Biodiversity Information Management for the HKH: Integration and the Role of an Information Cooperative

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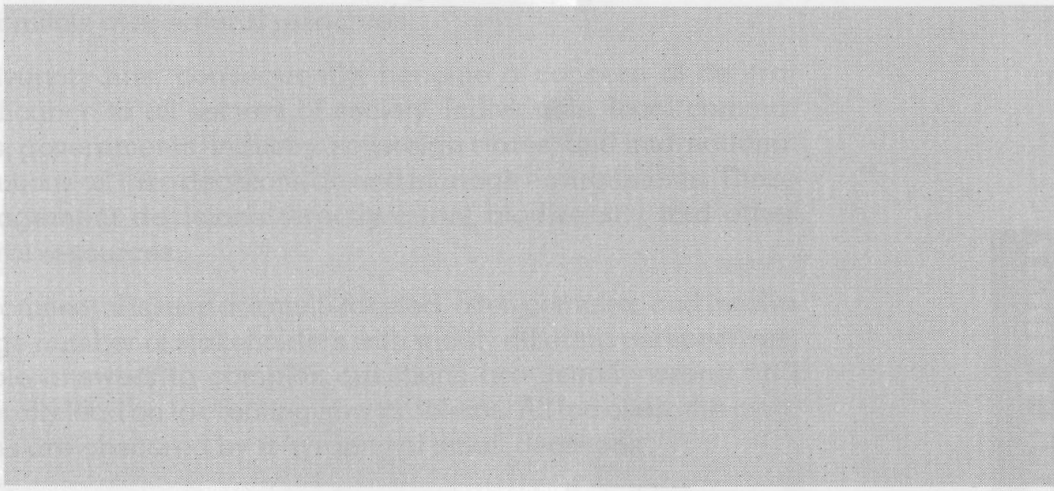

WCMC

THE CHALLENGE

Throughout the world, biological and other environmental resources are deteriorating rapidly, primarily due to 'unsustainable' human activities. The changes and potential impacts include:

- a decline in biological diversity as evidenced by accelerating species' extinction; reduction in the areas of distribution and abundance of species; and the destruction, modification, and fragmentation of habitats and ecosystems on all scales;
- decline in the health and functioning of ecosystems, as evidenced by biodiversity loss, degradation in air and water quality, and loss of soil; and
- decline in the human quality of life, as evidenced by increasing world poverty, increasing wealth disparities, and social, political, and economic instability, particularly the increasing conflicts over natural resources.

Biodiversity has, consequently, become a concern of central significance to all sectors of society. Individuals, local communities, governments, industry, sovereign states, and international institutions all take decisions on and manage environments. These management decisions directly affect biodiversity and other natural resources.

Environmental issues are multi-faceted, often complex, and involve a large number of stakeholders with widely differing perspectives. Simple answers to complex questions are usually wrong and generally lead on to creating new problems. All too often, the main issues are obscured by a 'tyranny of small decisions'.

INTRODUCING THE SOLUTION

Because decision-making occurs at all levels of society, all stakeholders need to be supported, and thereby empowered, to contribute to the reaching of appropriate and timely decisions.

Access to comprehensive and accurate data and information can enhance capacities at all levels to facilitate informed and well-reasoned decisions. Whether determining some optimal use for local land or negotiating obligations for an international treaty, authoritative data and information can inform the process, increasing the likelihood that outcomes will be sustainable and acceptable to all concerned.

NETWORKS AND CAPACITY-BUILDING

Capacity-building involves enhancing the ability, basically through 'empowerment', of institutions and individuals to, *inter alia:*

- assess their own information needs;
- determine and implement their own priorities;
- develop their own information system frameworks; and
- build their own information systems.

It, of course, includes, but extends well beyond, the provision of technical tools, such as computer hardware and software, and training. Capacity-building involves guiding people through all the issues that need to be considered, thus putting them in a position to be able to assess their own needs and set their own priorities for addressing those needs.

There are several key steps that will enable agencies operating within any jurisdiction, whether local, national, regional, or global, to build their own capacity to address their own environmental information needs. Information cooperatives may facilitate this process in a number of areas at various stages of systems' development.

Before going into the contribution that information cooperatives could and should make, it is useful to review the key steps in building strategic systems to better support environmental decision-making.

STEP BY STEP

Step 1

The first step is to determine the information needs of stakeholders that make or influence decisions at the given level: local, national, regional (e.g., Hindu Kush-Himalayas), or global. Very easy to say, very difficult to do.

The key is to focus on the processes that decision-makers use to reach decisions, and then on those information products that, in the context of other constraints and pressures, are capable of making a difference to those processes. Since the role that information plays in decision-making is highly context specific, often poorly defined, and difficult to determine in advance, formal analyses of user needs are very difficult to undertake.

The process of ensuring that user needs have been assessed appropriately, then that any developing system will meet those needs, must be carefully managed. This is best achieved by appointing a Steering Committee to act with the authority of senior management for the major stakeholder groups. The implementation of the system can then be delegated to an Implementation Team of scientific and information technology experts, responsible to the Steering Committee.

Systems' development is very much an ongoing process with, perhaps, the first few stages involving development of pilot systems to test user acceptance. A long-term commitment is essential if the evolving system is to be kept relevant to the needs of the main users.

Step 2

Once user needs have been determined or approximated, then the Steering Committee should allocate and manage custodianship of important subject themes, including minimising duplication and competition among the stakeholder agencies and collaborators.

Custodianship involves building and maintaining (including ensuring quality of and documenting) priority datasets and making them available, under agreed protocols, to the network. This process will also identify any needs for building additional capacities. This is a very demanding and challenging area, and one that has been largely neglected in the past. Successful management of custodianship is a key indicator to the success of any system, including the clearing house mechanism under the Convention for Biological Diversity and the Information Cooperative.

Step 3

In parallel with Step 2, the Implementation Team should identify the datasets needed to underpin user needs. Since the potential number of datasets is very large, criteria for identifying priorities need to be specified by the Steering Committee. Once the priority datasets have been identified, the next step is to determine: 1) whether those datasets exist; 2) who has them; 3) what their characteristics are (attributes, quality, etc); and 4) in what form they exist? Where datasets do not exist or are inadequate, then the Steering Committee needs to identify appropriate custodians and ensure that the necessary data are obtained or upgraded to the required standards. The Team will also plan and develop the most appropriate information system.

Step 4

Of course, dumping large volumes of raw data into the hands of decision-makers is not going to be effective. Decision-makers act on information and require data to be assessed for quality and relevance, and subsequently integrated, analysed, and (at least to some extent) interpreted. The process of transforming data into information requires access to a wide range of data management, manipulations, and visualisation tools; the salient literature; along with scientific and other kinds of advice.

It is important to point out that, despite the many challenges facing us, experience has proven that it is possible to build and operate such systems, and that these can achieve the realistic expectations set for them.

SOME FUNDAMENTAL PRINCIPLES

These principles should be the backbone of every decision taken and procedure implemented.

EVERYONE IS A USER

The environment impinges on everyone; in every facet of their daily lives. It follows that everyone is a stakeholder and has a right to be informed and to participate in environmental decision-making. Environmental information systems can be a very important mechanism for empowering all sides of any environmental debate. Obviously, because of limited resources, priorities must be set, but care should be taken that decisions made do not disenfranchise or otherwise inhibit potential contributors to that debate. The information cooperative, therefore, has a key role here.

INFORMATION *VERSUS* DATA

There are important distinctions between data and information, which are too often blurred. The definitions are:

- data — observations, measurements or facts referenced to some kind of accepted standard — which are subsequently integrated, processed, interpreted or otherwise manipulated (by people, with or without electronic assistance) to produce information; and
- information - the knowledge (product) derived from the analysis and interpretation of data, which can include 'expert' opinion. In general, it is highly purpose-specific and has a short shelf life. It is specifically designed to support decision-making.

It should be noted that standards can include not only absolute measures, such as the units of length or volume, but also commonly understood conventions or professionally generated products, e.g., maps that comply with some accepted format.

It should be recognised that perceptions of data vs information vary. What is information at one level can be regarded as data by the next higher level and can be subject to further processing analysis and abstraction.

Environmental data must be organised in order to facilitate its conversion into information that is useable and leads to a difference in the decisions that are made and implemented.

DATA MANAGEMENT AND USE

Data should be:

- stored and managed by the agency best able to do so — the custodian (managed includes acquired, quality-assured, standardised, backed up, etc);
- readily available (e.g., on a network) for integration with other data; stored in its primary form rather than classified, aggregated, or otherwise interpreted, thus facilitating its use for multiple purposes; and
- stored following accepted conventions that expedite its communication and interpretation.

INFORMATION GENERATION AND USE

Information needs to be generated, managed, processed, and disseminated in quite different ways from data. It empowers decision-makers by, *inter alia*:

- providing a range of options;
- providing a wider context within which to assess impacts and options (landscape, catchment, national, regional, and so on);
- providing a common basis of agreed facts upon which to base debate and decision-making — the 'honest broker'; and
- discouraging options or decisions with predictably adverse consequences.

To be a useful and an effective tool, information should be:

- available to decision-makers at all levels when and where required;
- readily available, i.e., at a minimal cost in time, money, and administrative overheads and free from unnecessary restrictions on its usage;
- available through standard interfaces which require minimal, if any, training;
- available in a form that is readily understood and easily communicated; and
- accompanied by an auditable trail so that all underlying data and intermediate products can be scrutinised and reviewed independently.

These framework issues and principles need to be considered in order to ensure that we have a clear understanding of the context within which an information cooperative needs to operate. Not only do we need to understand what it could do for us all, but also we need to understand where it fits within our various corporate

activities, including existing relationships with partner agencies, in order to ensure that it really helps us improve our performance.

ROLE OF AN INFORMATION COOPERATIVE

Progress in the development of information cooperatives, comprising of agencies using electronic networks, particularly the Internet and supporting tools such as the World Wide Web, has been breathtaking over the past five years.

Solutions to key issues such as priority environmental datasets, standards, metadata, and custodianship and developments in tools for data management, analyses, and visualisation, are well advanced.

The areas where progress has been less dramatic are those involving organisational and people issues. These include resolving agency jurisdiction (i.e., which agency is responsible for what activity, including datasets), along with intellectual property rights, copyright and related issues, and protocols for data and information exchange. Other key deficiencies are in the areas of data comprehensiveness, quality, and the tools required to turn raw data into information, which is genuinely useful in supporting decision-making.

The next great challenge is to better integrate the use of environmental information into decision-making processes at all levels of society, from international priority-setting, through government policy-making, to decisions taken by management agencies and resource users such as individual farmers or fishermen. This is going to be essential if the Global Information Infrastructure is going to assist with Sustainable Development, which is the prime objective.

Why is this a challenge? Surely, the marshalling of scientific expertise and the increasing exchange of data and information through the Internet is the answer. What else could possibly be needed?

The problem, as Jeff McNeely notes (McNeely 1995), is that science and policy provide two rather different approaches to reality. Scientists tend to view research, even network-building, as an end in itself, driven by ideas or techniques or, dare I say it, availability of funding. Scientific work is conducted by an elite priesthood, away from public scrutiny, and is accountable only to the mysterious cultural process of 'peer review'. Scientists are thus in a poor position to determine, and indeed seldom try to find out, what decision-makers really need to know.

Public policy developers and resource managers, on the other hand, address problems. These are intractable and untidy

problems with many interest groups and often in the full glare of public scrutiny. Many of the activities seem little more than attempts to contain or defuse crises with inadequate resources, including lack of relevant information.

The primary aim of decision-makers is to control resources, information, and, where possible, public opinion. Of necessity, they must deal with the larger picture and are not able to indulge in the luxury of manipulating a single variable in an experiment, or taking the time to 'get all the answers'. Research results are, therefore, only one of a multitude of factors which must be considered. While decision-makers value scientific advice, they do not appreciate uncertainty and will ignore advice that is ambiguous or unclear. Despite this, they often know what kind of information they require, if only the scientists took the trouble to ask.

Thus, the scientific and decision-maker subcultures of modern society have never communicated very well, as both have sought to protect their power base. This situation has been made more difficult because of the concerns of the wider society and the large number of stakeholders with different perspectives and agendas. The dynamic nature of the interactions between these interest groups explains why controversy is so pervasive in fields such as forestry, fisheries, and land use, not to mention biodiversity conservation. Science is often used by environmental management agencies to underwrite inaction or to provide political reassurance. How often have we heard lines like "We are monitoring the situation carefully and can assure the people that there is no risk to their health," or "This is a very difficult issue and studies are underway to find the best way", and so on.

Having said all that, there is scope for linking science to decision-making. The need for science pervades the policy-making arena. Decision-makers need scientific advice in preparing legislation, regulations, projects, and budgets; the various interest groups need science to back their efforts to ensure their concerns are built into legislation and resource management; and science is needed to monitor the impacts of various management actions. The extent to which science is actually used in these processes depends very much on its packaging and presentation.

So how do we link science and decision-making?

One key is the environmental information infrastructure, which is where the idea of an Information Cooperative comes in. Facilitating access to comprehensive and accurate data and information will enhance capacities at all levels to make informed and well-reasoned decisions in all the areas mentioned earlier.

BIODIVERSITY INFORMATION

The purpose of this paper is not to indicate what the priorities should be for mobilising biodiversity information. We need the users, particularly key decision-makers, to tell us what information they require. It is possible, however, to hazard a few guesses.

Users will require information on the context within and the issues oh which they need to focus. They want options backed up by documents, maps, and expert opinions. These supporting documents and maps need to be authoritative and will increasingly be derived from a variety of sources holding a variety of data. These data will be in the form of text documents, tabular databases, spatial databases, image files, and so on, and will include topographic, environmental, species, administrative, socioeconomic, and other themes. By and large, we know what these data are, more or less who has them, and, in general, what we need to do to bring them all together. International agencies such as UNEP and IUCN have been working in this area for years. Individual nations are also building systems, some of which, such as Environmental Resources' Information Network (ERIN) in Australia, are highly advanced. Others, such as Cuba, are very well-organised but lack key components, which we can help provide.

Thousands of datasets are being built and maintained by almost as many custodians operating at local, national and global levels. A key issue is how to make the user aware that they exist, and whether they can usefully assist in making better decisions. One solution is through metadatabase systems operating on networks.

One key point needs to be raised before concluding.

WHY WILL CUSTODIANS PARTICIPATE IN A NETWORK?

An information cooperative has to do more than provide a directory or metadata service, valuable though that is. A key issue is how do we ensure that custodians will, even in principle, make their data available for network access? How do they reach the judgement that it is in their corporate best interests to do so? If you can't afford to pay them, or likely data sales are unlikely to cover their establishment, management, and marketing costs, how do you ensure their initial, let alone continued, participation?

The information cooperative should provide tangible direct benefits to the participants. There should be sufficient value to be gained from participating in the network to more than cover the overhead costs involved. There are two areas in which members could gain benefits through the network that exceed their cost of participation:

- they gain access to valued data; or
- they gain access to services and expertise.

The contention is that they will only participate on this basis.

CONCLUSION

One key to the success of an information cooperative, not only on the theme of biodiversity but also in the others, is a focus on and resolution of the issues of custodianship. We need to agree on roles to be played by cooperative members, including all their partner agencies and existing networks, and we need to focus on the incentives that would induce data custodians to initially contribute their metadata and, hopefully, data and, more importantly, to continue to participate.

LITERATURE CITED

McNeely, J.A., 1995. 'Strange Bedfellows: Why Science and Policy Don't Mesh, and What Can be Done about It. Presented at *Living Planet in Crisis: Biodiversity Science and Policy*. American Museum of Natural History, NY, 9-10 March *1995*.