WCMC Handbooks on Biodiversity Information Management

A DARWIN INITIATIVE PROJECT

WORLD CONSERVATION MONITORING CENTRE

COMMONWEALTH SECRETARIAT

Information Networks

Volume 4

WCMC Handbooks on Biodiversity Information Management

Volume 4 Information Networks

World Conservation Monitoring Centre

Series Editor J.H. Reynolds

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The **World Conservation Monitoring Centre**, based in Cambridge, UK, is a joint venture between three partners in the *World Conservation Strategy* and its successor *Caring for the Earth*: IUCN – The World Conservation Union, UNEP – United Nations Environment Programme, and WWF – World Wide Fund for Nature. The Centre provides information services on the conservation and sustainable use of species and ecosystems and supports others in the development of their own information systems.

The United Kingdom's **Darwin Initiative for the Survival of Species**, launched at the 1992 Earth Summit in Rio de Janeiro, aims to support the Convention on Biological Diversity by drawing on Britain's scientific, educational and commercial strengths to assist in the conservation and sustainable use of the world's biodiversity and natural habitats. Key tenets of the Darwin Initiative include collaboration and cooperation with local people, capacity building, distinctiveness and complementarity of project initiatives, poverty alleviation, and long-term sustainability. Through training, awareness raising, and research on undervalued areas of biodiversity, Darwin support is particularly aimed at strengthening links between Britain and those countries rich in biodiversity but poor in financial resources.

Under the auspices of its **Environmental Training for Sustainable Development** initiative, the Management and Training Services Division of the **Commonwealth Secretariat** supports short- and long-term training, internships and institution development for environmental policy makers, environmental 'operatives', and environmental information professionals in the Commonwealth, in various areas of the environment including biodiversity and gender. Funding support for training, institution development and publications under the aegis of the Management and Training Services Division is provided by the Fund for Technical Co-operation (CFTC).

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The generous support of the *United Kingdom's Darwin Initiative for the Survival of Species* has provided for the development of a comprehensive programme of training in biodiversity information management. This programme comprises an international training team, drawing on expertise from collaborating organisations around the world; the preparation of a training resource in the form of a handbook series and related materials; and the development of computer-based demonstration tools. Training is being promoted through the delivery of post-graduate modules, and through regional and national workshops which have received additional support from The British Council, British Airways Assisting Conservation Scheme, and contributions from participating organisations. The programme has been appropriately titled *Darwin Initiative Training in Biodiversity Information Management.*

Development of the handbooks has also benefited from experiences gained through the Biodiversity Data Management (BDM) Project, administered by the United Nations Environment Programme (UNEP) and funded by the Global Environment Facility (GEF), and related initiatives supported through the European Union (EU) and European Environment Agency (EEA). Indeed, Volume 6 draws extensively on one of the key outputs of the BDM Project, the *Guide to National Institutional Survey* (UNEP/WCMC 1998), developed in consultation with participating countries, the BDM Advisory Committee and the UNEP management team. The concept of an information cycle was developed in collaboration with the International Institute for Environment and Development (IIED) with support from the UK Department for International Development (DFID). The handbooks have been published through the generous support of the Commonwealth Secretariat.

Fundamental to the development of this programme have been the partnerships established with training organisations around the world. These organisations have worked collaboratively in hosting workshops, in reviewing the handbook materials, and in providing guidance on how regional and national training needs can be met most effectively. The training programme has significantly benefited from the input of numerous individuals working in the field of biodiversity information management. Among these individuals, particular mention goes to Professor Ian Crain and Gwynneth Martin of the Orbis Institute, Ottawa, Claire Appleby, an independent consultant, and to Drs Jake Reynolds and John Busby of WCMC for their insightful work in developing the handbook series. Thanks are also extended to Laura Battlebury for her tireless administrative and logistical support. The series

editor for the handbooks was Jake Reynolds, while Donald Gordon managed the overall project.

To the many individuals, both within and outside WCMC who have contributed to the development of materials and the delivery of training in biodiversity information management, a profound debt of gratitude is owed. It is through this collaborative effort that a service is being developed to contribute to the conservation and sustainable use of living resources.

BACKGROUND

The purpose of the *WCMC Handbooks on Biodiversity Information Management* is to support those making decisions on the conservation and sustainable use of living resources. The handbooks form part of a comprehensive programme of training materials designed to build information-management capacity, improve decision-making and assist countries in meeting their obligations under Agenda 21 and the Convention on Biological Diversity.

The intended audience includes information professionals, policy-makers, and senior managers in government, the private sector and wider society, all of whom have a stake in the use or management of living resources. Although written to address the specific need for improved management of biodiversity-related information at the national level, the underlying principles apply to environmental information in general, and to decision-making at all levels. The issues and concepts presented may also be applied in the context of specific sectors, such as forestry, agriculture and wildlife management.

The handbooks deal with a range of issues and processes relevant to the use of information in decision-making, including the strengthening of organisations and organisational linkages, data custodianship and management, and the development of infrastructure to support data and information exchange. Experience suggests that some of the greatest challenges in information management today are concerned with organisational issues, rather than technical concerns in the delivery of information which supports informed decision-making. Consequently, topics are addressed at management and strategic levels, rather than from a technical or methodological standpoint, and alternative approaches are suggested from which a selection or adaptation can be made which best suits local conditions. Nevertheless, in adopting this framework approach, we have tried to adhere to recognised conventions and formalisms used in information management and trust that in producing a 'readable' set of handbooks the integrity of the materials has not been compromised.

Overall, the handbook series comprises:

Companion Volume
Volume 1 Information and Policy
Volume 2 Information Needs Analysis
Volume 3 Information Product Design
Volume 4 Information Networks
Volume 5 Data Custodianship and Access
Volume 6 Information Management Capacity
Volume 7 Data Management Fundamentals

Collectively, the handbook series promotes a shift from tactically based information systems, aimed at delivering products for individual project initiatives, to strategic systems which promote the building of capacity within organisations and networks. This approach not only encourages data to be managed more effectively within organisations, but also encourages data to be shared amongst organisations for the development of the integrated products and services needed to address complex and far-reaching environmental issues.

The handbook series can be used in a number of ways. Individual handbooks can be used to guide managers on specific aspects of information management; they can be used collectively as a reference source for strategic planning and project development; they can also provide the basis for a series of short courses and training seminars on key challenges in information management.

The companion volume provides the background to the handbook series. It also assists readers in deciding which handbooks are most relevant to their own priorities for strengthening capacity.

A second series of handbooks is planned to provide more detailed guidance on information management methodologies, including the areas of data and technology standards, database design and development, application of geographic information systems (GIS), catalogues and metadatabases, and the development of decision-support systems. The current series deals only briefly with formal system development methodologies, and for more detailed treatments the reader is encouraged to access the wide range of published and electronic resources available in libraries and on the Internet, some of which are alluded to in individual handbooks and reference sections.

A number of computer-based training tools have been developed to accompany the handbook series and are used in the training programme. These are based on a protected areas database, a tree conservation database, a GIS demonstration tool and a metadata directory. They aim to demonstrate key aspects in the collection, management and analysis of biodiversity data, and the subsequent production and delivery of information. They also illustrate practical issues such as data standards, data quality-assurance, data access, and documentation. Each training tool is supported by a user guide, together with a descriptive manual which traces the evolution of the tool from design, through development to use.

1 INTRODUCTION

Many groups possess knowledge of a cultural, economic or scientific nature which could be of great value to the conservation and sustainable use of living resources. This may have been built up over many years or generations and represents a significant investment in terms of time, money and intellectual effort. The intellectual property resulting from this investment is often seen as an important asset, to be guarded from outsiders and made available only in exchange for other assets, for example money. It is not surprising, therefore, that the flow of information between different segments and levels in society is often frustrated by political, organisational or even personal barriers.

In general, there is a lack of awareness of the **benefits of information sharing**, allowing the potential disadvantages, including fears about loss of intellectual property, to dominate. This leads to the erection of unnecessary barriers to information sharing based, for example, on the belief that intellectual property will be diluted, misrepresented, or otherwise used to the detriment of its owner when shared. Sometimes such beliefs are well founded, for instance in the case of owners of indigenous knowledge who are fearful of exploitation by drug companies; owners of scientific knowledge, particularly those whose careers depend on publication, who fear plagiarism or lack of acknowledgement; and owners of technological knowledge who fear infringement of patents, copyright and other forms of know-how.

Owners of all types of information may feel uncomfortable about sharing their investment until they understand **why it is needed** and **how it will be used**. Given that access to information is a vital part of most people's everyday work (whether this is from different parts of the same organisation or from external individuals, organisations or sources), efficient procedures for information sharing are essential to productivity. For example, human population figures generated by a national census agency may be required by planners in the agricultural and health sectors; forestry department maps may be needed by an environmental lawyer assessing a claim on public forest land; and, calling on generations of experience, a village elder may need to advise his community on the best moment to harvest a wild crop. Such work can be delayed, devalued or prevented by lack of information sharing.

A special challenge arises when producing information to address environmental concerns. The information needed to support policy and practices in this area is multi-disciplinary in nature, even when confined to a single sector such as forestry or agriculture, and may be required on a diverse and variable set of topics. It is

inevitable, therefore, that the underlying datasets will be scattered amongst many organisations and sources, making the task of integration especially time-consuming. Furthermore, if some organisations are unable or unwilling to provide access to their data, there may be no option but to reproduce secondary copies at great expense. Even worse, decisions may be made in the absence of important data because the latter have not been accessible.

Box 1 presents a variety of constraints which can hinder the unrestricted exchange of data. In many cases, such constraints will be perfectly reasonable. Where unnecessary barriers are erected, there are powerful techniques for overcoming these based around the principle of **custodianship** (see Volume 5). A simple method for assessing which constraints may be the most plausible in any given situation is to consider what would happen if a request was made for one's own data. This helps to anticipate and appreciate the difficulties encountered by others.

Box 1 Common constraints on data access

- No established corporate policy or guidelines on data access.
- Not willing to release data (e.g. for reasons of copyright, confidentiality, security or institutional/personal rivalry).
- Physical procedures for retrieving data too complex (e.g. inefficient means of accessing/ compiling/editing/copying data).
- No funds to process the request (e.g. due to staff costs or costs of media).
- Request for data is not made clearly enough.
- Requested data are still under development.
- Requested data are not fit for release (e.g. not standardised or quality-assured).

2 BASIC PRINCIPLES

Information networks, which are simply assemblages of individuals, groups and organisations with common information goals, overcome barriers to data access by focusing on the need for cooperation. They range in size from loose associations of individuals based upon personal contacts and historic ties, to actively managed consortia of government agencies, NGOs, scientists and private organisations, all with shared information goals. The aim is to build trust and confidence between the network's partners, who may include scientists, policy-makers and resource managers, leading to **improved uptake of scientific information in policy and planning** (see Volume 1).

The rewards of information networking can be great. For example, more reliable access to data can enable organisations to fulfil their core responsibilities more effectively and consider new opportunities and roles. Participation in networks enables information products to be developed with wider support and with greater efficiency. It is a classic 'win-win' situation in which organisations — whether they are providing or receiving data — become empowered through cooperation.

However, it would be naive to assume that active and positive cooperation will happen as a matter of course. Each partner (or stakeholder) must be able to see some **concrete benefits in joining the network**, whether this is the ability to improve the quality of a dataset, acquire access to other datasets, or enter a long-term relationship with another organisation. As the network becomes established and recognised, further potential benefits are economies of scale, minimised duplication of effort, and external investment on a scale which could not be attracted by individual partners.

Information networks require substantial effort to establish and further effort to maintain. Benefits must be perceived as exceeding the costs of participation, for example in terms of the time and resources spent liaising with other partners (networks are unlikely to succeed unless this fundamental principle is understood). When balancing the costs and benefits of entering an information network a key question is 'what will it cost me to contribute?', as well as 'what can I expect to gain?'.

Information networks tend to establish themselves in similar ways. The initial push is from non-governmental organisations, professional associations and scientists who are often among the first to become aware of impending environmental issues, and wish to share information and experiences in order to support each other's activities.

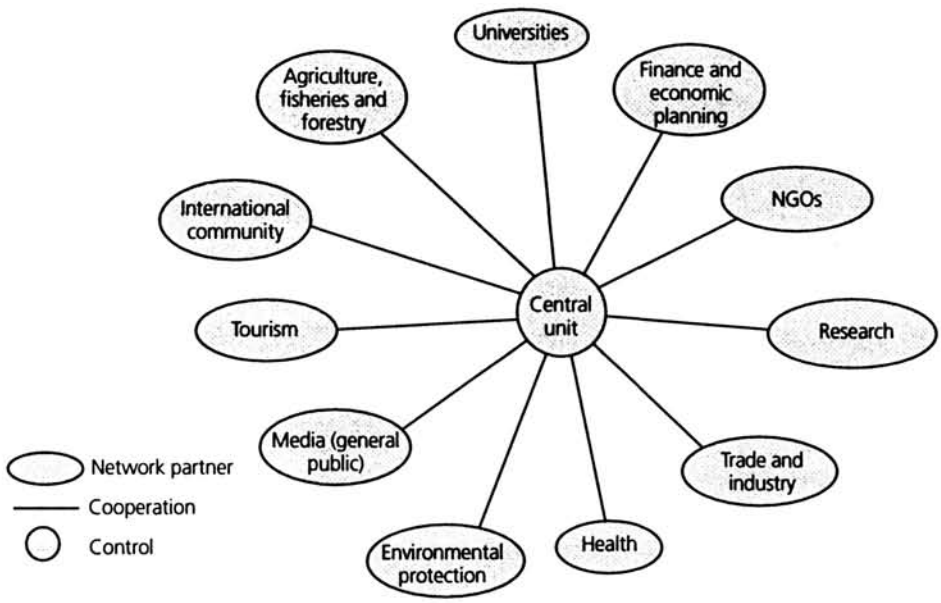
As awareness of the issues rises, and the activities of the individuals concerned become seen by outsiders as a credible source of information, cooperation is consolidated by harmonising approaches to data management and by developing information as a group rather than separately.

Informal networks of this kind can be operated on very low budgets, since they are driven primarily by the personal commitment of individuals. Eventually, however, increased size, prominence and acceptance by greater numbers of users can enable information networks to grow into self-supporting bodies, for instance with secretariats, which are **recognised or even adopted by governments**. Not all networks develop in this way: some may be initiated directly by governments or industry, or indirectly via externally sponsored projects.

3 NETWORK DESIGN

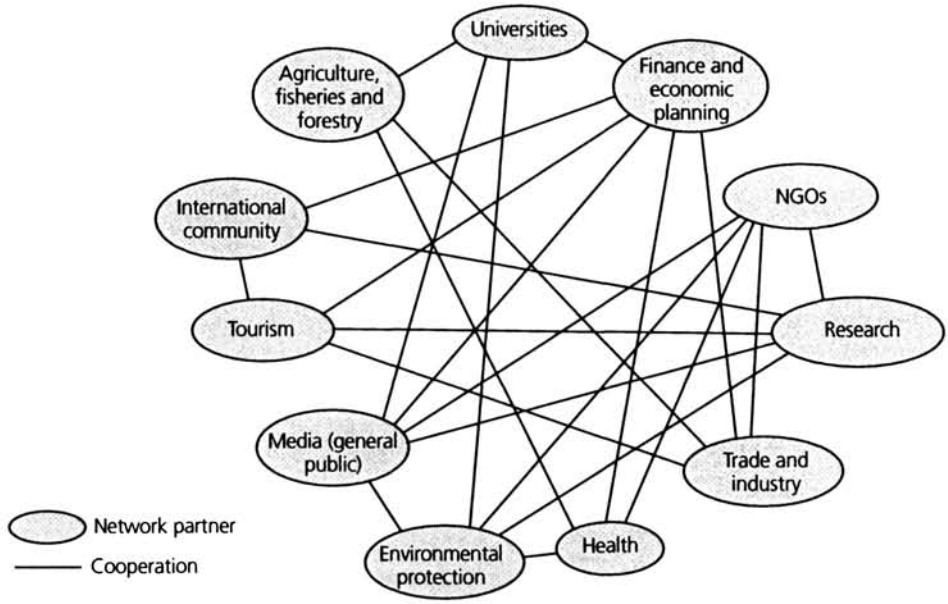
There are two basic forms of information network. The first uses a **centralised** architecture (see Figure 1) where there is a single organisational unit at the centre of the network. Individual partners communicate and cooperate with that unit, for example by providing specific data and advice, but not directly with other partners. The implication is that the central unit provides all the necessary people, facilities and procedures to generate information products. This is equivalent to saying that the information system is located in one, central location, with partners supporting this as necessary. Centralised data management is efficient in situations where partners work within a single operation, so that individual feelings of data ownership are subsumed by corporate objectives. It is also useful in situations where, for security reasons, data must be managed under tightly controlled conditions (e.g. in a bank). Finally, it is the only practical way forward in cases where individual partners do not have the capacity to manage data themselves.

Figure 1 Centralised network



The second form of network has a **distributed** architecture (see Figure 2). Partners operate in an unrestricted environment where communication is encouraged between all parties. No attempt is made to coordinate or control the partnerships which may develop; there is total democracy of cooperation. This is equivalent to saying that the information system is spread across all of the network's partners, i.e. the network *is* the information system. Interestingly, the two architectures — centralised and distributed — mirror wider changes in information technology strategy over the last decade, from large, centralised computers (mainframes) to small, desktop computers (personal computers) communicating with each other via ever more extensive electronic networks. The Internet is the ultimate example of a distributed network, albeit chaotic and unfocused, although electronic communication is not essential to network functioning in general.

Figure 2 Distributed network



There are drawbacks to both architectures. In the first case, the central unit may be perceived as controlling access to data and information products by custodians (see Volume 5). Under such conditions it may be difficult, even impossible, to establish a 'cooperative spirit' since, quite correctly, partners expect to retain full rights and responsibilities over their data. With distributed networks, however, partners are not coordinated or provided with direction, resulting in duplication of effort, lack of agreed standards, and generally impeded progress towards common information objectives.

The weaknesses of both approaches can be rectified through the formation of a hybrid, or **managed** network, which allows free communication between partners and provides coordination and other network-wide services through a 'hub' (see Figure 3). Unlike a centralised network, the hub of a managed network serves the collective interests of the network's partners, rather than the specific interests of a single organisation or operation. Usually, the hub would be managed by a committee representing the interests of each partner in the network, plus associated administrative support (WCMC 1994). A dotted line is used to denote the hub in

Figure 3 Managed network

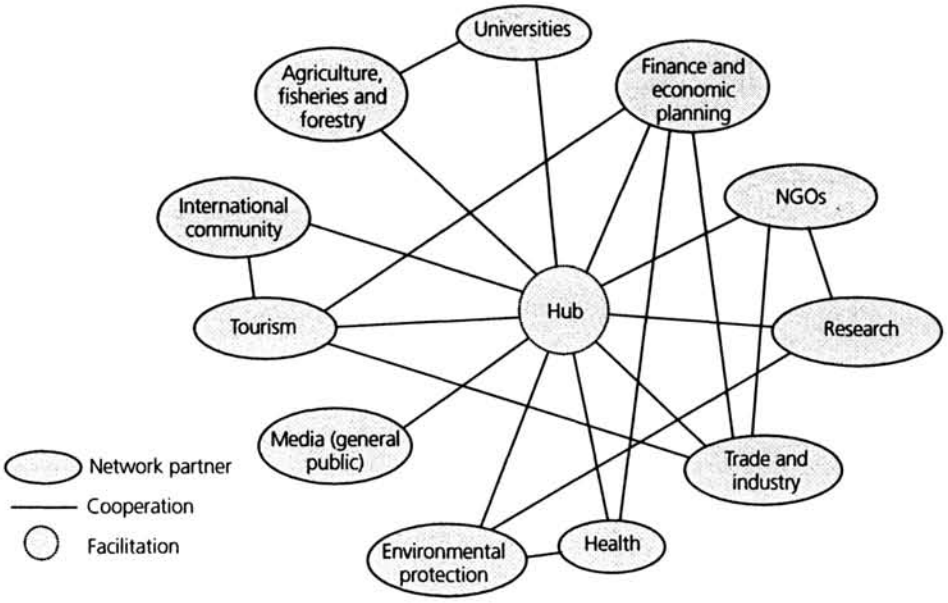


Figure 3 to reinforce its role as **facilitator**, not controller, of the network. A good measure of the success of the hub in serving collective interests is the number of bilateral partnerships it helps to form. This feature distinguishes the managed network from more centralised approaches. The table below summarises the advantages and disadvantages of each type of network.

Type of network	Advantages	Disadvantages
Centralised	Efficient planning and administration. Useful when capacity of partners is low.	Partners must be prepared to give up/mandate management of their data to another body.
Distributed	Perceived as very democratic. Cheap to set up.	Difficult to achieve long-term results due to lack of coordination.
Managed	Efficient planning and administration. Good communication and cooperation between partners.	Potentially costly to maintain.

4 PARTNER ROLES AND RESPONSIBILITIES

4.1 Overview

In the current context, the main purpose of an information network is to support the development of good policies, plans and decisions on the conservation and sustainable use of living resources (see Volume 1). To achieve this purpose effectively, partners need to feel comfortable contributing to the smooth running of the network, and know how their contributions are leading to its overall goals. To ensure that this occurs, the roles and responsibilities of the network's partners need to be identified, fully defined and, most importantly, agreed.

In a managed network there are three distinct roles for partners to play: **custodians**, the **hub** and **users**. All the activities necessary to achieve the network's goals are encompassed by these roles. One or more roles may be undertaken by each partner, provided that the implications of each role, in terms of the services they are expected to provide to the network, are fully appreciated. In practice, partners will determine the roles they wish to play on the basis of how closely their corporate objectives match those of the networks in which they operate and by their physical capacity to participate.

4.2 Custodians

A custodian is an organisation (or other group, occasionally an individual) which is regarded to be in the best position to **ensure the quality and accessibility of a dataset**, and to advise on appropriate uses thereof (see Volume 5 for a full discussion). Many of the network's partners will be custodians, some of nationally-significant datasets, such as national census results, vegetation cover, and climatic surfaces, and others of specialist interest, such as the breeding locations of rare species, or the variety of non-timber products obtained by local people from a forest.

Proper assignment and management of custodianship is fundamental to the success of an information network, particularly where the management of so-called essential datasets is concerned (see Volume 3). Its principal aims are:

- to minimise duplication in the collection and management of data;

- to ensure that datasets are available for use as and when required (i.e. they exist and are accessible); and

- to ensure that they are quality-assured (i.e. valid, maintained, documented and secure).

In cases where the custodianship of an important dataset is in dispute, or was simply never resolved, the network may wish to facilitate a solution in the interests of all of its partners (see Section 4.3).

Custodianship of a dataset carries with it certain **responsibilities**, as presented in Box 2. Each of these contribute to the well-being of a dataset and, thus, to internal productivity gains as well as an increased capacity to collaborate with others. Naturally, custodians may harbour concerns at the prospect of providing access to their data. For this reason they are also invested with certain **rights**, consistent with broader government, corporate and other applicable policies and agreements, which determine the conditions under which the dataset can be used (see Box 2). Such rights are not intended to prevent legitimate use of a dataset. Indeed, the aim is to foster an environment in which data access is straightforward and encouraged. Above all, custodians must feel comfortable providing data to others, and users should be satisfied with the data they receive.

4.3 The Hub

The hub of a managed network is responsible for **facilitating cooperation** between the network's partners. This ensures that the partners are aware of and are comfortable with their roles, and provides the coordination necessary to ensure that they can work together efficiently. Furthermore, the hub can act as a mouthpiece for network products and services and, as a consequence, attract income for the network's activities.

Despite the obvious leadership role of the hub, the network should remain driven by the interests of individual partners, rather than be subsumed into the programme of a single organisation. This can be achieved by ensuring that the hub is directed by a committee of partner representatives which, if desired, can meet anywhere it chooses. It should be noted that, for administrative reasons, it is also wise to establish a small team to carry forward the committee's decisions. This team, plus their supporting communications and office facilities, are commonly known as a **secretariat**.

Box 2 Responsibilities and rights of custodians

Responsibilities

- To build a dataset (with partners, as appropriate).
- To maintain a dataset (i.e. keep it up to date, abreast of standards, structured as necessary).
- To ensure the quality of a dataset (i.e. ensure that it is valid, maintained, documented, secure).
- To provide access to a dataset (to legitimate users).
- To provide advice on appropriate uses of a dataset (e.g. suggested/unwise/improper uses).
- To coordinate the development of a dataset (with appropriate partners).

Rights

- To regulate access to a dataset (depending on category of user).
- To safeguard intellectual property (e.g. acknowledgement, regulation of copying).
- To recover costs (e.g. recover market value, investment, cost of supply).

Box 3 summarises the overall responsibilities of the hub. There is a close correspondence between these responsibilities and the main activities of the 'information cycle' introduced in Volume 1, which provides a guiding framework for cooperative information production. Indeed, an over-arching aim of the hub is to oversee implementation of the information cycle.

The hub delivers its programme through a secretariat, which may vary in size from a single individual (and associated office facilities) to a dedicated team of staff in the largest cases. Box 3 also summarises the responsibilities of the secretariat which enable it to pursue the hub's — and thereby the network's — overall purpose.

Box 3 Responsibilities of the hub

Overall

- Promote cooperation between the network's partners (e.g. meetings, workshops, newsletters).
- Facilitate agreement of the network's goals (e.g. which issues to address, which users to serve).
- Facilitate preparation of strategic plans for information production (e.g. information needs analysis, information product design, objectives and targets for the network's partners).
- Facilitate implementation of strategic plans (e.g. through formation of multi-partner teams).
- Facilitate access to data (e.g. through custodianship, data access agreements, Memoranda of Understanding, standards).
- Facilitate the development of the network (e.g. assess capacity, identify areas for restructuring or investment, seek support).
- Market the network's products and services.
- Monitor the effectiveness of the network's products and services.

The hub has no direct need to manage scientific data, since this is the role of individual custodians (see Section 5). Nor has it any need to develop other information management capacities unless these are directly related to its facilitation role. However, given that the hub is responsible for tasks such as preparation of strategic plans for information production, and for facilitating access to essential datasets, it may need to develop its capacity to manage a limited number of datasets.

In particular, the hub needs to know where capacities are located in the network, how readily they can be mobilised for specific tasks, where essential datasets are located, what state they are in, and where financial and other support can be obtained to drive the network's development. Thus, three distinct datasets may be considered:

Box 3 Responsibilities of the hub (cont.)

Secretariat

- Organise meetings and workshops for the network's partners.
- Provide editorial and office support for preparation of key documents (e.g. strategic plans, project proposals, marketing literature).
- Brief the network's partners on new opportunities, plans and progress (e.g. newsletters, email).
- Handle enquiries about the network's activities, referring to individual partners as appropriate.
- Maintain copies of the network's products and services for distribution to users.
- Manage data on the status and availability of the network's capacity.

1. Sources of capacity

Details of the status and availability of capacity within the network. For example, details of the core businesses, expertise, facilities and particular strengths and weaknesses of the network's partner organisations (see Volume 6).

2. Sources of data

Details of the status and availability of datasets which are significant to the network's goals. For example, details of their theme, scale, completeness, currency, reliability, accuracy and pricing strategy, plus an indication of how they were collected, their intended uses, and the data standards and quality-assurance procedures which have been applied. Such details are commonly known as **metadata**, since they are, literally, data about data. When compiled as a catalogue, they enable users to locate the datasets they are looking for and judge whether the data are suited to their needs (see Volumes 5 and 6).

3. External sources of support

Details of national and international sources of external (non-network) development assistance, including funding, technical assistance and access to technologies.

4.4 Users

Users vary, with many having their own individual information needs (see Volume 2). Some of these may correlate closely with each other, in which case the network can produce similar information for multiple users, saving time and resources. However, in the majority of cases, information will need to be tailored to specific users (see Volume 3).

One issue is clear: **information is useless until it is used.** In the current context, this implies that an information network can have no direct bearing on the conservation and sustainable use of living resources unless active use is made of the information it produces. Thus, an urgent requirement for any information network is to define which issues it is trying to address, which users it is trying to serve and, once this has been achieved, actively attempt to recruit these users as full partners in the network. Special attention can then be given to analysing their information needs, and empowering them to make better decisions with relevant and timely information products and services.

In general, networks do not purely serve the interests of users; they serve the interests of all of the network's partners, only some of which will be users. Thus, although users may receive direct support in the form of information products, custodians may receive indirect support in the form of access to each other's data, specific investments in capacity, or new opportunities for cooperation. All partners in a network should feel that they are being served in some way, either directly or indirectly, just as they are aware of how they are contributing.

Users have much to offer an information network. Firstly, they enable a network to project its influence into policy and management domains, through the conversion of information into decisions, then actions and, ultimately, positive effects on the ground. Without users, there is no means of using information to address environmental concerns and, thus, no means of justifying the existence of a network. Secondly, users expose other partners to policy and management perspectives, and wider societal goals, enabling them to understanding more fully how information

Box 4 Responsibilities of users

- Make rational decisions on the basis of the network's information.
- Provide advice on forthcoming information needs, including budgets and schedules.
- Provide feedback on the relevance, timing and quality of the information received.
- Acknowledge sources in publications and reports.

influences decision-making. Greater understanding of the working methods of different partners — whether these are users, custodians or the hub — is helpful in planning effective strategies for dealing with the underlying environmental issues. Box 4 summarises some responsibilities of users.

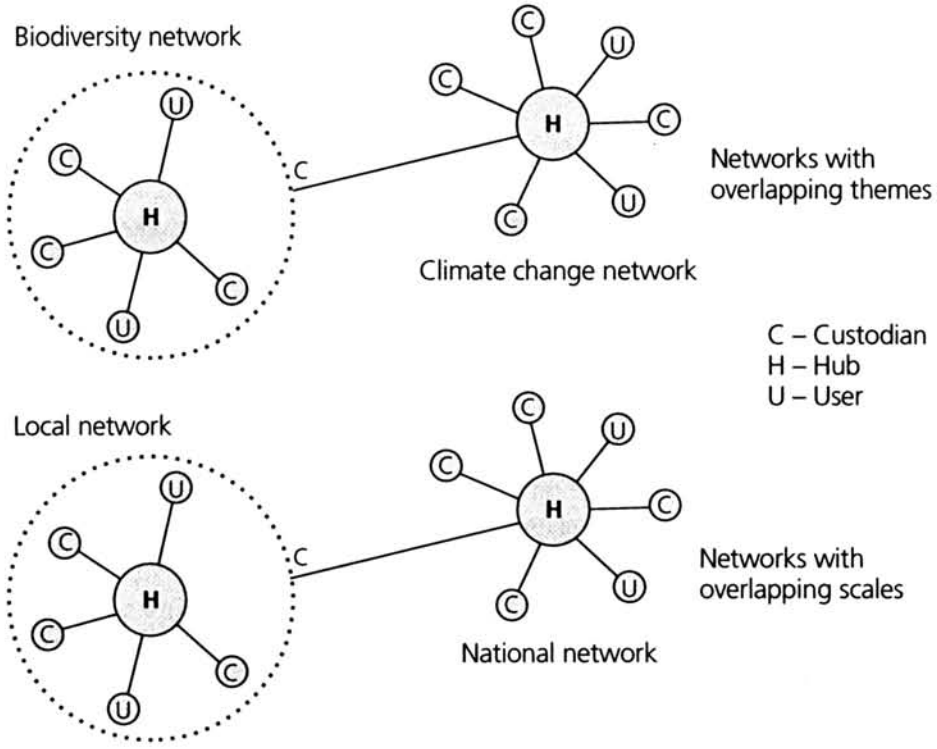
4.5 Multiple Roles

It is quite usual for individual partners in a network to take on more than one role. For example, a national forestry commission may be the custodian of several key datasets relating to timber stocks, forest biodiversity, and demand for wood products, including firewood. It may also be the primary decision-making body regarding the development of forestry-sector industries, plantations, and protection of forest environmental services. This would make it a substantial user of forest-related information produced within the organisation and outside. Further, stakeholders outside of government, for example non-governmental and community-based organisations, may have developed strong, informal partnerships with each other, but be unable to translate these into forest policy and management support. They may welcome the opportunity to develop formal ties with the forestry commission in order to boost their status and acquire an important user. To consolidate this arrangement they may request facilities for a secretariat and steering committee. Thus, very easily, the forestry commission could find itself in the multiple roles of custodian, user and hub, all at the same time.

The probability of assuming multiple roles increases with each new network that is created, especially where these overlap in theme or scale. Networks which cover, say, water pollution, may overlap significantly with networks covering the themes of biodiversity, climate change or primary health care. The hub of the water pollution network may be viewed as the custodian of water pollution data in the primary health care network; similarly, the hub of the biodiversity network may be viewed as the custodian of biological data within the climate change network. Thus, **single organisations may play multiple roles in different networks** (see Figure 4 and Volume 5).

The same effect occurs with scale. At the local level, a network of concerned organisations may have formed to address specific environmental concerns. These may be coordinated by an NGO which runs campaigns to encourage action. This organisation, which acts as a local hub, may deliver local information to a high-level committee examining the same issues at the national level. To the national committee, the local NGO is a custodian; but to its local partners, it is a hub (see Figure 4).

Figure 4 Multiple roles in information networks



5 ACHIEVING COMMON OBJECTIVES

5.1 Overview

A tangible measure of network success is the number and quality of information products delivered to its users. The question is: how can partners be organised to deliver these products when each custodian has its own objectives, and each user its own agenda? Clearly, the function of the hub is to identify **common information objectives** and enable partners to achieve them.

Within an active network of custodians and users, coordinated by a hub, most of the requirements for information production will be available. For example, amongst custodians many essential datasets will be available, some in better states of integrity and accessibility than others. Much expertise may also be found in the areas of data analysis, integration, and advice on how the data should and should not be used. Amongst users, extensive knowledge of policy and management goals may be available, encompassing all that is needed to design effective information products.

Given the complexity of environmental issues, the capacity to design, generate and use many information products may not be available in single organisations, whereas the network as a whole may have all the data, skills and facilities required. The task, then, is to explore ways of managing the various contributions in an efficient, cost-effective manner, which recognises and sustains the commitment of individual partners. One approach is to establish **multi-partner teams**.

5.2 Multi-partner Teams

Multi-partner teams (hereafter just teams) are a network's **main tool for generating products and services**. They enable the network to deliver a programme which may, for example, be modelled on the information cycle introduced in Volume 1. Teams are referred to in a variety of ways according to the terminology of the network in which they operate. Common names include task forces, project (or technical) teams and working groups. They may be applied to any task which the network, through its organising hub, views as priority. They are, by definition, vehicles for cooperation between the network's partners.

The responsibilities of the teams should reflect the objectives of the hub (see Box 3). For example, a team might be established to review the network's goals, in terms of which environmental issues and users to treat as priority. Another team might develop strategic plans for the design and development of information products, based on a thorough analysis of information needs. A further team might review approaches to data collection and management across the network, including the issue of custodianship, and make recommendations on how methods can be standardised and made more efficient. Alternatively, teams may be thematic in nature, each dealing with a subset of the network's interests. Although they may lead to new tasks after they are completed, most tasks undertaken by teams are of finite duration.

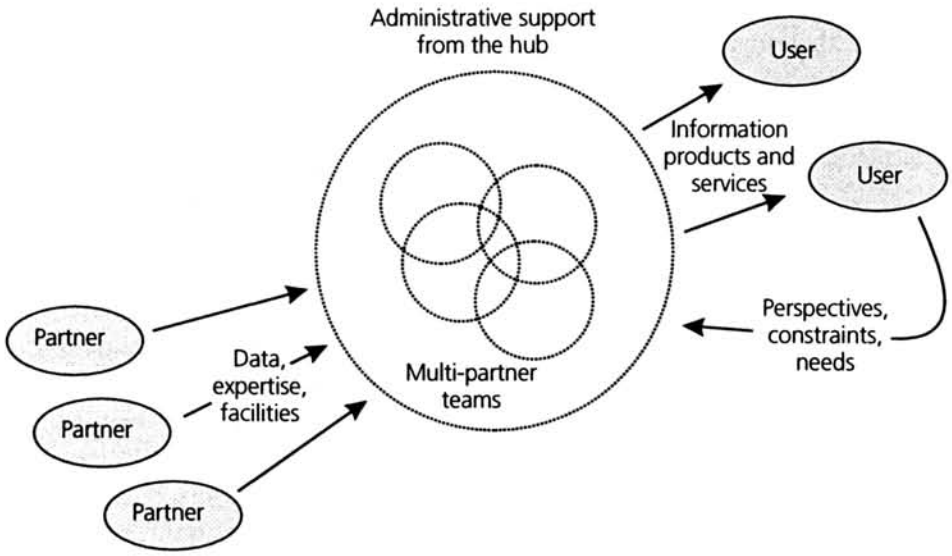
The network forms and manages teams through the administrative support of its hub (see Figure 5). Since this would normally be directed by a committee of partner representatives, the interests of all partners are taken into account when deciding which tasks the teams will undertake. The particular resources required by a team depends entirely on the task it is trying to achieve. In general, however, teams are likely to contain representatives from several partners, each contributing a mixture of data, skills and facilities to the tasks being undertaken. The nature and level of support provided by partners to the teams is a matter for the over-arching hub to decide, and for its secretariat to follow up and arrange.

Users of the network's products and services have an important role to play in the work of its technical teams. As a minimum, they should be consulted with regard to their perspectives, constraints and information needs, when considering how to deliver the network's programme. Preferably, **users should be incorporated as active members of the teams**, contributing resources, expertise and added relevance to their work (see Figure 5).

5.3 Network Sustainability

Information networking concepts are applicable at all levels, whether international or local, and on any theme. The Internet, for example, literally has tens of thousands of listservers and newsgroups serving particular interest groups. Admittedly, these are not fully-fledged information networks because they are mainly based upon a loose collection of individuals with access to electronic communications. They may have no agenda as such, nor any ambition to influence decision-making. However, their

Figure 5 Operation of multi-partner teams



mere presence is an indication that there is huge untapped potential in participatory information management. Indeed, a revolution in this area is currently in progress.

Successful networks have a **recognised and easily understood purpose**, and are operated only as long as this purpose remains valid (naturally, the purpose of a network may evolve over time). All partners, whether custodians, the hub or users, need to be fully aware of their role within the network, in terms of the benefits they can expect to receive and the contributions they are expected to make.

A key factor sustaining their success is **effective dialogue with users**. The capacity of information to influence decision-making increases when users are aware of why and how information has been developed (see Volume 1). Preferably, they have been involved actively throughout the process of information production, from issue definition to publication. Understanding the perspectives, constraints and information needs of users is vital to engage the support of decision-makers in network activities.

Successful networks will **build on existing resources and capabilities**, rather than developing totally new solutions, ensuring synergy and reducing duplication of effort. Building a network requires more negotiation and interpersonal skills than sheer technical 'know-how'.

Initial investments should be sought on the basis of promised benefits, but successful delivery of these, including notable products and services and the positive effects which result from their use, need to be monitored closely and made visible to potential investors. Investment is likely to be needed in a concrete form for the functioning of a secretariat, for workshops, and for specific enhancements in information management capacity across the network.

Finally, information networks must remain **flexible**. Organisations frequently change their priorities or scope, and are often merged with others or split into separate parts. The composition of a network can be expected to change similarly, with new partners being added, roles changing, and other partners dropping out. The way that the hub delivers its services may also change, for instance the location of its secretariat or the degree of its coordination. Multi-partner teams — the driving force of information production — are inherently flexible in structure, and this flexibility should enable the network to respond to the needs of decision-makers as and when they emerge.

6 CASE STUDIES

6.1 Biodiversity Conservation Information System (BCIS)

Overview

BCIS is an evolving framework within which the Members' networks — thousands of conservation experts and organisations around the world — will work together toward a common goal: to support environmentally sound decision-making and action by facilitating access to biodiversity data and information. A consortium of 11 non-governmental conservation organisations and programmes[1], BCIS Members collectively represent a comprehensive resource for global biodiversity conservation information.

BCIS is developing as a flexible and decentralised network, governed by a common framework that complements and supports other data and information systems, including the clearing-house mechanism of the Convention on Biological Diversity (CBD-CHM). It endeavours to foster cooperation amongst its Members and a wide spectrum of other users. BCIS is building on existing data, information, expertise and networks by:

- identifying key data sources and promoting accepted indicators and standards;
- integrating and disseminating quality data and information to aid decision-making;
- linking experts to help address local problems, support national planning, and inform international policy debates; and
- building capacity of data owners and managers where needed — South and North — through a decentralised system of data custodians.

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1 As of July 1997: BirdLife International, Botanic Gardens Conservation International, Conservation International, IUCN Commission on Ecosystem Management, IUCN Environmental Law Centre, IUCN Species Survival Commission, IUCN World Commission on Protected Areas, The Nature Conservancy, TRAFFIC International, Wetlands International, World Conservation Monitoring Centre.

Characterising the Network

Underpinning the development of the BCIS network is the concept of BCIS as a 'thematic network' within a wider network including, but not restricted to, the CBD-CHM, i.e. part of a 'network of networks'. This concept is very helpful in defining and characterising the membership of BCIS. If, as in this case, the thematic network is designed to primarily deal with large regional or global datasets held by non-governmental organisations, then the members are those non-governmental organisations dealing with those kinds of data. Governmental or intergovernmental agencies, or agencies dealing primarily with national level data, would not be appropriate members. Similarly, a national network would comprise governmental, non-governmental and corporate entities holding or using data primarily at or relevant to the national level.

Clarifying the subject domain and organisation type keeps the network focussed on its primary purpose and objectives and prevents it from growing large and unmanageable.

Network Inter-relationships

Since BCIS needs access to data and information that are not held by the component Members, e.g. topographic or socio-economic data, links need to be built to other networks or agencies that hold those data. Thus issues of custodianship and data access agreements need to be resolved both within and between networks.

Network Governance

Each Member of BCIS is, by virtue of signature by executive management, bound by an Agreement of Principles. This Agreement specifies the Goal, Objectives, Rationale, Principles, Participation and Governance of BCIS. Criteria for BCIS Membership have been developed.

BCIS is led by a Steering Committee, comprised of up to two representatives from each consortium member. The Committee currently meets twice per year and operates on the basis of consensus. A formal Terms of Reference Manual for the Steering Committee is being developed. Among other issues, the Manual lists the various responsibilities of the Steering Committee, which are as follows:

- to develop a long term vision;

- to coordinate fund-raising activities to optimise opportunities and avoid conflicts or duplication with individual consortium member's activities;

- to agree membership (including admitting new members and partners to the consortium) and establish management, administrative structures and procedures for electing Chairpersons of the Steering Committee;

- to prepare a business plan for developing BCIS and agree priorities and projects;

- to allocate management roles and duties and devise monitoring and evaluation procedures;

- to establish and maintain links with relevant, related initiatives, agencies and programmes and invite observers as appropriate;

- to oversee development of and agree to mechanisms, guidelines, and/or licensing arrangements for data collection, custodianship, management, validation, quality control and use, including conflict resolution;

- to ensure equitable and prudent financial management; and

- to establish sub-committees as needed.

The Manual also covers issues of joining and withdrawal from BCIS and the formation and management of Sub-committees. Observers can be invited to Steering Committee meetings, but do not participate in decision making.

Network Development

A comprehensive Framework has been developed for BCIS, including a Logical Framework Analysis. This includes background information on the origin of BCIS and its Members and the planned BCIS objectives, products, services and activities.

In any consortium, it is important for Members to have a thorough understanding of the capabilities and needs of all the other members. In BCIS, an Assessment of the Needs and Capabilities of the Members is being made. This comprises an analysis of the strategic and operational issues in bringing the Member agencies together, the Member capacities and links with each other and to external agencies and programs, any known gaps within the system, and comprehensive profiles on each Member.

Products and Services

The BCIS framework is being designed to benefit a variety of users and participants. It will enable multiple entry points into the system, ensuring widespread access to BCIS products and services for natural resource managers and decision-makers at all levels. BCIS will offer customised information products to support, for example, national planning and implementation of treaties.

The BCIS framework will benefit individual experts and NGOs that comprise the BCIS Member networks. First, these network members will have access to the information management tools, and training to make best use of them. Second, data harmonisation, encouraged under the BCIS framework, will enable easy access to a wide variety of data and information sources not previously available to the network members.

Finally, the information delivery vehicles exploited by BCIS, such as the Internet, will allow access beyond the participants and primary users, for example the educational community.

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6.2 East African Biodiversity Network

Although East Africa represents a region (Kenya, Tanzania and Uganda) rather than a single country, its attempts to network biodiversity data have been conducted in such close cooperation in recent years that it is treated as a single entity in this study.

In 1991, a number of organisations in East Africa began coordinating efforts to manage biodiversity data. This was achieved by means of annual workshops held in different locations throughout the three countries, in particular Bwindi (1991), Nairobi (1992, 1995), Kampala (1993, 1996), and Dar es Salaam (1994). The results of each workshop were published and circulated to participating organisations (for example, see NMK 1995).

The objective of this informal network was to standardise approaches to documenting and assessing biodiversity in the East African region, enabling

participants to access each other's data and expertise more easily for use in their own information programmes. Separate working groups (multi-partner teams) were established to deal with the development of standard taxonomic lists and habitat classifications; others reviewed data management procedures (including data exchange policy) and regional training needs.

As well as providing an opportunity to review the status of the datasets[2] being developed by the network's partners, the annual workshops enabled participants to present research progress and exchange experiences in seeking financial backing, applying information technology and accessing international datasets. Improved dialogue and coordination is one of the most important features of the network, enabling relatively ambitious information products to be developed, such as a regional red data list for birds and, in future, similar lists for other taxonomic groups.

As the network grew, in terms of the number of institutions participating, data holdings and internal capabilities, it became clear in 1993 that tighter coordination was necessary. The annual workshops, however useful, were too far apart to enable agreed targets to be monitored and achieved on time. Indeed, following the meetings, each institution tended to revert to its internal priorities and devote only modest time to regional goals.

None of the participating institutions were able to provide the facilities and staff time necessary for improved network coordination. As a result, in 1995 it was proposed to seek support for a secretariat, whose main task would be to enhance communications both within the region and with international organisations, such as IUCN, UNEP, WCMC and WRI. Specific tasks of the secretariat were envisaged to be: ensuring continuity of the annual workshops, including production of proceedings; production of a quarterly newsletter, reporting progress on development of essential datasets, reviews of hardware and software, and summary of international information programmes; maintaining and updating an existing database of institutions and datasets relevant to East African biodiversity; acting as a clearing house to promote data exchange; and identifying data development and other capacity building needs.

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2 For example, electronic lists of birds and mammals, the List of East African Plants (LEAP), and a regional gazetteer.

A Steering Committee was elected in 1995, with a mandate to develop these ideas into a costed proposal for submission to a development assistance agency — and subsequently facilitate implementation of its objectives. It consisted of representatives from two institutions in each of the three countries as follows: National Environment Secretariat (NES) and National Museums of Kenya (NMK) in Kenya; University of Dar es Salaam (UDS) and National Environmental Management Council (NEMC) in Tanzania; and Makerere University Institute of Environment and Natural Resources (MUIENR) and the Uganda Forest Department in Uganda.

The initial proposal was limited in scope, since participants agreed that the network should develop slowly and sustainably on the basis of established goodwill and commitment. A range of organisations pledged their support to the secretariat, including the East African Natural History Society (EANHS), the East African Regional Office (EARO) of IUCN and WCMC.

Source: Concept Paper, Regional Secretariat for Biological Databases, November 1995.

6.3 Environmental Resources Information Network (ERIN)

Overview

The Australian Environmental Resources Information Network (ERIN) is a national facility, using the latest computing technology to provide access to a vast reservoir of information on the Australian environment, and the analytical tools to interpret it. The ERIN unit is located within the Federal Department of Environment, Sport and Territories.

The information that ERIN makes available is drawn from many sources and includes maps, species distributions, documents and satellite imagery, covering environmental themes ranging from endangered species to drought and pollution. The information is used by a wide range of individuals and organisations ranging from government to industry, and from research workers to community groups.

Characterising the Network

The ERIN Program is based on cooperative efforts with those agencies interested in environmental information and effective decision-making. These cooperative efforts are based on the following principles:

- Environmental information should be made available through a network, so that it is available at the point where it is required.

- Data should not be stored centrally, but rather in a node where they are under the control of a custodian. This ensures the data will be updated and otherwise maintained by those best able to do so.

- All data, regardless of type, should be accessible through an easy-to-use interface, incorporating a comprehensive data directory.

- Analytical and modelling tools should be available through the same user interface as data.

- Priority must be given to the acquisition of point-based primary, rather than aggregated or interpreted, data. This ensures that conclusions based on those data can be rigorously reviewed, alternative analyses can be performed and baselines for monitoring established.

- Planning, research, development and management using environmental information must be based on established and well coordinated interdisciplinary and multi-agency collaboration and cooperation.

- There should be ready access to data, both at reasonable cost and without administrative encumbrances which would otherwise impede responsible environmental decision making.

ERIN launched its public on-line service in 1994, providing access to the ERIN network through the World Wide Web. This has evolved into Environment Australia Online, which can be accessed at http://www.environment.gov.au/.

Source: documents at Environment Australia Online, including http://www.environment.gov.au/environment/ecpg/erin/about.html and http://www.environment.gov.au/portfolio/esd/csd95/case21.html.

6.4 Environmental Change Network (ECN)

Overview

Founded in 1992, the Environmental Change Network (ECN) is the United Kingdom's integrated long-term environmental monitoring network. It is designed to collect, store, analyse and interpret long-term data based on a set of key physical, chemical and biological variables which drive and respond to environmental change.

The objectives of the network are as follows:

- To establish and maintain a network of sites within the UK from which to obtain comparable long-term data sets through monitoring a range of variables identified as being of major environmental importance.

- To establish agreed protocols for standard measurements of a range of environmental variables, to facilitate the collection and management of data to support integrated monitoring across a range of sites and organisations.

- To provide for the integration and analysis of these data, so as to identify natural and man-induced environmental changes and improve understanding of the causes of change, and to distinguish short-term fluctuations from long-term trends, and predict future changes.

- To provide for research purposes a range of representative sites with good instrumentation and reliable environmental information.

Characterising the Network

The network is a multi-agency programme sponsored by 14 different organisations, including government departments, research councils and other statutory authorities. ECN operates as a managed network (see Figure 3), although some of its activities require the hub to function more like the 'central unit' of a centralised network (see Figure 1). The structural components are:

- *Steering Committee*

  The Steering Committee is ECN's main policy-making committee and is made up of representatives from the ECN sponsoring agencies. It normally meets annually

at one of the sites, though a sub-committee meets more frequently to deal with issues in more detail, and is empowered to take interim decisions on behalf of the Steering Committee.

- *Working Groups*

  Technical matters relating to the core measurements undertaken at the network's monitoring sites are dealt with by Working Groups set up by the Steering Committee. A Technical Working Group and a Statistics and Data Handling Working Group, each consisting of experts from universities and research institutes, are responsible for proposals for core measurements, statistical procedures, and so on.

- *Central Co-ordination Unit*

  The Natural Environment Research Council (NERC) is responsible for the management of the network on behalf of all the sponsoring agencies. Day-to-day management is carried out by the ECN Central Coordination Unit (CCU). CCU staff are responsible for coordinating all the network's activities, including data collection and transmission, and for managing a central database and geographic information system (GIS). The CCU also services ECN Committees, and is responsible for liaison with contributing and external agencies.

Use of ECN Data

The ECN database is managed and developed by the CCU. Data are collected by ECN Site Managers according to standard protocols, and are submitted in standard formats via email. Data are then validated and incorporated into the database with associated metadata describing their quality.

Data is made available to external users subject to the following **conditions of use** developed by the network's partner organisations, both to protect the rights of individual organisations and to ensure the appropriate involvement of the network in projects that use its data. The conditions of use are as follows:

- *Ownership*

  The ECN Summary Database and its component datasets are proprietary products of NERC, on behalf of ECN, and thus protected by copyright law. Rights of ownership and copyright in these data are reserved.

- *Allowable uses*

  Users may not: a) transfer, assign, rent, lease, sell, give or otherwise dispose of the data; b) release a product or tradable commodity based in whole or in part on data supplied by ECN, unless prior written agreement has been obtained, and any royalties due have been paid; and c) reproduce any digital or numerical data other than for back-up purposes.

- *Acknowledgement*

  Users are required to acknowledge ECN in all reference or publications which involve use of the data. Users must offer ECN acknowledgement and/or co-authorship of any proposed publication arising from the use of the data. ECN will have the right to accept this offer, allow the user to publish in his/her own right, or refuse permission to publish.

- *Data quality and liability*

  Although the data are subject to quality-assurance procedures, ECN are not able to warrant the accuracy of the data supplied, nor do they accept responsibility for determining the fitness of the data for their intended use. The provision of data carries no liability for its accuracy or reliability and ECN or its sponsors cannot be held accountable for any loss, damage, injury or any other occurrence arising from the use of their data.

- *Publications*

  Copies of, or a reference to, any publications which refer to these data should be sent to the ECN Coordinator.

Source: ECN's web-site at http://mwnta.nmw.ac.ukecn/index.html.

7 REFERENCES

NMK 1995. *Biodiversity in East Africa: Proceedings of the sixth regional workshop on biodiversity databases.* National Museums of Kenya, Nairobi, Kenya.

WCMC 1994. *The Biodiversity Information Clearing House – Concepts and Challenges.* WCMC Biodiversity Series No. 2. World Conservation Monitoring Centre, Cambridge, UK.

These handbooks have been developed for use by senior decision-makers and mid-career professionals. They review the issues and processes involved in the management of biodiversity information to support the conservation and sustainable use of living resources. They also provide a framework for the development of national plans and strategies and for meeting reporting obligations of international programmes and conventions. Collectively, the handbook series may be used as a training resource or, more generally, to support institutions and networks involved in building capacity in information management.

Companion Volume
Volume 1 Information and Policy
Volume 2 Information Needs Analysis
Volume 3 Information Product Design
Volume 4 Information Networks
Volume 5 Data Custodianship and Access
Volume 6 Information Management Capacity
Volume 7 Data Management Fundamentals

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