subheadings are as follows:

- Social (poverty, demographics, health, education, human settlements);
- Economic (international cooperation, trade, changing consumption patterns, financing, technology, industry, transport, sustainable tourism);
- Natural Resource (agriculture, atmosphere, biodiversity, desertification and drought, energy, forests, freshwater, land management, mountains, oceans and coastal areas, toxic chemicals, waste and hazardous materials);
- Institutional (integrated decision-making, major groups, science, information, international law).

Nations are free to include data tables under the various sub-headings, but most do not. In addition to these mainly narrative descriptions of responses, a subset of participating countries have been engaged in a trial of indicators, and these trial indicators are available – the only quantitative information available through the site (URL: // www.un.org/esa/sustdev).

2.5 United Nations Statistical Division

Under the UN Department of Economic and Social Affairs, the United Nations Statistics Division provides a wide range of Economic and Social statistical databases. These are assembled as time-series on national basis, mainly available in an unrestricted way for download.

They include tables of social indicators covering a wide range of subject matter fields such as education, housing, health, water, and so on, as well as population data for capital cities and cities of 100,000 and more inhabitants, and populations of city proper urban agglomerations.

There is also a "good practices database" that provides information on good practices in official statistics.

Of considerable interest, as well, is the Millennium Indicators Database that is assembling the data for the 48 indicators measuring progress towards the achievement of the Millennium Development Goals.

Also available on a subscriber basis is the United Nations Common Database (UNCDB) that provides selected series from 30 specialized international data sources for all available countries and areas, and the Monthly Bulletin of Statistics Online (MBS Online) that presents current monthly economic statistics for most of the countries and areas of the world (URL: //unstats.un.org/unsd/default.htm).

2.6 Organisation for Economic Cooperation and Development (OECD)

The OECD Statistics Directorate maintains extensive time series databases on a comparable basis across the 29 OECD member countries (and some non-members). The principal databases are:

- Economic accounts for Agriculture;
- Financial statistics;
- Industry and Services statistics;
- International trade statistics;
- Labour Statistics;
- Leading Indicators and Tendency Surveys;
- National Accounts;
- Prices and Purchasing Power.

The information is obtained from standardised forms submitted by member countries, and is closely controlled using the OECD Quality Framework.

The OECD also collects a range of environmental information and this process has been harmonised with EuroStat data collection and the European Natura 2000 and Emerald network process.

It should be noted that only the three North American countries are OECD members in the Americas region (URL: // www.oecd.org/statsportal).

2.7 GEO Data Portal

The GEO Data Portal provides access to all the data tables supporting the Global Environmental Outlook. The GEO Data Portal is the authoritative source for data sets used by UNEP and its partners in the Global Environment Outlook (GEO) report and other integrated environment assessments. Any table or diagram published in the three “GEOs" to date should have the data presented here in a downloadable form. The online database holds more than 400 different variables, as national, sub-regional, regional and global statistics or as geospatial data sets (maps), covering themes like Freshwater, Population, Forests, Emissions, Climate, Disasters, Health and GDP. These can be displayed on-line as maps, graphs, and data tables, or downloaded in several different formats.

It includes not only “environmental” data but also a range of socio-economic information by country and region, which is useful in making indicators or linking biodiversity to sustainable development. The information is culled and integrated from a range of primary and secondary sources (URL: //geodata.grid.unep.ch).

2.8 World Bank

The World Bank maintains a large collection of economic and social time series data. Almost all the data held are derived, either directly or indirectly, from official statistical systems organized and financed by national governments.

Datasets include:

- World Development Indicators;
- Millennium Development Goals;
- Global Development Finance;
- Population, GDP, GNI (formerly GNP) in atlas method, per capita and PPP terms.

URL: // www.worldbank.org/data

2.9 The Global Observing Systems

With the dismantling of the UNEP Global Environmental Monitoring System (GEMS) in the early 1990s, a set of three "Global Observing Systems" was established as a replacement:

- Global Climate Observing System (GCOS) – hosted by WMO;
- Global Ocean Observing System (GOOS) – hosted by UNESCO/IOC;
- Global Terrestrial Observing System (GTOS)– hosted by FAO.

The last of these, GTOS is a source for biodiversity information and has been discussed in Document 1, particularly with regard to its associated Terrestrial Ecological Monitoring Sites (TEMS) that hold information from long-term monitoring projects.

GCOS and GOOS are key information sources for non-biological atmospheric and oceanographic information respectively, and have large and well organised databases available on-line and via other media (URL: // www.wmo.ch/gcos , //ioc.unesco.org/goos).

CHAPTER 3 CURRENT PROCESSES AND EXPERIENCES

3.1 GEO Process

3.1.1 Overview

The UNEP Global Environment Outlook (GEO) project was initiated in response to the environmental reporting requirements of Agenda 21 and to a UNEP Governing Council decision of May 1995, which requested the production of a comprehensive global state of the environment report. The first such report was issued in 1997, the second in 2000 and GEO-3 in 2003. It is the intent to prepare such a report approximately every three years as an on-going process.

The GEO Process is a collaborative effort coordinated by UNEP with some 40 identified “Collaborating Centres” around the world. This partnership approach provided a number of challenges to information management, and required a good structure for data organisation, means of data sharing and quality review.

The GEO Data Portal was initiated in October 2000 to provide a comprehensive, reliable and timely supply of data for the preparation of UNEP’s GEO reports. Subsequently, it has evolved into a data and information system which responds to the needs of the global environmental community for access to systematic and well-documented data on the environment, including the state of natural resources, as well as the societal driving forces and root causes of environmental change and degradation. The GEO Process requires having readily accessible a wide range of statistical and geo-spatial data sets that, as much as possible, meet the following requirements:

- Offering world-wide coverage, but with data at the national level;
- Characterised by harmonised data values, collection units and definitions;
- Available for every year since 1970 to coincide with the GEO "retrospective" period;
- Freely and easily accessible to GEO contributors and broader user community;
- Offering aggregated values for the sub-regional, regional and global levels.

The GEO now has a comprehensive on-line database with a graphical user interface, for use by the GEO user community and beyond. It has effectively become the standard data reference and access tool for the GEO assessment process, both for UNEP and its reporting partners. The GEO Data Portal holds an ever-growing body of global environmental statistics and maps, now amounting to

some 300 data sets in total. These can all be displayed, queried and explored on-line through maps, graphs and tables, and downloaded for further use.

The principal themes for the data held are: atmosphere; biodiversity; coastal and marine; disasters; forests; freshwater; land; socio-economic; and urban-areas.

3.1.2 Data Integration Experiences

The GEO reporting process is organised along regional lines (mainly continents) and sub-regions, and national data sets. National level information is the fundamental building block. In order to allow for aggregation and presentation of information at the sub-regional and regional levels, a fixed definition by way of a country list of regions and sub-regions has been established. This not only permits aggregation in tables and charts, but also mapping onto a standard base of country boundary polygons. All data in databases are therefore available at one of these three levels and can be aggregated to the next higher level. No other spatial frameworks (such as bio-geographic) have been introduced.

The source data have been obtained from a large number of recognised international sources, including UN and other affiliated inter-governmental organisations. In general, the datasets are selected as those related to societal driving forces, environmental pressures, state-of-the-environment measures, and impacts on natural ecosystems and human health.

Apart from the basic service of making core data sets available to the user community, additional functionality has been added to strengthen the analytical capacity of the network. This includes the development of functionality for:

- Graphs to show and explore the evolution ('trend') of a variable over time;
- Histograms to highlight the absolute distribution of values;
- Extreme value analysis - displaying the range of minimum and maximum values;
- A search tool to query the database and select among the variables;
- Exporting the data sets in different formats (such as Excel, PDF etc).

The experience to note from this process was the need to define a fixed spatial framework (country based) that would be maintained through time, to permit useful time-series to develop. This particular set of region and sub-region definitions form a useful base and example for IABIN to follow.

The lack of any natural spatial framework, such as ecosystems or watersheds, for analysis limits the potential use and analysis of the data in relation to natural processes, although it is noted that availability of the statistics with country

boundaries does permit the use in GIS systems to overlay on other frameworks, albeit at a very coarse level.

Data gaps and uneven data quality are still noted as a continuing feature of this type of data integration and assessment effort, as is the problem of assuring comparability of information gathered by differing national collection methods and conditions.

3.2 Millennium Ecosystem Assessment

3.2.1 Overview

The Millennium Ecosystem Assessment (MA) was established with the involvement of governments, the private sector, non-governmental organizations and scientists, to provide an integrated assessment of the consequences of ecosystem change for human well being, and to analyse options available to enhance the conservation of ecosystems and their contributions to meeting human needs. The MA, although labelled an "ecosystem" assessment, is examining the relationships between ecosystem "services" and the indirect drivers of change (including demographic and economic factors), the direct drivers of change (such as changes in land use and technology adaptation and use), and ultimately human well-being and poverty reduction. The MA is therefore closely concerned with the issues and problems of linkage of biological and non-biological information. The Convention on Biological Diversity, the Convention to Combat Desertification, the Convention on Migratory Species, and the Ramsar Convention on Wetlands plan to use the findings of the MA, which will also help meet the needs of others in government, the private sector, and civil society.

The MA is also expected to contribute to the United Nations Millennium Development Goals and assist in carrying out the Plan of Implementation of the 2002 World Summit on Sustainable Development.

The MA programme has been described in some detail in Document 2 - *Biodiversity Information for Decision Making – International Experiences*. The key aspect is making the linkages between *ecosystems* and economic activity and social consequences, and so it represents a successful example of linking biological and non-biological data.

3.2.2 Data Integration Experiences

The MA, when completed in 2004, will leave behind an archived database of the key datasets gathered to support the assessment. The intent is that this will form a baseline against which progress can be judged in subsequent assessments and will contribute to a base for the MDGs and the 2010 target.

Data integration methods and experiences are not yet well documented, but some observations can be made. As with the GEO Process, a large number of institutions are partners in this endeavour, so that it was imperative to establish standard reference frameworks. In this case it was essential to define an ecosystem framework. This is a broad scale global assessment, so ecosystems were identified at the highest level, resulting in 10 categories. Each category was defined according to the central ecological concept, and its interpretation as boundary limits for mapping, as shown below.

Table 2: Conceptual and Spatial Definition of Ecosystems for MA

Principal Concept	Category	Boundary for mapping purposes
Open ocean; fishing is the dominant force causing ecosystem change	Marine	Marine areas beyond 50 m bathymetry
Interface between oceans and land extending seaward to about the mid-continental shelf, and inland to the areas strongly influenced by proximity to the ocean.	Coastal	Area between 50 m bathymetry and 20 m above the high tide level. Includes coral reefs, intertidal zones, estuaries, coastal aquaculture and seagrass communities.
Inland water systems	Inland water	Rivers, lakes, floodplains, reservoirs and wetlands; includes inland saline systems. (Note: Ramsar wetlands are found in both the "inland water" and "coastal" MA ecosystems).
Lands dominated by trees; used extensively for timber, fibre and fuelwood production	Forest	Areas with at least 40% crown cover. For statistical comparability the MA will also use at least 10% crown cover as used by FAO. Includes temporarily cut-over forests and plantations which in principle could be self-regenerating, excludes non-self sustaining tree crops such as orchards, which would be considered crop lands.
Desert lands or lands dominated by grasses and shrubs; used extensively for production of grazing animals	Dryland	Dryland areas as defined by the Convention to Combat Desertification (FAO arid, semi-arid and sub-humid agro-ecological zones, or lands with length of growing period less than 270 days) as well as deserts (hyper-arid zones), excluding areas with <40% barren, grass and shrub cover. This category excludes polar deserts.
Isolated lands with a high proportion of coast to hinterland	Island	
Steep and high lands	Mountain	Based on a combination of altitude, slope and topography. In the tropics the lower limit of mountains is at about 1000 m, in the temperate and boreal zone at about 800 to 300 m, slopes greater than 15%, includes plateaus and valleys within mountainous terrain.
High latitude systems frozen for most of the year.	Polar	Includes ice caps, permafrost, tundra, polar deserts and polar coastal areas. Excludes high altitude mid or low latitude cold systems.
Lands dominated by domesticated plant species; used extensively for crop production; crop production is the dominant force causing environmental change.	Cultivated	Areas in which at least 30% of the landscape comes under cultivation in any particular year. Includes integrated agriculture-aquaculture systems.
Built environments with high human density	Urban	Contiguous areas of built up lands with human population density of > 1000/km2

These definitions then enable the development of GIS boundaries for the ecosystems in both polygon and gridded form. That, in turn, enables the use of GIS technology to link the differing collection frameworks (e.g. administrative

units for economic data) at the various levels of the assessment – global, regional and sub-regional.

This process is currently underway, with the GIS work being done at GRID-Arendal, UNEP-WCMC and CIESIN. As the process is not complete, experiences are not fully documented at present. Some experiences, data gaps and anticipated issues are discussed in Chapter 4 of the MA "Methods" document, and the following extracts are informative, noting that many refer to information problems with 'ecological' and the associated challenges that presents for integration with non-biological information:

"The condition and trends assessment process is reliant on access to existing data and information that has been generated from historical and ongoing research and monitoring efforts. Compiling and analysing such available data in an integrated, multi-scale framework is the core challenge of the condition assessment of the MA.

There are of course various data limitations that arise in attempting to conduct an integrated assessment. For example, many potentially useful data simply do not exist. Often those that do have not been collected with sufficient time series to be meaningfully incorporated into an assessment of trends …

… by far the majority of data on ecosystem variables have not been collected with the intention of further compilation to correlate with specific ecosystem types.

In general, information on drivers and threats to ecosystem integrity and biodiversity has not been collected in a systematic fashion, and trends have typically been identified on the basis of anecdotal or qualitative information.

Change in wetland area (such as by drainage) is an important parameter, although available information is mainly anecdotal or qualitative. Few country-level assessments of wetland loss exist, and information at global level is very poor.

Some coastal ecosystems are relatively well documented at local to national scale, but of these only coral reefs are covered by a structured global set of spatial data. A more systematic and comprehensive approach to classification of marine ecosystem types is required …

Ecosystems are governed by variables that typically vary continuously in space. As a result, ecosystems are difficult to classify spatially because their boundaries are gradual instead of discrete.

Protocols must be adopted for translating data and findings among scales using units that do not nest perfectly (such as land cover types to watersheds to nations).”

3.3 Standards and Protocols for Non-Biological Networks

The principal non-biological networks and information services are relatively consistent in the way that information can be obtained. Essentially they provide data “tables” (usually downloadable) in which aggregated statistics are presented against an administrative or political unit (usually country) and a time-period (often one year). Most commonly these are presented as a simple text file, or a Microsoft compatible table or spreadsheet that can be easily integrated into user databases, provided there is an appropriate link to the administrative unit.

The main issue, therefore, is the standardisation of country and region designations. Many, but not all, services use the ISO three letter country codes. Regions and sub-regions generally follow the UN Statistical Division standard, although some services (such as FAO and regional development banks) may deviate from this for administrative or programming purposes.

Where graphic interfaces and mapped output are provided, these are usually simple and mainly consist of national or regional boundaries in common formats such as ”shape” files – see Document 4). Interactive geo-spatial processing is not generally provided.

As far as can be determined all significant non-biological information services are supported by relational database technology, and use common Web-based interface methods, but there is no consistent standard. “Interoperability” that would imply an enterprise model and alignment of entity names etc. with IABIN, while technically feasible, would not seem to be of great utility. It would be better for IABIN to maintain catalogue-level information on the content of key non-biological databases (that could be used in developing indicators), and “how to” guidance for users wishing to download tables as needed.

CHAPTER 4 ISSUES IN INFORMATION LINKAGE

4.1 Overview

The linkage of non-biological data to "biodiversity" data is acknowledged as essential to effective decision-making for sustainable development, and various methods have been used over the years with varying levels of success. To be truly effective two major barriers to such linkage must be overcome: one due to the nature of "biodiversity data", and the other arising from the traditional incompatibility of the spatial frameworks used for socio-economic and biological information. These issues are outlined in the following sections along with considerations for surmounting the barriers.

4.2 Intrinsic Issues with Biodiversity Information

4.2.1 Issues

The scope and meaning of "biodiversity data" for the purposes of this project and the B-IABIN project are defined in Document 1. Biodiversity information deals mainly with the observational and assessment aspects of conservation biology – a very descriptive science. The intrinsic nature of the information and the way it is customarily collected and presented make it difficult to integrate with other non-biological information due to some of the following characteristics:

- Biodiversity information it is often both descriptive and subjective, rather than quantitative. Assessments of the state of ecosystems are often entirely narrative and contain un-standardised relative terms such as "declining" "improving", "healthy", "fragmented", with little or no quantitative information.

- There are few agreed standard ways to classify or typify habitats or ecosystems (or bio-geographic zones, or biomes, or vegetation cover, etc, etc). Where such classifications exist, they tend to be applicable only in a limited region.

- There is little long-term systematic monitoring of ecosystems – nor agreement on what to monitor – hence no baselines from which to measure change, or assess the impact of implemented actions.

- There is no agreed way to "value" biodiversity or to assess the "health" of an ecosystem or the state of its biodiversity, even in relative terms.

Because of these factors, biodiversity reports on ecosystems, protected areas, countries, districts, and species may contain huge amounts of information that is difficult to relate even to similar assessments of similar areas, and impossible to

effectively link to non-biological information. The two related natural fields of climate change and oceanography are seemingly much more advanced in knowing what is important to measure, what and how it can be measured, and what are causes and effects. Arguably, this is due to the intrinsically more complex nature of biology (and/or ecology), but it also stems at least in part from the "gentleman scientist" and "natural history" roots of biodiversity.

4.2.2 Some Solutions

All the experiences reflected in this report and its companion reports, point to the urgent need to reduce these barriers to linkage of biodiversity information. Solutions require the development and application of a range of harmonisation processes, tools and frameworks. Some of these are:

- Agreed classification systems for habitats or "ecosystems" and associated global mapping of such a biodiversity spatial framework;
- Established "core datasets" for the major components of biodiversity information – protected areas, species status and distribution, state of ecosystems;
- Systematic long-term monitoring programmes with standardised measurement protocols;
- Agreement on indicators.

Some work is progressing on almost all these fronts and the European situation provides a good model (see Document 2 - *Biodiversity Information for Decision Making – International Experiences*). In Europe there is growing harmonisation of habitat definitions, protected areas classification and core datasets, species nomenclature, and indicator development linked to national reporting, harmonisation and standardisation of environmental statistics efforts (i.e. between OECD, EuroStat and the EEA). Global processes like the MA and the GEO provide the beginnings of a framework that could be expanded towards increased precision in content semantics and quantification (i.e. better definition of what to call things and how to measure them).

4.3 Linking Spatial Frameworks

4.3.1 Issues

Non-biological information (e.g. socio-economic) has traditionally been collected, organised and presented on an administrative framework – countries, provinces, census districts, etc. This is a logical and reasonable approach given that the decision-maker is likely to hold responsibility on the same geographic basis, and so the information "makes sense" in that framework.

Biodiversity, on the other hand, does not respect administrative borders, but rather natural boundaries such as watersheds, climate or other bio-geographic zones that cross national and sub-national borders. Information structures and indicators are relevant to these natural spatial units – as are the needed actions and responses. Linking the two spatial frameworks is the key to achieving an integrated picture for sustainable development decision-making. In fact, the use of "ecosystem" boundaries rather than administrative boundaries is a useful way to defuse defensiveness – the "problem" is no longer to be attributed to the person responsible for that county or country, but a problem in an ecosystem that "we" must solve.

4.3.2 Some Solutions

One approach frequently used is to employ the administrative framework and attempt to squeeze biodiversity information into it. This is the approach taken (mainly) in the GEO process where the environmental variables are summarised by country and then aggregated into "regions" (mainly continents).

The best and obvious solution is the application of GIS technology. In fact, the earliest GIS systems (in the 1960s) were specifically developed to address just this issue – for instance to link soil and agricultural land quality to socio-economic data. It therefore continues to be surprising how infrequently this technique is used today. In the main, GIS is used as a means of producing maps to illustrate a narrative assessment, or for providing single coverage datasets, such as protected areas boundaries, or coral reef distribution. The case at hand requires use of the analytical capability of GIS to overlay the two spatial frameworks to produce a spatial base that can be aggregated in either way and hence expressed to both the biologist and the administrator in meaningful ways.

A prerequisite for such application of GIS technology is consistent ecosystem mapping across the region (preferably the Globe). This process is being done with the MA for the 10 defined ecosystems, in order to make the connections between ecosystems and human-well-being indicated in Section 3.2.

In the case of IABIN, a consistent multi-level "Ecological Regions of North America" has been prepared (but little used) in digital form by the CEC, and could be extended across the Americas region to provide the requisite biodiversity spatial framework for overlay on the administrative (socio-economic) framework.

CHAPTER 5 RECOMMENDATIONS

The principal business of IABIN is to facilitate the exchange and (integration) of biodiversity information in the Americas. It should therefore not engage in the exchange of non-biological data, *per se*. However, there are a number of ways in which IABIN can contribute to ensuring that the biodiversity data **can** be linked with the non-biological data for effective decision-making, and for ensuring appropriate input of biodiversity components to the MDGs and the 2010 Targets. Some recommendations for addressing this are as follows:

IABIN should:

- Encourage and facilitate the preparation and wide availability of ecosystem mapping frameworks for the region, including, a consistent ecosystem map of the Americas that extends the existing North American map, boundary mapping of the 10 MA Ecosystem categories, and other internationally recognised mapping frameworks.
- Assemble, standardise and make available a consistent GIS coverage of administrative boundaries within the Americas, at least to the first sub-national level, suitable for use to overlay with the ecosystem mapping. Such a coverage should be made compatible with the national and regional designations used by the principal non-biological networks, particularly the UN Statistical Division and the GEO process;
- Provide guidance and standards for using the analytical capability of GIS to integrate information from administrative and natural spatial frameworks;
- Facilitate the development of harmonisation tools for biodiversity information management (following the European model), including agreed classification systems for habitats and ecosystems, core datasets for major biodiversity information categories, standardised species nomenclature, standardised vocabulary (multi-lingual), and so on, thus enabling consistent linkage with non-biological networks;
- Maintain links to the web sites of the key international and regional sources of non-biological data, and maintain metadata and provide guidance information (including case studies and tool-kits, and links to reference guides such as the UN Statistical Division's good practices guides) on best uses of these sources;
- Actively participate in global processes such as GEO by providing consolidated and standardised information across the region;
- Work to define indicators suitable to the region and resulting needs for biodiversity and non-biological data to develop a systematic long-term monitoring system. This should be suitable for supporting the 2010 targets and

MDGs, in structures that facilitate linkage with national and regional socio-economic data. Specifically, IABIN should seek to provide the data to support MDG Indicators 25 and 26 and support information for other targets of Millennium Development Goal 7;

- Clearly define the roles and responsibilities of the Thematic Networks and their Co-ordinating Institutions in the development of indicators and the implementation of long-term monitoring programmes that can provide consistent time-series using standardised IABIN ecosystem and administrative mapping units – and hence can be linked to non-biological data, regionally and internationally.

ANNEX 1 - Acronyms and Abbreviations

B-IABIN	Building the Inter-American Biodiversity Information Network (project)
CBD	Convention on Biological Diversity
CEC	Commission for Environmental Cooperation (North America)
CIESIN	Center for International Earth Science Information Sources
COP	Conference of the Parties
EEA	European Environment Programme
ENTRI	Environmental Treaties and Resource Indicators
EuroStat	European Statistics Office
FAO	Food and Agriculture Organisation (UN)
FAOSTAT	Food and Agriculture Organisation Statistical service
GCOS	Global Climate Observing System
GDP	Gross Domestic Product
GEMS	Global Environment Monitoring System
GEO	Global Environmental Outlook
GIS	Geographic Information System
GNI	Gross National Income
GNP	Gross National Product
GRID	Global Resource Information Database (UNEP)
GTOS	Global Terrestrial Observing System
IABIN	Inter-American Biodiversity Information Network
IUCN	World Conservation Union
MA	Millennium Ecosystem Assessment
MBS	Monthly Bulletin of Statistics (UN)
MDG	Millennium Development Goal
NGO	Non-Governmental Organisation
OECD	Organization for Economic Cooperation and Development
PID	Project Implementation Document (World Bank)
SEDAC	Socio-Economic Data Application Center

TEMS	Terrestrial Ecology Monitoring Sites (database of GTOS)
UK	United Kingdom
UN	United Nations
UNCDB	United Nations Common Data Base
UN-CSD	United Nations Commission for Sustainable Development
UNEP	United Nations Environment Programme
WCMC	World Conservation Monitoring Centre
WSSD	World Summit on Sustainable Development