

Brief description of relevant monitoring programmes and initiatives and their links with BRIM

AFRIMAB

The AfriMAB Network was launched at a Conference in Dakar, Senegal, in 1996. Among the recommendations from this conference were:

- Strengthening of existing research institutions working in the area of conservation, promoting interdisciplinary research in harmony with the activities of the MAB Programme;
- Establishment of an information exchange network with a databank of biodiversity along with a system for the dissemination of information using GIS (Geographical Information System) and EIS (Environmental Information System), mainly as a segment of the activities of AfriMAB;

The main goal of the AfriMAB Network is to exchange information as expressed in the following specific objectives of the MAB Programme in Africa:

- To strengthen biodiversity conservation and sustainable development in the region by enabling national specialists leading MAB activities to share their knowledge and experience;
- To develop a framework for exchange of information and experience of biosphere reserves;
- To promote the ecosystem approach adopted by the CBD (Convention of Biological Diversity) and to examine how to help test and develop the practical implementation of this approach using the World Network of Biosphere Reserves.

AfriMAB and BRIM

BRIM neither can nor should by itself develop, implement and sustain integrated monitoring programmes. Rather, it can help build capacity for such programmes that effectively address MAB objectives, as well as other international, regional, national, and local concerns. It can do so by building on current initiatives to improve information exchange, identify and disseminate best practices, promote regional co-operation, and identify other capacity-building needs and resources.

BRAAF

Within the framework of the BRAAF project (Biosphere Reserves for Biodiversity Conservation and Sustainable Development in Anglophone Africa), five countries have been sharing information to inventory biodiversity and generate income for people living in or around biosphere reserves. One of several international technical and scientific seminars organized within the project, served to identify methodologies to be used so that findings can be more easily compared, using, for example, the quadrat sampling method for plant species inventory, or applying the Rapid Rural Appraisal method for assessing the socio-economic features of the biosphere reserves.

Integrated projects

Examples of other integrated pilot projects underway in Africa using the BRIM concept are RCS-Sahel, IPALAC, and CIPSEG.

The RCS-Sahel Project (Strengthening of Scientific Capacities in the Field of Agro-silvo-pastoral Management in the Sahel) is a transboundary multi-functional project. It was implemented from 1989 to 1997. Particular attention was given to training of researchers and technicians, notably through the organization of international courses on methodological issues (taxonomy, vegetation, water soil-plant-atmosphere relations, etc.) and on ecosystem restoration techniques to combat desertification, and to improve production systems (Sahelian silvo-pastoral systems, improvement of soil fertility, etc.).

The IPALAC Project (International Programme for Arid land Crops) is located in Sub Saharan Africa. The aim is to contribute to the combating of desertification and improvement of agricultural productivity in arid and semi-arid lands through the application of appropriate management techniques and the transfer of germplasm of multi purpose species.

The CIPSEG Project (Co-operative Integrated Project on Savannah Ecosystem in Ghana) concerns sacred groves. It aims at providing answers to the question of how the Guinea type of savannas in Western Africa may have looked like before human pressure on the savanna grew too strong. The goals are to develop scientific knowledge based on the relict sacred grove ecosystems, in order to help in the restoration of the adjacent and degraded savanna areas. This is envisaged to be done by using native plant species from the sacred groves' gene pools, and to formulate sound management guidelines for development intervention aiming at the environmental conservation of the area at large.

Innovative projects in progress

Among the new pilot projects launched by MAB that could serve to promote BRIM, there are ERAIFT, and a UNEP/GEF project. The ERAIFT Project (Regional Post-Graduate Training School on Integrated Management of Tropical Forests) was established in 1999 at the University of Kinshasa (Democratic Republic of Congo) and involves several Sub-Saharan African countries and the Indian Ocean region. ERAIFT trains students at the Masters and Ph.D. level. This regional school seeks to train a new type of specialists, of future decision-makers capable of appreciating the ecosystem approach in the search of solutions to the complex problems brought about by rural development of African societies. Within the training programme, field research in biosphere reserves is taking place. A cartographic center has been set up which uses Geographical Information System (GIS) and which could become a reference center for reinforcing capacities of managers in monitoring in biosphere reserves.

The UNEP/GEF Project to "Reinforcing the Technical and Scientific capacities for the Conservation and Sustainable Use of Biodiversity in Dryland Biosphere Reserves in West Africa" involves biosphere reserves in six different countries. It aims to preserve and use the biodiversity in a sustainable way in the biosphere reserves, essentially made up of savanna ecosystems. Emphasis will be placed on the implications of the different actors in the management of the biosphere reserves and the use of the AfriMAB Network for exchange of technical and scientific information and for capacity building.

AfriMAB-BRIM Workshop (Yaoundé, Cameroon, 26 – 29 November 2001)

The first AfriMAB Workshop on BRIM intends to advance progress in the West African region for implementing BRIM. The workshop will build on ongoing monitoring and research initiatives in the region, as well as on training courses on biodiversity, biotechnology, and law. It will promote regional approaches to conservation and sustainable development through co-ordinated monitoring efforts centered on biosphere reserves. It will then review current monitoring (environmental and social) activities in the region, with special emphasis on biosphere reserve experiences, as well as on data communication and usage (impact of monitoring on decision-making) and sustainability. It will identify capacity building measures for effectively communicating monitoring results to users in the region. It will also:

- Discuss how monitoring activities in the region should be designed and carried out, including the choice of indicators and methodologies, in order to match the political, social and economic questions that need to be addressed in order to formulate appropriate policy options for conservation and sustainable development;
- Identify opportunities and challenges to implementing a West African regional monitoring network of which biosphere reserves are a critical component. Links will be identified with monitoring activities outside biosphere reserves and with international networks, such as, the Forest Dynamics Plot Programme, at the Centre for Tropical Forest Science (www.ctfs.si.edu/), the Global Terrestrial Observing System (www.fao.org/gtos/), and International Long Term Ecological Research Programme (www.ilternet.edu/);
- Assess how West African biosphere reserves can contribute, through their monitoring activities, to implementation of international conventions by signatory countries, such as the Convention on Biological Diversity, Ramsar Convention on Wetlands, Convention to Combat Desertification, and the WTO's Trade Related Aspects of Intellectual Property.

ARABMAB

The ArabMAB network was launched in Amman in 1997. The Arab National Committees of the Man and the Biosphere Program (MAB) decided to launch the ArabMAB network for:

- Coordinating and enhancing collaboration in various disciplines related to the MAB programme;
- Establishing principles of a common Arab programme including the creation of biosphere reserves and other types of protected areas;
- Assisting member committees to adhere to relevant international conventions;
- Undertaking collaborative research projects and other activities according to proposals from member committees.

The ArabMAB network is an already existing forum of a biodiversity information system on operating networks, with about 13 member countries and one member from an international organization. By year 2000, 14 biosphere reserves had been designated in six countries (Algeria, Egypt, Jordan, Morocco, Sudan, and Tunisia).

ArabMAB activities include meetings, establishment of new biosphere reserves in Arab countries, capacity building (training workshops), and environmental awareness.

A web site (www.arabmab.net) was established for the ArabMAB network in 1998, which includes regional biodiversity information. The biodiversity database of the ArabMAB web site is created for Arab countries having established biosphere reserves. The database includes an embedded search engine that finds information by country name, biosphere name, and flora and fauna names. The database is accessible to the responsible administrators of the individual biosphere reserves (by using a username and password), for them to update and manage the contents of their biosphere reserve online.

Several training workshops have been held to train users to administer their database online. A guideline manual has been published and distributed and currently there is a training CD with these guidelines being printed that will be distributed to member countries in the ArabMAB network to enhance the process of database administration among Arab biosphere reserves.

EAST ASIAN BIOSPHERE RESERVE NETWORK (EABRN)

East Asian Biosphere Reserve Network (EABRN) was established in 1994. It consists of the People Republic of China, the Democratic People's Republic of Korea, Japan, Mongolia, the Republic of Korea and the Russian Federation. By 2000, 45 protected or other similarly managed areas in this region had been designated as biosphere reserves. EABRN has focused on a number of thematic topics for regional co-operation including ecotourism in biosphere reserves, transboundary conservation cooperation using biosphere reserves, gap assessment in national conservation policies, and biosphere reserve field evaluation. The activities of EABRN are to pursue these subjects including national and regional workshops (the forthcoming EABRN-7 Meeting will be held in the Sikhote-Alinsky Biosphere Reserve, Russia from 6 -12 September 2001), field projects including GIS applications, studies as well as advisory service through field visits to biosphere reserves. These activities are within the overall workplan of the MAB Programme and the World Network of Biosphere Reserves.

With regard to the Biosphere Reserve Integrated Monitoring (BRIM) Programme and other related activities, EABRN members have been informed since 1994. Activities carried out include the introduction of MABFauna and MABFlora at EABRN meetings by the representative from BRIM; compiling of the required datasets in a number of biosphere reserves during 1997-1999; contribution to the construction of the UNESCO Biosphere Reserve Directory; introduction of UNESCO MABnet in 1995; and the opening of EABRN web site in 1997. In addition, EABRN has started research on ecotourism indicators since 2000.

Although monitoring is not a stated EABRN priority, the countries continue their long-term scientific research and monitoring on biodiversity in many biosphere reserves. For instance, all biosphere reserves in Japan and the majority of the biosphere reserves in the Far East of the Russian Federation have long-term ecological research and monitoring activities. Similar activities can be found in the Republic of Korea, in Changbaishan, Xilingol and Dinghushan Biosphere Reserves in China (many sites are included in the Chinese Ecological Research Network - CERN). China has also embarked on long-term monitoring of climate change, impacts from hydroelectric power, water quality, flora and fauna. Based on these monitoring activities various centers have been developed such as The Forest Insect Monitoring Station and the publication of Karst Forest Ecology Study. Some methodologies have been developed in the form of manual and guides. This offers a good basis for developing a new phase of MAB-BRIM. The real challenge for EABRN is how to set up a sound scientific, interdisciplinary, manageable, and cost effective monitoring programme that can generate information on the change of these managed ecosystems and support the governments to improve the related management in biosphere reserves, in line with the objectives defined by the Seville Strategy.

SOUTH-EAST ASIAN BIOSPHERE RESERVE NETWORK (SeaBRnet)

The South-East Asian Biosphere Reserve Network (SeaBRnet) was initiated in Ho Chi Minh City, Vietnam at an UNESCO-MAB Regional Workshop in 1998. The rationale, missions, objectives, philosophy and design, criteria for site selection, network structure and operation, and implementation strategy for monitoring were approved and reached an agreement for action plans.

This initiative was developed in the Ecotone IX Seminar on "Wise Practices in Coastal Tourism Development in Protected Areas" held in Puerto Galera Biosphere Reserve in the Philippines, in 2000, in collaboration with other MAB National Committees of the East and Southeast Asian region and with UNESCO-Jakarta.

Several biosphere reserves in the South-East Asian region (SeaBRnet) have ongoing research and monitoring activities, which is often self-funded. Some have developed monitoring methodologies, including cooperation with international partners. A major technical limitation is due to the fact that SeaBRnet has virtually no access to Internet. Until now, SeaBRnet has not officially embarked on BRIM.

The UNESCO-MAB regional seminar Ecotone X: "Ecosystem valuation - for assessing functions, goods and services of coastal ecosystems in Southeast Asia" and the SeaBRnet meeting for coastal Biosphere Reserves cooperation with fund-in-trust support from the Government of Japan, will be held during 19 - 23 November 2001, Hanoi, Vietnam. Based on a minimum baseline data and comparability, basic background information and a minimum core set of processes at each site, the determination of specific variables, periodicity and methods of the survey of monitoring schemes will be discussed in this meeting.

To ensure the success of SeaBRnet, standards will be followed. The complexity of current environmental processes and problems, and the philosophy of SeaBRnet to conduct research on these issues, require that all participating sites must use similar state-of-the-art conceptual and technical tools. These tools include networking; database management; GIS; modeling; plots, watershed, landscape; equipment; reference and voucher collections.

EUROMAB

The EuroMAB network, founded in 1987, is operating in the European and North American countries. It is a large network, with more than 40 countries with very different socio-economic and ecological conditions, varied cultural backgrounds and multiple languages. There are over 200 biosphere reserves in the EuroMAB region, many of which were designated in the early part of the MAB programme and which are under revision to conform to the current criteria set out in the Statutory Framework for the World Network of Biosphere Reserves. At the same time, many of today's most exciting innovations in implementing the biosphere reserve concept can be found in the EuroMAB region.

BRIM was a product of one of the first EuroMAB meetings in 1991 and its early development was led by MAB-US and MAB-Germany. This is essentially due to the fact that the USA had developed its network of Long-Term Ecological Research (LTER) sites and that the countries notably of Eastern Europe and the former USSR had a long experience in biotic and abiotic monitoring. The initial idea of BRIM was to take advantage of the growing network of biosphere reserves in the EuroMAB region as a basis for establishing an integrated long-term ecological and social monitoring programme. MAB Russia was particularly interested in developing co-ordinated monitoring in biosphere reserves making up large scale transects across spatial or ecological gradients. The BRIM initiative would provide a welcome activity in common for the EuroMAB countries. In the EuroMAB region, support for BRIM in its early form was mixed. However, it is certain that the work of BRIM, such as the compilation of ACCESS 1996 giving a directory of contacts and environmental databases, was a considerable impetus in encouraging different countries and sites to start using the Internet as a means of communication and accessing information. At the last EuroMAB meeting in April 2000, there was a call to reorient the work of BRIM, including the idea to expand it to cover socio-economic aspects, sustainability as to the implementation of Seville+5 indicators.

Today, it is becoming clearer that, given the large size of the region and the disparity of interest and capacity of the countries concerned, it is difficult to find a common thread for co-operative activities involving all countries. This also applies to BRIM. Most EuroMAB work for 2000-2002 is taking place through activities of groups of countries on specific themes and/or geographical sub-regions. Several countries, for example Canada and the UK, have set up their own systems of environmental monitoring for various purposes. There are many biosphere reserves which do and which will continue to participate actively in a renewed BRIM, since it will valorize their experience and accumulated data sets. While in the past it was not possible to set up monitoring across transects due essentially to a lack of resources, the idea is still very valid, especially as awareness about climatic change increases. The challenge will be to provide an affordable system that can give quasi-immediate benefits at the site level and also serve the longer-term interests of detecting and understanding global changes.

INTEGRATED ENVIRONMENTAL MONITORING IN GERMANY – THE RHÖN PROJECT

The research and development project "Exemplary implementation of the concept for integrated environmental monitoring, using the cross-boundary Biosphere Reserve 'Rhön' as an example" (Rhön Project) contributes to the activities initiated by the Federal Ministry of the Environment towards a better coordination and more effective organization of environmental monitoring carried out at federal state levels. At the same time it helps to implement the restructuring of current environmental monitoring practices as suggested by the Council of Environmental Advisors in 1990 (SRU 1991). The cross-boundary Biosphere Reserve Rhön was selected for testing the methods developed for integrated environmental monitoring. This example illustrates how the monitoring and measuring results of different programmes and networks of three different countries can be interlinked.

The approach used to put integrated environmental monitoring into practice essentially comprised the following steps:

- Development of a core set of parameters, based on data collected in the process of integrated environmental monitoring or provided by existing measurement and monitoring

programmes: the parameters of the core set were selected using a problem and data oriented approach as well as a system theoretical approach;

- Development of proposals for a harmonized collection of environmental data: these recommendations are particularly effective when taken into account in the planning and implementation of new integrated monitoring activities;
- Development of a data interpretation concept for integrated environmental monitoring. The interpretation concept represents the centerpiece of integrated environmental monitoring. The biggest development potential of environmental monitoring is to realize an integrative interpretation: by bringing together data sets, even across authorities, the validity of the information obtained from existing monitoring programmes and measurement networks can be significantly increased.

The exemplary implementation and testing of these methodological proposals in the Biosphere Reserve Rhön comprised the following stages:

- Compilation of an overview of all environmental monitoring activities in the biosphere reserve;
- Overview of methods applied by the state authorities to interpret the data collected by the monitoring programmes and measuring networks;
- Formulation of regional cause-effect hypotheses as required to implement a problem oriented approach to integrated environmental monitoring;
- Development of an exemplary environmental report.

The results of the project are discussed with a view to their applicability to different landscapes and types of ecosystem.

THE INTERNATIONAL TUNDRA EXPERIMENT (ITEX)

(<http://www.dpc.dk/NSNITEX/ITEX.html>)

The International Tundra Experiment (a MAB Northern Sciences Network (NSN) programme) has been working since December 1990 toward an improved understanding of the potential impacts of global warming on tundra vascular plant species. The approach has been based upon simple, robust but effective passive warming of *in situ* tundra vegetation at a range of sites within the tundra biome (both arctic and alpine). The geographical spread of sites in ITEX, and the range of physico-chemical environments that they encompass, are considered key elements of the programme.

ITEX comprises research teams from 12 countries operating at 27 different stations in the circumpolar area. Similar activities are carried out at the different sites, which makes it possible to compare circumpolar annual variation in plant performance with respect to phenological response to climate conditions. The observations contribute a set of base-line information on which the simulated climate change response can be evaluated. Similar observation may be carried out after several years.

ECOLOGICAL MONITORING AND ASSESSMENT NETWORK (EMAN)

(<http://eqb-dqe.cciw.ca/emanops/intro.html>)

The specific interest of EMAN and of Environment Canada is in coordinating and communication monitoring information on what is changing in Canadian ecosystems. One of the approaches EMAN takes in doing so is by encouraging the standardization of ecosystem monitoring (including design, sampling, analysis, data management, metadata, interpretation and communication) at Network sites and among many other EMAN partners. This has now extended to the involvement of communities and volunteers (e.g. www.frogwatch.ca).

Over the next 18 months EMAN will be testing techniques to engage communities in the adaptive management of sustainability within their surrounding landscapes using ecosystem monitoring to provide timely feedback. The experiences at the Canadian biosphere reserves and other relevant areas will be reviewed as 'experiments' in how best to do so with the

results being synthesized and subsequently tested in a variety of Canadian communities. The objective is the development of a manual on best practices that can be applied broadly and which should be of direct interest to BRIM and EuroMAB.

EMAN is developing approaches to monitoring and the use of monitoring information which are applicable and of interest to other biosphere reserves and programmes elsewhere. The Rome meeting will bring an opportunity to discuss and compare experiences with others in similar positions, which would be beneficial at this point.

THE UNITED KINGDOM ENVIRONMENTAL CHANGE NETWORK (ECN) (www.ecn.ac.uk)

ECN is the UK's long-term integrated monitoring network designed to aid in the detection, interpretation and forecasting of environmental changes resulting from natural and human causes. It is a multi-agency initiative which currently has 15 sponsoring organizations and a network of 54 terrestrial and freshwater sites. These sites make regular measurements (using standard protocols) on the main drivers of change (e.g. climate, atmospheric chemistry, land use) and ecosystem responses (e.g. soil, flora, fauna and water).

ECN is designed to be relevant to a wide range of contemporary, emerging and future environmental issues. It is particularly relevant to environmental issues associated with some of the key pressures on ecosystems (impacts of climate change, atmospheric pollutants and changing land-use and land management) and their effects on key ecosystem responses such as biodiversity, water resources and soil quality and land degradation. ECN data are maintained in a central database. This enables data to be quickly disseminated in a variety of forms to suit the information requirements of different stakeholders (see www.ecn.ac.uk for direct access to data and data products).

ECN is recognized as an UK national focal point for initiatives related to long-term environmental monitoring. The UK National Strategy for Global Environmental Research published by the Inter-Agency Committee on Global Environmental Change (September 1996) cited ECN as a major monitoring facility to support UK Global Environmental Research. ECN is part of the International Long-term Ecological Research Network (ILTER) and is involved in initiatives of the Global Terrestrial Observing System (GTOS). ECN has also developed close links with the European monitoring initiatives through its coordination of the EC NoLIMITS (Networking of Long-term Integrated Monitoring in Terrestrial Systems) preparatory action (<http://nolimits.nmw.ac.uk>).

Relevance to BRIM

One of the ECN sites is a UK biosphere reserve (Moor House/Upper Teesdale). ECN has good links to policy and land managers. It works hard to ensure that its data are relevant to a broad range of users across a range of environmental issues. ECN has considerable strength in data and information management. It has developed a seamless system for delivering timely information products from its data collection programmes. ECN has strong partnerships with similar programmes in Europe and globally. ECN does not currently undertake socio-economic measurements. However, it is already exploring ways in which the human dimensions of integrated monitoring can be incorporated into its programme and is involved in discussions with European collaborators on this subject.

In summary, ECN is actively involved in long-term integrated monitoring and is keen to cooperate in international initiatives which can give added value to our programme. The issues of: data harmonization; data management and data exchange; product development for end-users at local, national and international scales; and the incorporation of the human dimension into integrated monitoring programmes are of particular interest.



The UK Environmental Change Network

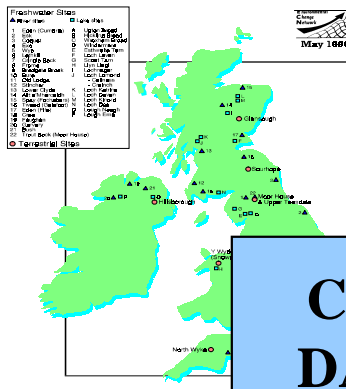
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HUNGARIAN BIODIVERSITY MONITORING SYSTEM
(<http://www.ktm.hu/gridbp/biodiver/index.htm>)

The Hungarian Biodiversity Monitoring System (HBMS) is a national effort to include the monitoring of all levels of biological organization, that is genetic, species, community/habitat and landscape. The influence of socio-economic changes is included - to a certain extent - at landscape level (land use changes). Monitoring has been carried out since 1998, with an increasing volume every year. The biosphere reserves included in the World Network of Biosphere Reserves (5 sites) are also target areas of sampling within HBMS. The programme is actually planning the set up of an information system and the potential use of the BioMon database (developed by the Smithsonian Institution) will be examined. The Director of HBMS is the secretary of the National Committee of MAB.

THE INTER-AMERICAN INSTITUTE FOR GLOBAL CHANGE RESEARCH, IAI
(<http://www.iai.int/>)

The Inter-American Institute for Global Change Research, IAI, was designed as a regional network of cooperating entities. Its mission is to develop the capacity to understand the integrated impact of present and future global change on regional and continental environments in the Americas and to promote collaborative research and informed actions at all levels. The IAI works under the principles of scientific excellence, international cooperation, and the free and open exchange of scientific information relevant to global change.

Since 1995 the IAI has been supporting over 60 multinational/multidisciplinary projects addressing the 4 main themes of its Science Agenda: 1) Understanding Climate Variability in the Americas, 2) Comparative Studies of Ecosystems, Biodiversity, Land Use and Water Resources in the Americas, 3) Changes in the Composition of the Atmosphere, Oceans and Fresh Water, and 4) Integrated Assessments, Human Dimensions and Applications.

The 14 projects of up to 5 years of duration that compose the Collaborative Research Network (CRN) are of particular importance since they involve approximately 200 scientists of 16 member countries.

The IAI operates through open announcements of opportunities in which it requests Institutions of at least 3 member countries to be part of them. The proposals evaluation is made through a peer-review system involving the mail, the panel, and the IAI Scientific Advisory Committee (SAC) participation. Priority is increasingly given to the support of projects addressing both natural and human dimensions components of global change.

The IAI is developing a Data and Information Service (IAI-DIS), which was conceptually framed by CIESIN. The system is used to disseminate scientific information generated by IAI projects and also to allow other scientific Institutions from the Americas to document their own information. The IAI-DIS is a distributed database system, composed of national nodes connected by the Internet. The IAI-DIS has currently 2 active nodes: Brazil and Uruguay (Brazilian Node: <http://disbr1.iai.int> and Uruguayan Node: <http://disuy1.iai.int>).

Relevance to BRIM

1. The IAI projects have already been or are expected to produce data and information relevant to policy and decision-makers.
2. Through the IAI-DIS, the IAI facilitates the access to the information of other data and information systems.

In summary, the IAI is today a successful mechanism to promote and to support the development of research networks addressing global environmental change issues of regional relevance and ensuring, at the same time, sustained human resource development and significant capacity building in all its member countries.

The IAI is placing high priority on the issues addressed at this special meeting on BRIM and is ready to work in collaborative projects of mutual interest.

UN ECE ICP ON INTEGRATED MONITORING
(http://www.vyh.fi/eng/intcoop/projects/icp_im/im.htm)

The multi-disciplinary Integrated Monitoring programme (ICP IM) is part of the effects monitoring strategy under the Long-range Transboundary Air Pollution Convention of the United Nation's Economic Commission for Europe (UN ECE). It belongs to a group of six specialist International Cooperative Programmes (ICPs) which have been set up under the UN ECE Working Group on Effects to look at relevant receptors and environmental issues.

UN ECE Convention on Long-range Transboundary Air Pollution

International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems

The integrated monitoring of ecosystems refers to the simultaneous measurement of physical, chemical and biological properties of an ecosystem over time and across compartments at the same location. In practice, monitoring is divided into a number of compartmental sub-programmes, which are linked by the use of the same parameters (cross-media flux approach), and/or same/close stations (cause-effect approach).

The ICP IM sites are catchments/plots located in natural or semi-natural areas. Other ICP's are ICP Forests, ICP Waters, ICP Vegetation, ICP Materials, ICP on Mapping of Critical Levels and Loads, and Task Force on Health.

The overall aim of integrated monitoring was originally to determine and predict the state and change of terrestrial and freshwater ecosystems in a long-term perspective with respect to the impact of air pollutants, especially nitrogen and sulfur. This was to provide one basis for decisions on emission controls and assessment of the ecological impact of such controls within the UN ECE Convention on Long-range Transboundary Air Pollution.

However the full implementation of the Integrated Monitoring Programme will allow the ecological effects of tropospheric ozone, heavy metals and persistent organic substances to be determined. Implementation of the Programme will provide a major contribution to the international data requirements for examining the ecosystem impacts of climatic change, changes in biodiversity and depletion of stratospheric ozone. A primary concern is the provision of scientific and statistically reliable data that can be used in modeling and decision making. The main emphasis is to establish consistent time series for environmental variables rather than establishing representative surveys across the UN ECE region.

The aims are fulfilled by:

- Monitoring both biogeochemical trends and biological responses in small (10-1000 ha) clearly defined areas;
- Seeking to separate the noise of natural variation, including succession, from the signal of anthropogenic disturbance by monitoring natural or semi-natural ecosystems;
- developing and applying tools, e.g. models, for regional assessment and prediction of long-term effects.

The Integrated monitoring network covers 21 European countries. These countries have on-going data submission from at least one monitoring site. All in total, integrated monitoring data are at present available from 70 mostly European sites, about 50 sites with on-going data submission. Additional earlier reported data are available from sites, which have either been suspended or taken out of the IM network and used for regional monitoring.

UNEP'S WORLD CONSERVATION MONITORING CENTER (WCMC)
(<http://www.unep-wcmc.org>)

Relevant WCMC 'interests' in and experience with BRIM concerns:

- An independent review of BRIM, which UNEP-WCMC carried out in 1999/2000;
- Harmonization of information management and reporting for international treaties and programmes;

- Management of information on internationally recognized and designated protected areas;
- Support services to international conventions and programmes;
- Provision of distributed, web-based information services, including delivery of database and maps;
- Significant role in UNEP's GEO (Global Environment Outlook) programme, UNEP.Net and in the Millennium Ecosystem Assessment

Informal consultations between the MAB Secretariats and UNEP-WCMC have underlined the following issues related to BRIM that UNEP-WCMC suggests covering:

1. What are we trying to achieve?
 - * Statutory Framework and its information requirements
 - * Seville Strategy and its information requirements
2. What are we already doing to achieve this?
 - * Components of existing BRIM programme
 - * MAB regional networks, programmes and projects
 - * MAB Secretariat
 - * Other biosphere reserve information projects
3. What are others doing relevant to BRIM?
 - * ILTER
 - * International Tundra Experiment
 - * Organization of biological field stations
 - * Others
4. Future strategy
 - * Defining the purpose
 - * Creating a framework for monitoring
 - * Building on existing experience
 - * Building capacity in the network
 - * Developing a clearing-house capacity to support the network
 - * Links to other programmes and initiatives
 - * Organization, management and resourcing

UNEP-WCMC stressed that, clearly, the most important part of the meeting is the last item, section 4. According to UNEP-WCMC, the real challenge is to identify what can be done that is meaningful and achievable, and that builds on the wealth of experience that is already available both within our networks and elsewhere.

CENTER FOR INTERNATIONAL EARTH SCIENCE INFORMATION NETWORK (CIESIN)
(www.ciesin.columbia.edu)

CIESIN, Columbia University's Center for International Earth Science Information Network, harnesses state-of-the-art information technologies to better understand the linkages among human and environmental systems. The center specializes in on-line data and information management, spatial data integration and training, and interdisciplinary research related to human interactions with the environment.

Designated the World Data Center for Human Interactions in the Environment by the International Council of Scientific Unions, CIESIN has broad experience in identifying and disseminating socioeconomic data related to the environment. It operates the Global Change Research Information Office (GCRIO) and the Socioeconomic Data and Applications Center (SEDAC), a data center within NASA's Earth Observing System program. Under the auspices of the latter, CIESIN has created georeferenced data at both global and regional scales. One example of this is the Gridded Population of the World (GPW) data set, which

provides data on population and population density on a 2.5 minute grid (4.6 km at the equator) worldwide.

CIESIN has a diverse staff, including individuals with training in the computer and information sciences, economics, political science, demography, public health, geography, international affairs, history, library science, and ecology. CIESIN staff are proficient in software development, web and media design, systems integration, GIS, remote sensing, and other technologies. CIESIN is responsible for maintaining Columbia University's GIS site license and providing GIS training throughout the University. CIESIN has received numerous on-line awards for its work, including the Computerworld-Smithsonian Award for information technology in the category Energy, Agriculture, and Environment.

In the spring of 2000, a Memorandum of Understanding was signed between CIESIN, the Ramsar Bureau, and Wetlands International establishing a joint effort to create an online *Ramsar Wetland Data Gateway*. The Ramsar Wetland Data Gateway provides access to a multi-scale, multidisciplinary, diverse database, including spatial and tabular data, through a common search and visualization interface. This places the Ramsar site database in the

context of other relevant data on the sustainable management of wetlands and other protected areas. CIESIN has also developed a prototype on-line Internet mapping application (ArcIMS) that enables users to access satellite-derived data products, socioeconomic information and Ramsar site-specific data from distributed sources (<http://alpha.ciesin.org/rivers/ramsar>, <http://sedac.ciesin.org/ramsardg>).

Experience and Projects Relevant to BRIM

- Experience working with data and non-governmental organizations addressing issues related to internationally designated protected areas and biodiversity:
 - Ramsar, IUCN, World Conservation Society (WCS)
- Extensive data management, achieving and metadata expertise:
 - SEDAC (<http://sedac.ciesin.columbia.edu>) and GCRIO (<http://www.gcricio.org>)
- Application of remote sensing data in support of environmental treaties:
 - Remote sensing and treaties workshop (<http://sedac.ciesin.columbia.edu/rs-treaties>)
- Database interoperability
 - Open GIS Consortium partner
 - Web Mapping Test Bed Sever participant
- Experience developing data base architecture and design
 - Infusion model, supporting diverse data collections including Ramsar and IUCN
- Resources of a major research university
- Experience developing distributed information systems
 - Clients include the Inter-American Institute for Global Change Research (IAI) and the World Bank – Sustainable Rural Development Information System

In summary, CIESIN places a high priority on the issues addressed by BRIM and is especially interested in collaborative projects aimed at meeting these objectives.

GLOBAL INTERNATIONAL WATERS ASSESSMENT (GIWA)
(<http://www.giwa.net/>)

GIWA is a water programme led by the United Nations Environment Programme, UNEP. It is funded to about 50 per cent by the Global Environment Facility, GEF. The aim of GIWA is to produce a comprehensive and integrated global assessment of international waters, the ecological status of and the causes of environmental problems in 66 water areas in the world, and focus on the key issues and problems facing the aquatic environment in transboundary waters.

GIWA will work for four years (starting in June 1999). The objective is to produce a comprehensive and integrated global assessment of international waters. It is to be a systematic assessment of the environmental conditions and problems in international waters, comprising marine, coastal and freshwater areas, and surface waters as well as groundwaters.

The overall objective of GIWA is to develop a comprehensive strategic assessment that may be used by GEF and its partners to identify priorities for remedial and mitigatory actions in international waters, designed to achieve significant environmental benefits at national, regional and global levels.

GIWA is designed not merely to analyze the current problems and their societal root causes, but to develop scenarios of the future condition of the world's water resources and analyze policy options. Ultimately, the aim is to provide sound scientific advice to decision-makers and managers concerned with water resources and dealing with environmental problems and threats to transboundary water bodies. GIWA will focus on five major problem areas, including 23 specific environmental and socio-economic problems. Causal chain analyses will be an essential tool used to identify and better understand the links between perceived problems and their societal root causes.

Global assessments have already been made on biodiversity, climate change, and the ozone layer (stratospheric ozone) for the purpose of supporting the implementation of the GEF project portfolio in these areas. GIWA is intended as a comparable assessment in support of the implementation of the international waters component of GEF.

THE MILLENNIUM ECOSYSTEM ASSESSMENT
(<http://www.millenniumassessment.org/en/index.htm>)

The Millennium Ecosystem Assessment (MA) is a four-year process starting in April 2001. It is designed to improve the management of the world's natural and managed ecosystems by helping to meet the needs of decision-makers and the public for peer-reviewed, policy-relevant scientific information on the condition of ecosystems, consequences of ecosystem change, and options for response. The MA will provide information and also build human and institutional capacity to provide information. More specifically, the MA will:

- Increase understanding of the linkage between ecosystems and the goods and services they provide;
- Build human capacity and the capacity of global, regional, national and local institutions to undertake integrated ecosystem assessments and act on their findings;
- Strengthen international environmental agreements and improve environment-related decisions of national governments by improving access to scientific information;
- Support regional, national, and local integrated assessments that will directly contribute to planning and capacity-building needs;
- Enhance civil society efforts to promote sustainable development by enabling ready access to peer-reviewed data and information;
- Increase the incentives and information available to guide change in private sector actions;

- Develop methodologies to undertake cross-sectoral assessments and to effectively integrate information across scales;
- Identify important areas of scientific uncertainty and data gaps that hinder decision-making and deserve greater research support.

The MA will provide the scientific underpinning to a wide range of national and international efforts to address environment and development challenges. These environmental challenges are interwoven, and thus an integrative assessment process is needed to highlight for decisionmakers the linkages among climate, biodiversity, freshwater, marine and forest issues. The Convention on Biological Diversity, the Convention to Combat Desertification, and the Convention on Wetlands all have endorsed the establishment of the MA as a joint assessment process to meet some of the information needs of the conventions.

The MA will be undertaken at multiple spatial scales. The design consists of a global assessment as well as assessments of conditions and change in ecosystems in individual communities, nations, and regions. A multi-scale "cluster" of assessments will be undertaken in southern African and Southeast Asia, with the possibility of including additional regional clusters and separate assessments during 2001. Assessments at these sub-global scales are needed because ecosystems are highly differentiated in space and time and because sound management requires careful local planning and action. Local assessments alone are insufficient, however, because some processes are global and because local goods, services, matter, and energy are often transferred across regions. The sub-global assessments will be designed to foster and build capacity for widespread adoption of integrated assessment approaches in other regions and nations.

INTERNATIONAL GEOSPHERE - BIOSPHERE PROGRAMME (IGBP)

(<http://www.igbp.kva.se>)

Based on a broadly disciplinary perspective of the Earth and its functioning, the current IGBP structure is organized around a small number of core projects and framework activities. However, IGBP is now evolving towards a new, more systems-oriented structure with more emphasis on the Earth System as an integrated whole. The new IGBP structure will be launched in 2003. Six research activities will be centered on the three major Earth System compartments – ocean, land and atmosphere - and the interfaces between them. PAGES (core project charged with providing a quantitative understanding of the Earth's past climate

and environment) and GAIM (Global Analysis, Integration and Modelling Task Force) will focus on a whole system perspective, providing data, analyses, understanding and insights on Earth System functioning from the past into the future.

The next decade of IGBP research will be undertaken in much greater collaboration with IHDP (The International Human Dimensions Programme on Global Environmental Change) and WCRP (World Climate Research Programme). The challenge to the three programmes is to build on the existing foundation an international programme of Earth System Science and Global Sustainability, driven by a common mission and common questions. The aims of this new Earth System Science consortium are to improve evaluation and understanding of current and future global change; and to place on an increasingly firm scientific basis the challenge of sustaining the global environment for future human societies.

GLOBAL CLIMATE OBSERVING SYSTEM (GCOS)
(<http://www.wmo.ch/web/gcos/gcoshome.html>)

GCOS was established in 1992 to ensure that the observations and information needed to address climate-related issues are obtained and made available to all potential users. GCOS is intended to be a long-term, user-driven operational system capable of providing the comprehensive observations required for monitoring the climate system. It addresses the total climate system including physical, chemical and biological properties, and atmospheric, oceanic, hydrologic, cryospheric and terrestrial processes.

GCOS coordinates and otherwise facilitates the taking of the needed observations by national or international organizations in support of their own requirements as well as of common goals. It provides an operational framework for integrating, and enhancing, observational systems of participating countries and organizations into a comprehensive system focused on the requirements for climate issues.

GCOS is intended to meet the needs for:

- Climate system monitoring, climate change detection and monitoring the impacts of and the response to climate change, especially in terrestrial ecosystems and mean sea-level;
- Climate data for application to national economic development;
- Research toward improved understanding, modelling and prediction of the climate system.

The GCOS priorities are:

- Seasonal to inter-annual climate prediction;
- The earliest possible detection of climate trends and climate change due to human activities;
- Reduction of the major uncertainties in long-term climate prediction;
- Improved data for impact analysis.

GCOS will build, to the extent possible, on existing operational and research observing, data management and information distribution systems, and further enhancements of these systems. The GCOS will be based upon, *inter alia*:

- Existing and enhanced World Weather Watch (WWW) systems;
- The Global Atmosphere Watch (GAW) and related atmospheric constituent observing systems;
- The Global Ocean Observing System (GOOS) for physical, chemical and biological measurements;
- The Global Terrestrial Observing System (GTOS) for land surface ecosystem, hydrosphere, and cryosphere measurements;
- The maintenance and enhancement of programmes monitoring other key components of the climate system, such as terrestrial ecosystems (including the International Geosphere-Biosphere Programme (IGBP)), as well as clouds and the hydrological cycle, the earth's radiation budget, ice sheets and precipitation over the oceans (including the World Climate Research Programme (WCRP));
- Programmes to monitor the key physical, chemical and biological aspects of the impacts of climate change (including the World Climate Impact Assessment and Response Strategies Programme);
- Data communication and other infrastructures necessary to support operational climate forecasting (including the World Climate Data and Monitoring Programme (WCDMP) and the Climate Information and Prediction Services (CLIPS)).

GLOBAL OCEAN OBSERVING SYSTEM (GOOS)
(ioc.unesco.org/goos)

GOOS is a permanent global system for observations, modelling and analysis of marine and ocean variables to support operational ocean services worldwide. The coastal component of GOOS (C-GOOS) will be described below.

The coastal module of GOOS is an effort to coordinate, enhance and supplement existing research and monitoring activities in coastal marine and estuarine ecosystems. The goal is to provide timely data and information on environmental changes effecting; the people who live, work and play in coastal environments, status of coastal ecosystems, and the living resources they support. As C-GOOS develops, it will become a global network of common observations that are nationally and regionally enhanced to address local and regional priorities. The system will provide assessments and predictions of state and changes in the quality and performance of coastal ecosystems worldwide.

C-GOOS is conceived as a global network for the measurement and analysis of a common set of key (core) variables that is regionally and locally customized to address those issues that are of greatest concern to participating countries. Linking user needs to measurements to form an end-to-end, user-driven system requires a managed, two-way flow of data and information among three essential subsystems:

- the observing subsystem (detection);
- the communications network and data management subsystem (integration); and
- the modeling (prediction) and applications subsystem.

The **observing subsystem** consists of the global infrastructure required to measure core variables and transmit data to the communications network and data management subsystem. Recommended core variables are for example sea level, temperature, salinity, surface currents and waves, turbidity, dissolved nutrients, phytoplankton pigments, and water clarity etc. The structure must incorporate the mix of platforms, sensors etc. required to measure core variables with sufficient spatial and temporal resolution to capture important scales of variability. This will require the synthesis of data from remote sensing and *in situ* measurements involving six categories of observing elements: (1) coastal observing networks for the near shore; (2) global network of coastal tide gauges; (3) fixed platforms, moorings and drifters; (4) ships of opportunity and voluntary observing ships; (5) remote sensing from satellites and aircraft; and (6) remote sensing from land-based platforms.

Data communications and management link measurements to applications. The objective is to develop a system for both real-time and delayed mode data that allows users to exploit multiple data sets from disparate sources in a timely fashion. A hierarchical system of local, national and supra-national organizations is envisioned to provide data, information, and access to users at each level.

Data assimilation and modeling. Real-time data from remote and *in situ* sensors will be particularly valuable in that data telemetered from these sources can be assimilated to (1) produce more accurate estimates of the distributions of state variables, (2) develop, test and validate models, and (3) initialize and update models for improved forecasts of coastal environmental conditions and, ultimately, changes in ecosystem health and living resources.

It is expected that C-GOOS will develop along two tracks:

1. The building of an initial global network through the incorporation of existing operational elements that meet GOOS design requirements and;
2. The implementation of pre-operational pilot projects that demonstrate the utility and cost-effectiveness of the "end-to-end, user-driven" approach and contribute to the development of the global network and regional enhancements.

Collaboration with key research programs will provide the scientific basis for continued development toward a fully integrated system. The major pieces missing are an internationally accepted global design; national and international commitments of assets and funds; and an unprecedented level of collaboration among nations, institutions, data providers and users.

GLOBAL TERRESTRIAL OBSERVING SYSTEM (GTOS)
(<http://www.fao.org/gtos>)

GTOS mission is to provide the scientific and policy-making community with access to the data necessary to manage the change in the capacity of terrestrial ecosystems to support sustainable development.

GTOS fulfills its mission through a number of complementary activities which include networking, development of regional programmes, and through demonstration projects. Among its highest priorities is the strengthening of communication between the many groups of the environmental data provider and user community. In most of its projects, GTOS serves in the role of a broker, bringing people of different fields of expertise together at one table.

GT-Net was developed as a "global system of networks" to improve information exchange among terrestrial research networks. It serves as a tool for network managers to exchange data, information and experience, explore areas of common interest, and harmonize data handling.

Through regional programmes GTOS seeks to strengthen national capacity to participate in global change studies that affect them, such as in relation to international conventions on the environment. It builds links with regional and global initiatives in the field of terrestrial environmental data assemblage, processing and use. In order to understand how data assemblage and processing on a national level can provide a basis to answer regional and global issues, these programmes assess user needs in the scientific and policy communities, assess the status of terrestrial monitoring within the respective countries, and assists in further developing the technical capacity to environmental monitor and to coordinate activities on a regional level.

The Net Primary Productivity (NPP) and the Terrestrial Carbon Observation (TCO) project are thematic initiatives that demonstrate the benefits of cooperation between different science communities (such as remote sensing scientist and in situ site managers), and the advantages of such alliances when tackling global environmental issues relating to biodiversity, climate change or desertification.

The Terrestrial Observation Panel on Climate (TOPC) and the Global Observation of Forest Cover (GOFC) panel are two GTOS expert groups aimed at providing regional and global datasets and promoting globally consistent data synthesis and interpretation according to their thematic focus. They have served a number of useful functions, including identifying key variables for the TEMS database and establishing regional networks. The TEMS database includes search facilities, browsing trees facilities (by environmental variables, networks, or T.Sites), maps, environmental variable sheets, socio-economic data, etc.

Significant collaboration has been developed with the UNESCO MAB Programme in the areas of integrated monitoring and database development. Collaboration also included efforts to bring biosphere reserves more directly into global change projects such as TCO and NPP through the BRIM Programme. At present, some 130 biosphere reserves are included in the TEMS database.

WWF – WORLD WIDE FUND FOR NATURE
(<http://www.panda.org>)

Protected areas and biosphere reserves are important repositories of biodiversity. They often also provide valuable sources of food, energy and livelihoods for the rural poor. WWF played an important role in setting up integrated conservation and development projects (ICDPs) in the 1980s with the aim of achieving effective biodiversity conservation whilst meeting basic human needs in a sustainable way. WWF also works closely with UNESCO's MAB Programme in planning and management of biosphere reserves. WWF is now seeking to increase effectiveness of its conservation impact by working on larger landscapes or ecoregions using more coherent approaches.

Monitoring and evaluation is an important perceived need in the effective implementation of these projects. While it has been possible to monitor the biodiversity impacts reasonably well, much less work has been done on the socio-economic aspects. This is partly owing to the complexity of determining human impacts and partly because of the rather recent interest in this field. Lack of attention to proper monitoring systems has reduced conservation effectiveness of these interventions while also failing to achieve further improvements.

WWF aims to contribute to this field using an adaptive management approach. For this, it is important that projects have clear, measurable objectives and indicators of success and employ a rigorous, comprehensive and participatory project design process which allows for ongoing learning and adaptation. From a socio-economic perspective, it is important to monitor the factors that affect the livelihoods and cultures of the local communities. These may be biological -- species, resources, and habitats that are directly utilized by the people, and socio-economic - such as credit, physical infrastructure, and human and social capital -- that shape these livelihoods and use of biological resources. The evolving thinking on poverty may add an important dimension to this work. The key purpose socio-economic indicators thus serve to monitor the interactions between human livelihoods and sustainability of biosphere reserves/protected areas and feed these lessons to improve project design. This will be an important contribution to ensuring effectiveness of biosphere reserves and other areas under similar community based management regimes.

WETLANDS INTERNATIONAL
(www.wetlands.org)

Wetlands International, maintains a range of biodiversity and habitat monitoring programmes, aimed at the provision of strategic information to enable the conservation of species dependent or strongly associated with wetlands and their wise use. The most longstanding monitoring activity is the International Waterbird Census. However, there are also many taxon-specific activities conducted at various scales concerning waterbirds, led by Specialist Groups, managed in association with IUCN Species Survival Commission and BirdLife International. In addition, the Ramsar Sites Database is maintained by Wetlands International, containing officially supplied information concerning Ramsar-designated Sites. A number of wetland inventories conducted by Wetlands International, and in particular the

Global Review of wetlands resources and priorities for wetland inventory - GroWI, are fundamental tools for linking biodiversity information data holdings of Wetlands International with habitat information.

International Waterbird Census

The International Waterbird Census started about 30 years ago by organizing co-ordinated waterbird counts in large parts of Eurasia: the International Waterbird Census (IWC sensu stricto). These counts take place in mid-January and were the first attempt to collect data on a species population level. Presently it is a large programme to which thousands of volunteers contribute and which has expanded to other parts of the world. More or less regular programmes are being carried out in Africa, Asia, Oceania and South America, all co-ordinated and reported on by Wetlands International regional and sub-regional offices. Similar activities are going on in North America, and closer contacts are being established to incorporate these data into the global overview of population figures. The data collected are essential for international conventions such as the Ramsar Convention. The data are used to determine the international importance of a wetland by e.g. using the presence of 1% of a flyway population of a waterbird or the presence of 20,000 waterbirds in total, as a criteria.

The data are also essential for the flyway agreements under the Bonn Convention, such as the African Eurasian Waterbird Agreement or flyway strategy plans such as the Asian-Pacific Migratory Waterbird Conservation Strategy.

Western Palearctic Water Bird Census

The International Waterbird Census (IWC) is conducted annually in most countries in the region. It is the primary tool for monitoring the conservation status of waterbird populations within the region. It is based on annual non-breeding season surveys at a sample of sites, and is undertaken mainly by volunteer counters. For most countries, Wetlands International provides international co-ordination of nationally organized January counts (although for some countries it directly co-ordinates counters). Head quarters activity, involving collation and analysis of data, interpretation and publication.

International treaty and national policy relevance of the waterbird monitoring programme

- Bonn Convention
- Ramsar Convention
- African-Eurasian Waterbird Agreement
- EU Birds Directive
- Biodiversity Convention

Relevance and linkage to BRIM

In many respects the BRIM works on those biosphere reserves that are wetlands and Ramsar designated Sites is a more focused and integrated monitoring programme, than the more broad-based, often flyway based work that is conducted under waterbird monitoring programmes. The strength of the waterbird population monitoring approach is that regional and sometimes global trends are apparent. However, the potential habitat dependence of such changes in species numbers and distribution is not a strong feature of Wetlands International's work at present. In addition the wise use of many wetlands cannot be assessed without strong integration of species-based monitoring with socio-economic and habitat information.

Wetlands International therefore regards the BRIM as a very useful mechanism for potential direct collaboration and also linkage to other partners activities, for example BirdLife's Important Bird Area monitoring programme, and in addressing strategic needs, especially the monitoring of Ramsar Site ecological status in partnership with Contracting Parties.

BIRDLIFE INTERNATIONAL – MONITORING IMPORTANT BIRD AREAS

(<http://www.birdlife.org.uk/>)

Background

Important Bird Areas (IBAs) are sites of international importance for the conservation of birds, identified against a set of globally standardised scientific criteria.

BirdLife International initiated the identification of Important Bird Areas in 1981, with a study funded by the European Commission of selected Member States of the European Union. Since then, the BirdLife IBA programme has become a worldwide initiative, aimed at identifying and protecting a network of critical sites for the conservation of the world's birds and making a major contribution to global biodiversity conservation.

The BirdLife Partnership, present in 105 countries, with 65 autonomous Partner organisations and a global membership exceeding 1.8 million, have adopted strategies to comprehensively document all the world's Important Bird Areas, and set a series of targets for their conservation. The IBA programme has therefore evolved from, initially, identifying Important Bird Areas to a comprehensive initiative encompassing site orientated research, action, monitoring, education, advocacy and national and international legal protection.

The value of monitoring biodiversity

Better environmental, and particularly biodiversity, indicators need to be developed to permit regular reporting of the state of biodiversity, the pressures it faces and the appropriate responses. A prerequisite for producing indicator statistics is the availability of good quality, time-series data on biodiversity. To ensure that key data on biodiversity are repeatedly collected over time monitoring schemes need to be established and developed.

There is great merit in the use of ornithological data to indicate the effects of environmental change on biodiversity. The wealth and quality of data on birds, relative to other taxa, may be

used to develop the thinking and lead the way in the development and application of biodiversity indicators at local, national and regional levels. Established networks of volunteers have proved a cost effective source of such data. How effectively we are conserving birds is a means of assessing how successful we are in conserving ecosystem functions and biodiversity as a whole.

Monitoring of IBAs

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

In 2000 the second Pan-European inventory was published, documenting 3,619 IBAs across 51 countries/autonomous regions. IBAs for the Middle East were published in 1994 and over 1,200 IBAs in Africa have been identified (to be published in 2001). IBA programmes are also active in Asia and the Americas regions. Through the BirdLife World Bird Database storage and analysis of data ensures that these data can be interpreted and communicated effectively. The database includes information on bird populations at IBAs (for Europe alone >100,000 records), habitat type and extent at IBAs (>12,000), threats (>12,000), protection status and management plans.

Developing biodiversity indicators using IBA data

BirdLife plans to build on existing data gathering and monitoring efforts to develop and implement a comprehensive IBA monitoring programme. For example in Europe a model is currently being developed which includes 6 core indicators that are easily measured, understood, communicated and are scientifically sound (summarised in brief below). They have been chosen carefully to allow monitoring of the state of IBAs and their key bird species, pressures acting upon them and responses taken to conserve them.

Indicator type	Indicator
State	Site boundary and area
	Habitat
	Key bird populations
	Land-use
Pressure	Threats
Response	Protection status
	Management plan

IBA monitoring and Biosphere Reserve Integrated Monitoring (BRIM)

Many of the 393 Biosphere Reserves will also be Important Bird Areas. An initial analysis of the BirdLife World Bird Database for Europe and Africa indicates that 121 IBAs in Europe are designated Biosphere Reserves (overlap with 86 Biosphere Reserves) and 44 designated in Africa. Table 1 shows the relationship between these areas.

A substantive amount of data is being gathered and will continue to be monitored through the IBA programme on Biosphere Reserves. Similarly the BRIM programme will generate key information relevant to the conservation of IBAs. BirdLife would therefore welcome exploring collaboration on monitoring biodiversity between the two programmes. Links and integration of socio-economic indicators developed through the BRIM work and their relations to IBAs would also be an interesting area to explore.