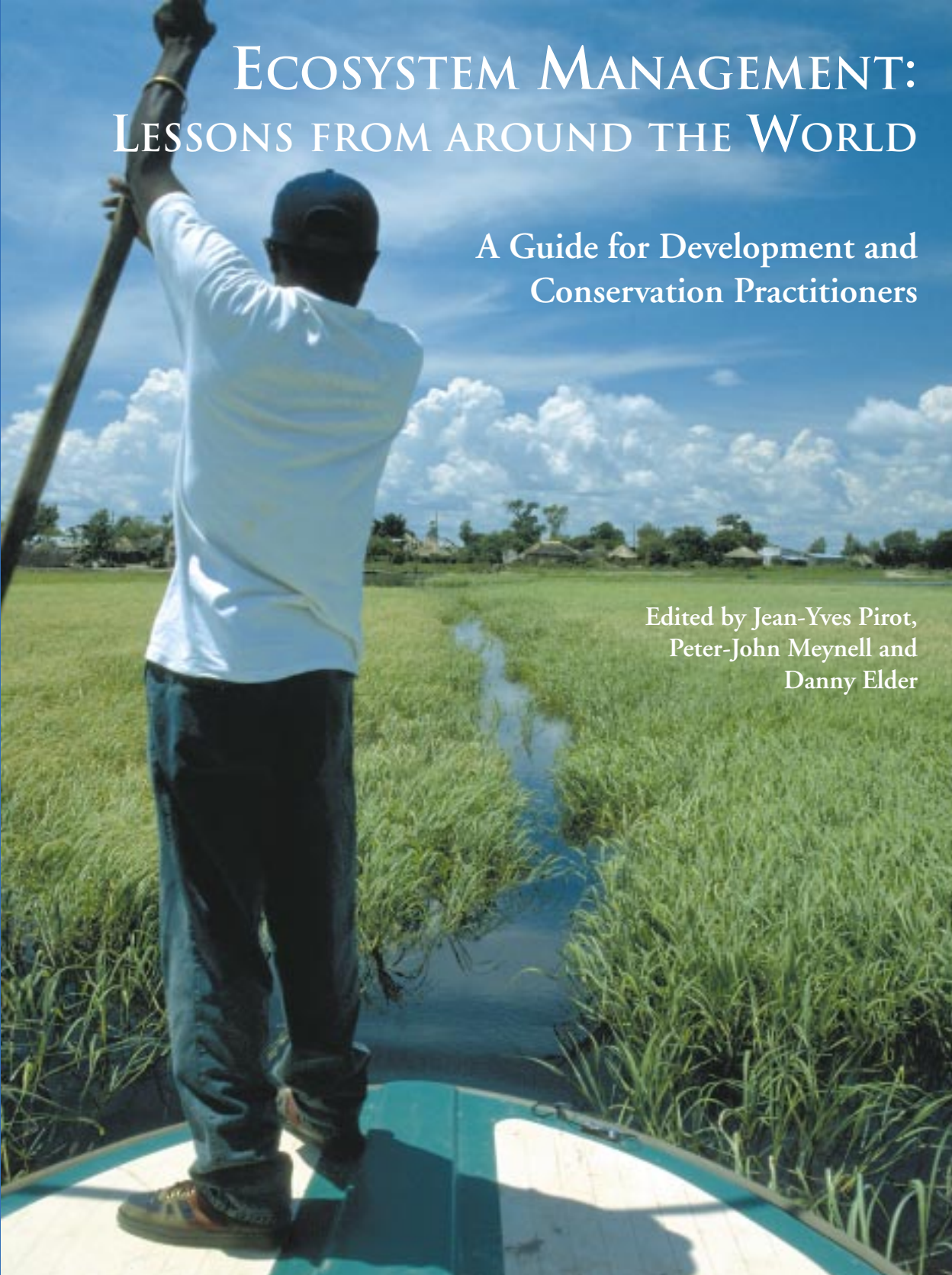

Ecosystem Management: Lessons from around the World

A Guide for Development and Conservation Practitioners

Edited by Jean-Yves Pirot, Peter-John Meynell and Danny Elder

IUCN
The World Conservation Union

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Ecosystem-based Management: Tools and Practice

Acknowledgements

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The Guide coincides with recognition worldwide of the growing importance of an ecosystem-based approach to environmental management. This is reflected in the development of IUCN's own Commission on Ecosystem Management and its publication of the first Sibthorp Seminar "*Ecosystem Management, Questions for Science and Society*" (Maltby *et al.*, 1999). It also builds on the Bank's own publication "*Mainstreaming Biodiversity in Development: A World Bank Assistance Strategy for Implementing the Convention on Biological Diversity*" (World Bank, 1995).

Many people have contributed towards the compilation and analysis of the case studies and the synthesis of the experience gained from ecosystem management initiatives all over the world. The main coordinators have been Jean-Yves Pirot and Peter-John Meynell, ably assisted by Nadene Canning-Wacker and Elroy Bos. The third co-editor, Danny Elder, contributed valuable comments and text. David Cassells and Colin Rees from the World Bank, and Achim Steiner from IUCN-US, have guided the preparation of the guide from the outset.

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Foreword

Healthy ecosystems are a fundamental requirement for sustainable development and biodiversity conservation. Biological resources support human livelihoods, and make it possible to adapt to changing needs and environmental conditions. Many sectors of national economies also depend on the diversity of ecosystems and the functions and services they perform or protect.

However, present trends of economic development, supported by inappropriate financial incentives, typically undervalue the ecosystem processes and services leading to the overexploitation of valuable resources worldwide. As a result, species are becoming extinct at an alarming rate and the degradation of many ecosystems, biomes and habitats are leading to unprecedented social strife. Most of this has taken place in the developing world and in countries in transition.

The irreversibility of species extinction, and the loss of genes and transformation of ecosystems through habitat degradation and overexploitation, all compromise options for present and future generations. It is therefore not possible to achieve a sustainable pattern of development without an effective strategy for ecosystem conservation and restoration. In recognition of this, development agencies need to integrate the conservation of biodiversity and ecosystems in development actions, and to implement ecologically effective, socially beneficial and economically viable ecosystem management practices in forests, wetlands, savannahs, arid and semi-arid rangelands, coastal and marine areas, mountains and agro-ecosystems.

Traditional approaches to biodiversity conservation have largely focused on conserving species and establishing various forms of protected areas. However, biodiversity will not be conserved effectively in protected areas alone. The existing global network of protected areas is too small and, under prevailing social and economic conditions, any major expansion of this network seems unlikely. Many existing protected areas are under threat and, even where significant areas have been placed in protected areas, prevailing development

patterns are creating barriers to species interaction and migration. The fragmentation of natural habitats has reduced the long-term viability of protected areas by making species more vulnerable to genetic erosion and to the impacts of climate change.

Thus, it has been recognized that, in addition to the establishment of protected areas, the future of much of the biosphere will depend on managing large areas using an integrated approach that recognizes human populations as having a keen interest in ensuring the continuing productivity of the ecosystems within which they live. Such an approach will have to meet local needs, maintain or restore ecosystem integrity and conserve biodiversity, simultaneously.

To help operationalize the principles underpinning ecosystem management, recently agreed by the Convention on Biological Diversity, IUCN – the World Conservation Union has prepared this Guide for use by those responsible for preparing and implementing conservation and development projects in the field.

This Guide presents the distinguishing features of the ecosystem approach and demonstrates how the concept can be introduced into policies, procedures, practices and investment support. The idea behind the Guide is to present the current state of knowledge about the management of a selected number of ecosystem types and to draw together the key lessons learned in the past 10 years from a number of major field projects. The intent is to integrate theory with the lessons from experience and to translate this into practical operational guidance for development and conservation practitioners inside and outside IUCN and the World Bank. I am convinced that this effort has been worthwhile, and look forward to seeing the results implemented.

Yolanda N. Kakabadse
President
IUCN – The World Conservation Union

Executive Summary

This Guide aims to encourage a wider understanding of the concepts of ecosystem and natural habitat management through the practical experience gained from 24 different field projects. It is based on a review of the institutional, technical and operational profiles of a number of carefully selected projects from around the world. The case studies ranged from unspoiled to degraded ecosystems and were drawn from a range of project types and scales (Appendix 1). The methodology for commissioning and analysing the case studies (Appendix 2) provided an important basis for the Guide. Summaries of the case studies are provided in the form of stand-alone boxes to illustrate the points being made.

On the basis of the case studies it became apparent that ecosystem management approaches must be flexible, that they are only partly about ecosystem science and must take into account socioeconomic and cultural factors, and that participation of stakeholders is imperative. The Guide presents the detailed background and principles concerning these conclusions and provides practical information on how to integrate them into projects in the field.

The Introduction explains the notion that **people are an integral part of ecosystems** and depend on other components of the ecosystems and their interactions – ecological processes – for our existence. These include the water cycle, the maintenance of stable atmospheric, climatic and hydrological conditions, and the continued production of foodstuffs and many other products and services of ecosystems that contribute to our well-being. Also introduced is the fact that ecosystem functions are the result of plants and animals (including humans) interacting with each other and with the physical components of their environment. **Ecosystem-based management attempts to regulate the use of ecosystems so that we can benefit from them while at the same time modifying the impacts on them so that basic ecosystem functions are preserved.** In other words, **use them, but don't lose them.** This notion has been incorporated in a number of international conventions and reviews con-

cerning environment and development, including the Convention on Biological Diversity.

The document is divided into two parts. **Part I**, which contains chapters 1-3, is given over to introductory materials.

Chapters 1 and 2 present notions about, and definitions of, ecosystems (and their characteristics) and ecosystem-based management; and about basic principles that should be followed in order to ensure that ecosystem-based management projects and activities will be successful. Examples of these principles are that: biodiversity must be maintained; people must be considered as part of ecosystems; ecosystems change over time; and that ecosystem functions and integrity must be maintained.

Chapter 3 discusses the importance of creating partnerships with a variety of groups in order to become fully integrated within projects or activities, thus helping to ensure their commitment and cooperation. Partnerships include those with local communities; local, regional and national administrations, government authorities and non-governmental organizations; and international organizations, donors and international non-governmental organizations. Creating partnerships helps preclude the problem of "top-down" approaches which in most cases are met with resistance at the working level of projects.

Part II presents information and checklists on: tools that can be used to formulate and implement ecosystem-based management activities (Chapter 4); and a set of guidelines on how to integrate ecosystem-based management approaches into development projects (Chapter 5). Examples of tools are: planning; environmental assessments; participatory processes; and institutional coordination. Integration of ecosystem-based management approaches into development projects includes: steps needed to identify projects; project formulation; project appraisal and approval; and project implementation. Each of the chapters in Part II contains a number of checklists that can be employed by users of the Guide to help with the formulation and implementation of projects and activities.

In a number of cases some of the information in Part I is repeated. This was done purposely so that Part II could, to an extent, be self-contained and read alone.

Introduction

People are part of the natural world. Our existence depends on ecological processes – the cycling of water and the elements, the maintenance of stable atmospheric, climatic and hydrological conditions, and the continued production of foodstuffs and many other products and services which make our existence possible and contribute to our well-being.

Ecosystem functions are the result of assemblages of plants and animals interacting with each other and with the physical components of their environment. **Ecosystem-based management* attempts to regulate our use of ecosystems so that we can benefit from them while at the same time modifying our impacts on them so that basic ecosystem functions are preserved.** Unless essential ecosystem functions are maintained, our use of them will not be sustainable. When this happens, our continued development will be hampered and may even stop.

There has been a general failure of development policies based on use of natural resources. As a result, there is a continuing loss of biodiversity and general degradation of the environment at many scales and within many different social and political systems. The growing recognition of this situation over the past 20 years has led to a number of attempts to promote more sustainable development practices that depend on natural resources. One of the first attempts to articulate the notion of sustainable use of ecosystems was embodied in the World Conservation Strategy (IUCN, UNEP, WWF, 1980). Subsequently, the World Commission on Environment and Development in its Agenda 21 (1992):

* Note: The term *ecosystem-based management* is preferable to *ecosystem management* because it reflects the notion that the principle activity is the management of human interactions with the ecosystem rather than the ecosystem itself. However, throughout the text, both terms are used interchangeably, because *ecosystem-based management* is clumsy to use continuously.

- defined the essential features of environmental systems;
- highlighted the constraints on using these environmental systems; and
- promulgated an approach that required that evaluation of alternatives be undertaken to determine how ecosystem products and services may benefit people without jeopardizing the functional integrity of the systems concerned.

The United Nations Convention on Biological Diversity (1992) approach to ecosystem-based management is that:

> *Ecosystem and natural habitats management seeks to meet human requirements to use natural resources, whilst maintaining the biological richness and ecological processes necessary to sustain the composition, structure and function of the habitats or ecosystems concerned. Important within this process is the setting of explicit goals and practices, regularly updated in the light of the results of monitoring and research activities.*

Similar approaches are embodied in many other international and regional conventions and agreements. The example highlighted in Box 1 concerning the Senegal River Valley illustrates what happened when a sectoral, rather than an overall, ecosystem approach was used.

This Guide aims to encourage a wider understanding of the concepts of ecosystem and natural habitats management so that they can be used more effectively in projects supported by multilateral and bilateral donors. The donor community wants to encourage development practitioners to recognize that ecosystems are more than just biophysical systems. People are an integral part of ecosystems and development projects must actively engage them in the process of ecosystem management. The success of ecosystem and natural habitats management will depend as much – perhaps more – on the management of social, economic and institutional factors as on the protection and management of the biophysical environment.

The Guide is based on the practical experience gained from 24 projects representing a broad range of spatial and time scales, ecosystem types, natural resource uses and community development activities from a variety of locations around the world. The projects are, or have been, implemented by a wide variety of organizations – government agencies, non-governmental organizations (NGOs) and local communities, and supported by many different international and national financing organizations. As in the Senegal River Valley project described below, particular lessons learned are summarized in boxes adjacent to the points being made. The list of case studies and

Box 1. Missed Opportunity: Investment without Ecosystem Management in the Senegal River Valley

In 1972, the governments of Mali, Mauritania and Senegal established the Organization for the Development of the Senegal River Valley (OMVS) with a view to constructing two dams – Manantali in Mali, for flood regulation and hydroelectricity, and Diama, in the estuary, to exclude saline water intrusion in the dry season. They were designed:

- for intensive rice production (Senegal: 240,000 ha; Mauritania: 125,000 ha; Mali: 10,000 ha);
- for electricity production (800 Gwh per year);
- to ensure year round navigability on about 500 km of the middle course of the river; and
- to allow an artificial flood on 50,000-100,000 ha of the former floodplain.

Socioeconomic factors, community participation, environmental considerations and health aspects were not integrated into the original project. Progress has been slower than anticipated. So far the outcomes are that:

- 50% of the phased programme for irrigating 4,000 ha of perimeter lands per year has been completed, but rising costs will probably prevent the timely completion of the overall irrigation scheme;
- rice production is considerably lower than the feasibility studies predicted, since soil salinization has prevented cultivation on 50% of the newly-created, irrigated fields;
- dam and dyke infrastructures have reduced traditional grazing lands from 80,000 ha to 4,000 ha;
- 75% of the seasonal floodplain wetlands have been altered and fish production in the river and estuary has fallen by 90%;
- floodplain forests and estuarine mangroves have been destroyed;
- grain-eating bird pests are much more abundant;
- stagnant waters have introduced or increased the prevalence of diseases; and
- pollution from pesticides and fertilizers is common.

These problems arose because the linkages between the different ecological components of the river basin were not recognized, and because the social and economic features of the target groups were poorly integrated into project planning. To resolve this, the OMVS plans to implement a series of country master plans for further development of the river valley.

To succeed, these will need to:

- ensure participation of local communities at every stage of planning in all future projects;
- integrate traditional flood recession and grazing practices into the operation of the two dams;
- minimize further wetland, forest and arid land degradation and foster restoration, e.g. through valuation of the natural resources and improved management of protected areas;
- adapt existing water development strategies to minimize health hazards;
- modify existing land ownership legislation to ensure that farmers have an interest in maintaining or restoring their soils; and
- undertake monitoring and regular evaluation of the management plan so that it can be adapted to address changing conditions or circumstances.

their authors is given in Appendix 1. The methodology used in the subsequent analysis is described in Appendix 2.

The **principles and guidelines** provided in this Guide **for ecosystem-based management are equally valid for large-scale projects on infrastructure development and for smaller scale conservation and development projects**.

If ecosystem management is adopted as a concept, with the principles and tools described in this Guide being put into practice, both conservation and development practitioners will be able to take into account the interactions between plant and animal species, their phys-

ical environment and the human actions impacting ecosystems. In short, they will be able to manage ecosystems more effectively, together with the full range of stakeholders. They will be able to ensure that ecosystem management considerations are integrated into projects that had previously failed to include them, and thereby rectify past mistakes.

In reviewing the case studies, a number of conclusions became apparent. Among them:

- ecosystem management must be flexible in its approach, in order to adapt to continually changing situations and conditions;
- ecosystem management is only partly about ecological sciences. It has much to do with gaining an appreciation of the economic, social and cultural factors affecting the communities concerned with an ecosystem management project; and
- public and community participation – at all stages of project development and implementation – is extremely important for success.

The scope of this Guide has focussed on relatively few projects. As the ecosystem management approach is tried in more projects in the future, many other lessons will be learned. These could guide development practitioners in formulating larger scale development projects, or projects with different foci, for example the management of coral reefs, which is not addressed in here.

Part 1

Ecosystems and Ecosystem-based Management: Definitions and Principles

***Part I** briefly reviews some ecosystem concepts and provides a definition of ecosystem-based management, with some guiding and operational principles to be taken into account during project formulation and implementation. These are intended to provide some insight into why ecosystem-based management aims to safeguard essential ecosystem structure, functions, services and benefits.*

1
Ecology

Ecology, as a scientific discipline, is relatively new when compared with physics, chemistry and mathematics that were practised in previous millennia. Writings which can purport to introduce notions about ecology and ecosystems are less than 200 years old, although it is certain that some of these notions have had a much more venerable origin. Formal notions about scientific approaches to ecology and ecosystems relevant to the discussions here are more recent.

This Guide does not provide an exhaustive treatise on ecology and ecosystems. Several sources are recommended (see References) for those who wish to learn more scientific detail and increase their technical vocabularies. A good example is *Ecology and Our Endangered Life-support Systems* (Odum, 1989), which is written in a popular style and focuses on contemporary environment and development problems. Another is *Ecosystem Management, Questions for Science and Society* (Maltby *et al.*, 1999), which summarizes the results of a 1996 seminar on the advances of ecosystem science, and their relevance to today's conservation and development concerns. Nonetheless, some basic background information on ecosystems and how they function will help set the stage for ecosystem-based management approaches and to understanding the examples that appear in this Guide.

1.1 ECOSYSTEMS

One of the first to provide a formalized, contemporary description of ecosystems was A.G. Tansley in 1935, when he stated that an ecosystem is a "**unit of vegetation which... includes not only the plants of which it is composed but the animals habitually associated with them, and also all the physical and chemical components of the immediate environment or habitat which together form a recognizable self-contained entity.**" He later supplemented this with, "all parts of such an ecosystem may be considered as interacting". During the 1950s and 1960s, "ecology" as a discipline came into its own, generating a surge of efforts to understand the Earth and its systems and processes in a more holistic way. Ecosystem science pro-

vided a framework for these efforts. Books such as *Gaia: A New Look at Life on Earth* (Lovelock, 1979) helped popularize this holistic approach.

Within the context of this Guide it is important to note that there are two notions common to the varied definitions of ecosystems. The first is that **ecosystems involve the interaction between plant and animal species and their geophysical environment.** This may seem self-evident but, until recently, botanists, zoologists and earth scientists went about their business without much reference to each other. The second is that **by definition, all ecosystems have boundaries**. This may also seem self-evident and therefore requires some explanation.

Ecosystem boundaries do not occur naturally but are a **human concept** imposed for the purpose of quantifying what goes on inside the chosen system. The researcher defines the boundaries based on the type of questions asked. To the researcher, a boundary is simply a threshold through which energy and materials enter the defined ecosystem and are transformed through processes taking place inside the boundaries. Many of the products of this transformation then exit the system. Much of the effort of ecologists is expended on qualifying and quantifying the whole process. In a simplistic way, the boundaries are a sort of aid for ecological "house keeping". For example, in studying a grassland ecosystem a scientist might decide to study an area as small as a square metre or one covering several hectares. A decision might require making a trade-off between the practicality of conducting the study and the accuracy that can be achieved in the smallest possible area. The point is that **the researcher sets the boundaries**. A researcher might therefore set the boundaries to include the entire Earth (see Lovelock, 1979) or just a few millilitres of pond water in a test tube.

Ecosystem-based managers usually take a somewhat more pragmatic approach. While accepting that every living thing, and all processes on Earth, are related and somehow interact, some naturally-occurring demarcations in the real word can justifiably be considered as boundaries for the purposes of ecosystem-based management projects. Examples are lakes, deltas, islands, floodplains, watersheds separated by mountains, and many others. Such "natural" ecosystems occur on many scales. Thus, ecosystems that serve as a focus for most field projects typically are areas such as marshes, rivers and streams, a watershed, a block of tropical rainforest, a portion of the open ocean, or estuaries. Examples of domesticated ecosystems include small towns, urban conurbations and agro-ecosystems.

Large ecosystems always include smaller ones. A large watershed, for example, may include a number of lakes that can be locally managed within the context of the overall watershed. Isolated coral reefs may also form part of a much larger atoll system. Thus, defining an ecosystem boundary is more a matter of practical convenience for the practitioner, and is usually related to easily identifiable demarcations. Nonetheless, one must not forget that a large quantity of materials moves back and forth across natural demarcations. In the case of mountain divides, for example, wildlife, seeds, hunters, slash-and-burn farmers, refugees, atmospheric pollutants and other elements may be transitory parts of the ecosystem. These should not be forgotten in an ecosystem management project. Nevertheless, **for the purposes of this Guide, the practitioner's approach provides the focus**, rather than the academically precise approach. This statement should not, however, be taken to imply that an ecologist could not be a good practitioner, or *vice versa*.

1.2 CHARACTERISTICS OF ECOSYSTEMS

Ecosystems are some of the components that constitute the **biosphere** – the complete assembly of the Earth's ecosystems. Ecosystems also include **habitats**, places where the plants and animals of an ecosystem live. For example, mussels are usually associated with a rocky shore habitat that is subjected to tidal currents and waves. Pandas live in bamboo forest habitats. Flamingos are usually found in shallow wetland and lake habitats. Wildebeest are found on African grasslands. Very large, easily recognized, groups of ecosystems possessing the same overall general character constitute **biomes.** Examples are deserts, tundra, evergreen tropical rainforests, boreal coniferous forests, coral reefs and mangroves.

Ecosystems are functional systems comprising living and non-living components. Within them are materials (humans, trees, fish, soil) that interact and, in so doing, consume or transform energy and materials. Within the kind of ecosystems discussed in this Guide the component parts and processes of their interactions are easily recognizable. These components and the interrelationships between them comprise the ecosystem's **structure** and **functions.** Figure 1 illustrates the structure of a typical African savannah system. Energy is derived from solar radiation, in part as direct warmth and in part through fixation by green plants in the biochemical process of photosynthesis. Plants (*primary producers*) sustain herbivores (*secondary producers*) which, in turn, support carnivores (*tertiary producers*). The decomposers and microbivores (those that eat microbes) break down the material remains of these processes and recycle the nutrient products back into the soil, water or atmosphere of the system. **Ecosystem integrity**

is maintained when these processes continue unperturbed by significant external influences. Ecosystems can lose their integrity through practices such as clear cutting of a forest, the dumping of pollutants into an estuary, the construction of a dam which interrupts the water cycle of a floodplain, or the capture and killing to near extinction of a species, for example the black rhinoceros.

Among the many characteristics of ecosystems that management practitioners should keep in mind, the concept of **change** is worthy of special mention. Many still harbour the notion that in a given ecosystem the component parts and the processes by which they are linked reach a state of equilibrium that remains constant, forever. This is incorrect. One of the characteristics of ecosystems is that they are in a constant state of change as a result of population dynamics of species within the ecosystem, dispersion of species across ecosystem boundaries, climatic changes, and many other factors.

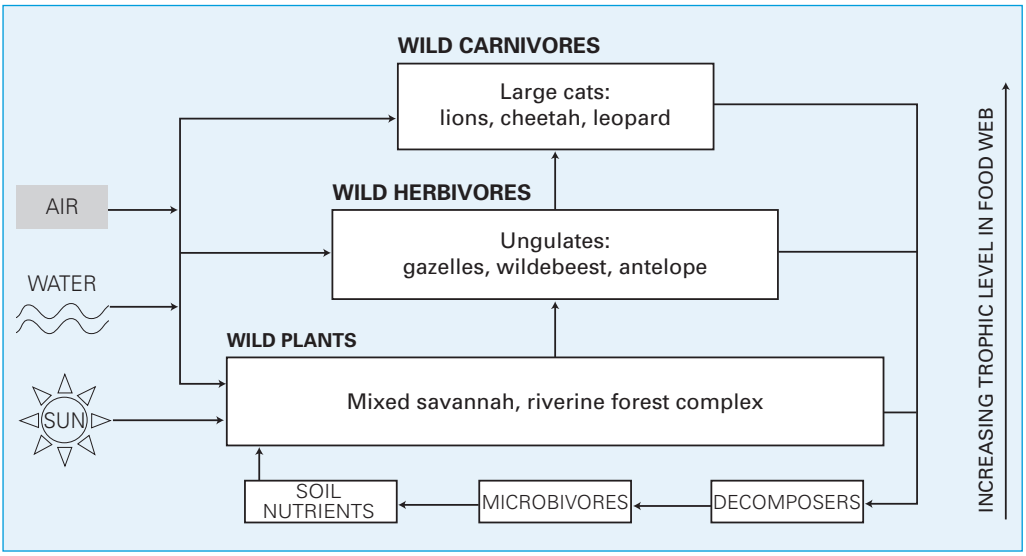

Figure 1. Diagrammatic representation of a mixed savannah, riverine forest ecosystem. Major elements include savannah grasses and woodland brush, which is grazed by a variety of ungulates, which in turn are preyed upon by the top predators in the food web. Residual material from the three trophic levels in the food web are recycled by decomposers (such as dung beetles, termites and ants) and microbivores which break this material down into the nutrient components of the soil which feed the plant system. Not shown on the diagram, but to be taken note of is that humans are part of the ecosystem and also utilize some of the plant material, herbivores and top predators, but to a minor extent in this particular system.

Ecologists expend a lot of effort trying to gain a better understanding of how such changes come about. While these theories are not always in agreement with each other there is still a solid consensus that ecosystems are in a constant state of change and do not exist

in some pristine state. The rate of change of different systems may vary considerably, but none are static. **Recognition of the inevitability of change** is critically important to the ecosystem management practitioner. The misunderstanding of this inevitability has led to many ill-fated efforts to restore perturbed ecosystems to their "original, pristine" state. Many desirable ecosystem characteristics and functions may result from such efforts, but the new ecosystem will not be the same as the one that was altered.

Two other characteristics of ecosystems, or groups of ecosystems, that are important to practitioners concerns their **resilience** and **biological diversity**, the latter often referred to as biodiversity. Conservation of biodiversity has become a global issue in recent years and is now the centrepiece of a global legal agreement, the United Nations Convention on Biological Diversity (CBD). For a number of years there was confusion about what the term "biological diversity" encompassed. Following extensive debate, those responsible for drafting the CBD adopted a practical working definition:

> *Biological diversity means the variability among living organisms from all sources including* inter alia, *terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.*

This definition can be conveniently thought of in terms of the three levels mentioned:

- **Ecosystem diversity**: the variety and frequency of occurrence of different ecosystems;
- **Species diversity**: the frequency of occurrence of different species;
- **Genetic diversity**: the frequency of occurrence and diversity of different genes and/or genomes within species. This includes the variation both within a population of species and between populations of that species.

Why is biodiversity important from the point of view of ecosystem management? To put it simply:

- the more diverse the assemblage of ecosystems in a large area, the greater the chance that some will survive a significant perturbation in the area;
- the more species represented in a given ecosystem, the better the chance of survival of the system if the populations of some species are perturbed; and
- the higher the level of genetic diversity within a population, the better its chances of undergoing the evolutionary changes necessary to adapt to changing conditions.

Loss of diversity at any of the three levels decreases the probability of recovery after a significant disturbance, or adaptation to changing conditions. The degree to which a system can recover from such a disturbance is a measure of its **resilience.** Systems with low resilience are less likely to recover than systems with high resilience. Systems with high levels of biological diversity are more likely to have a higher level of resilience than systems with less biological diversity.

1.3 ECOSYSTEM STRUCTURE, FUNCTIONS AND BENEFITS

The components of the types of ecosystems discussed in this Guide, as well as the processes of their interactions, are easily recognized. These components and the interrelationships between them comprise the ecosystem's **structure** and **functions.**

BIOME	FUNCTIONS AND SERVICES PROVIDED BY ECOSYSTEMS	COMMON ECOSYSTEM BENEFITS AND ATTRIBUTES
Forests	• Micro-climate stabilization • Carbon uptake and storage • Soil and watershed protection • Energy storage	• Carbon dioxide removal • fuel products • timber products • non-timber products • wildlife resources • biodiversity conservation
Wetlands	• groundwater recharge and discharge • flood control • water quality and quantity • water purification • sediment/toxicant/ nutrient retention	• medicinal and biomedical products • water supply • pollution clean-up • fish nurseries and fisheries products • forage products • agricultural products • transport
Mangroves	• storm protection • provision and renewal of nutrients • sediment accumulation	• aesthetic and recreational values • historical and cultural values • fish nurseries and fisheries products
Coral Reefs	• coastal protection • sand production	• construction material • genetic resources • global heritage • educational and scientific interest
Oceans	• global climate regulation	• fisheries products

Adapted from Cesar (1996), Dudley et al. (1996), Dugan (1990) and Miller (1996).

As an integral component of the natural world, people have always interacted with, and transformed, ecosystems in a variety of ways to take advantage of the **goods and services provided by ecosystems**. Some have speculated that we may have hunted woolly mammoths to their extinction before the last ice age. We have used fire to transform ecosystems in Australia, Africa and North America, constructed irrigation systems in the Fertile Crescent, domesticated horses and cattle, and, more recently, changed the hydrology of floodplains and many river systems through damming, channelling and building dykes, expanding urban areas onto reclaimed land (often land-filled wetlands that previously had a high level of biodiversity).

Some of the functions, services and attributes (or goods) provided by ecosystems are listed above.

With reference to the system presented in Figure 1, the simplest, and perhaps most benign interaction is for humans to assume part of the herbivore and carnivore role in partial competition with their wild counterparts. The CAMPFIRE project in Zimbabwe (described in Boxes 14 and 27) is an example of an improved system for cropping wild herbivores and carnivores. Competing wild carnivores, like lions, are commonly reduced in numbers but not to the extent that the structure and functions of the system are lost. Harvesting of primary and secondary producers takes place but not to the extent ecosystem structure and functions are threatened.

Figure 2 illustrates the kinds of transformation that commonly occur when intensive agriculture is introduced, again using the African savannah system as the example. Intensive farming usually causes a much greater ecosystem transformation. In pastoral grazing systems, people replace most of the wild herbivores with sheep, cattle or other livestock and destroy or drive out the carnivores that would otherwise prey on them. Agrarian systems substitute many primary producers with crop plants (reducing biodiversity), and exclude competing herbivores (using fences and pesticides), and competing wild plants (through use of herbicides). They boost productivity by nutrient injection, and often depend on fossil fuel energy to make fertilizers and other chemicals. Depending on how intensive or pervasive the agricultural system is, many of the components and functions of the former ecosystem may be maintained at some acceptable level, but sadly, in many cases, this is not so. They are usually supplanted by the new system. Often, the values of natural ecosystems are not taken into account before development activities take place. In others, a miscalculation may occur of whether the environmental factors supporting the establishment of a natural ecosystem will also support an agricultural scheme intended to replace it. The number

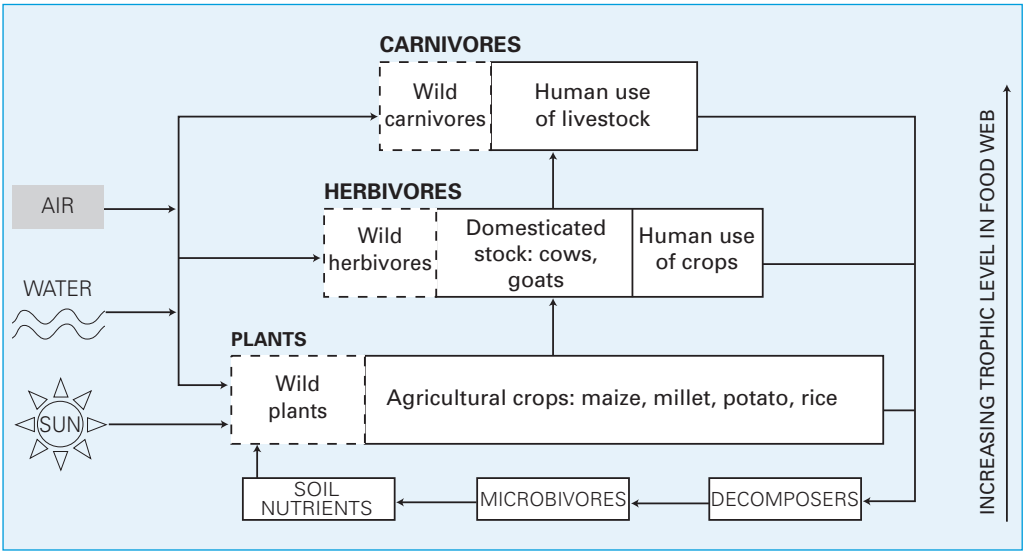

Figure 2. Diagrammatic representation of the same system as above, but heavily impacted by the introduction of extensive agriculture. At the trophic level of plants, domesticated agricultural crops, such as maize, millet, potato, and irrigated rice schemes have been introduced. Domesticated stock such as cattle and goats have been introduced and man now plays a much more important role as consumer of the plant crops (herbivore) and livestock (carnivore). One of the challenges for ecosystem-based management is how to reconcile the conflicts that arise when natural systems are thus heavily impacted in order to maintain the desired level of goods and services of natural ecosystems.

of abandoned and failed irrigation schemes around the world gives some credence to this observation.

The development of marine fisheries illustrates how humans regularly usurp the role of being the predominant hunter-gatherers and top predators in coastal and oceanic ecosystems. Maintenance of industrial fishing is made possible through heavy subsidies and continually improved techniques for catching fish and other species. A recent example from the South Pacific is the ability to harvest orange roughy (*Hoplostethus atlanticus*), a slow reproducing fish caught in trawls working at depths of thousands of metres. By the time adequate controls could be put in place many fisheries biologists feared that the species was already in danger of being fished to extinction. Because many fisheries exist naturally, outside of national jurisdictions, they are part of the global commons. They are free for taking on a "first come, first served" basis. Furthermore, no fishing company or government had to invest in building up the stocks. As a result, the most economical approach is to harvest as much of a stock as possible quickly, and then move on to new stocks when the one currently targeted is depleted.

Such approaches are yet to be supplanted by more benign practices. For many years mariculture was seen as a possible answer but it has transpired that it has many of the same perturbing effects as large agricultural systems. High nutrient inputs, release of pollutants and the introduction of alien species that compete with local species are just a few of the problems encountered in mariculture schemes.

All farming, grazing, fishery and forestry development projects should operate within the constraints of the ecosystems in which they are developed, even if they modify those systems. **Operating within the constraints of the system will make it more likely that these practices will remain productive over a longer period.** Modifications that are inappropriate in scale or character may lead to ecosystem degradation, which is usually manifested by:

- **a reduction in biomass** (the total amount of living matter in the system);
- **a reduction in productivity** (the amount of living material produced per unit time by the system as a whole); and/or
- **loss of biodiversity**.

In evaluating the likely impacts of a management process, and hence its suitability, it is **crucial** to examine the implications for productivity, biomass and diversity, with special emphasis on the species and products important to the user community.

1.4 ECOSYSTEM-BASED MANAGEMENT

What does ecosystem-based management mean? **For the practitioner, there are three important aspects to ecosystem-based management, all of which have to do with the human component of ecosystems.** One focuses on the ultimate **objectives** of management actions, another concerns ecosystem **boundaries** in relation to other types of boundaries not yet discussed, and the third concerns management **actions** and to what they are directed.

Objectives

Ecosystems provide a full array of goods and services upon which people depend for their livelihood and well-being (examples of the goods and services obtained from ecosystems were tabulated in section 1.3). **Ecosystem-based management seeks to organize human use of ecosystems in order to strike a balance between benefiting from the natural resources available from an ecosystem's components and processes, while maintaining an ecosystem's ability to provide these at a sustainable level.**

Management schemes for national parks, conserving particular species, or areas of biomes have provided good examples of sound ecosystem-based approaches. In particular, the various categories of protected areas promulgated by IUCN for many years are based on holistic ecosystem approaches as is the bioregional approach which encompass larger ecosystems, i.e. at the landscape scale. However, it would be a mistake to assume that ecosystem-based management is, or should only be, applied in national parks or for preserving floral and faunal components in their wild state. There are many cases where agricultural, forestry, fisheries and coastal zone management schemes of development projects have been based on maximizing extraction of goods and services of ecosystems. Eventually the schemes failed when the systems were no longer able to function. Ecosystem-based management approaches could have been used to help foresee the impact of extractive practises and set limits which would allow ecosystem functions to be maintained.

In brief, the purpose of ecosystem management is to use ecosystems, but not to lose them. The objective of ecosystem management projects then should be to ensure that their goods and services are available on a sustainable basis.

Boundaries

In section 1.1, it was pointed out that by definition all ecosystems have boundaries. From the phrase "ecosystem-based management" it should be self-evident that the focus is on management actions within these boundaries. The window through which an ecosystem management practitioner should primarily view an area should be the ecosystem-based window. Ecosystem managers need to develop an inventory of the components comprising the system and their interrelationships. They also need to develop knowledge concerning biomass, productivity and the various levels of biological diversity of the system. They need to develop an understanding, or ideally be able to make predictions, about how much an ecosystem can be perturbed without undue degradation or destruction. This knowledge will help form the basis of management decisions.

At the same time, however, ecosystem management practitioners have to be aware of, and take into account, the fact that other important boundaries lie within or cross the boundaries of ecosystems. These include boundaries established as a reflection of socioeconomic and legal/administrative systems.

A typical example of this situation is a coastal floodplain. The natural demarcation that an ecosystem manager might choose could be

the upper limit of the watershed that supplies the floodwaters. Within that area, however, many communities may use the system for different purposes such as water extraction for irrigation, grazing of cattle and horses, fishing, wildlife viewing, source of medicinal plants, or for religious or other cultural purposes. Some uses may be compatible with the constraints of the system, others may not. Conflicts often arise among such groups and cannot be solved through understanding the ecosystem alone. **Ecosystem managers therefore need to understand how different societies interact with the systems within which they live.**

The area of ecosystem to be managed may have overlapping sectoral jurisdictions or mandates held by different communities, counties, provinces, cantons or central governments. A ministry of fisheries may have a mandate to manage fisheries and land-use (e.g. ports) in adjacent coastal areas; a parks department may be responsible for managing human activities not only within a park's formal boundary but also outside the boundary, especially where human actions affect the park; and irrigation might be controlled by a local authority, or regional or central government. The objectives of these sectors or government entities may conflict, or the areas over which they might be responsible may cut across the boundaries of the ecosystem to be managed. **The various jurisdictions in an area will rarely coincide with the demarcations that serve as the boundaries for an ecosystem management project.** In some cases, ecosystem management projects have failed because managers were unable to determine how to resolve these conflicts, or were unable to appreciate the existence of administrative boundaries. These problems will be examined again later in this Guide.

Focus of management action

What should be the focus of action taken by ecosystem managers?

As stated earlier, ecosystems are natural systems, the boundaries of which are imposed by humans for scientific and management purposes. In general, perturbations of ecosystems are due to two causes. Some are brought about by natural phenomena such as storms that destroy a deltaic system, an ice age, hurricanes, or invasive plant or animal species. On the other hand, when humans began to develop strategies to manipulate their surroundings in order to multiply their access to the goods and services from natural systems, they became major causes of perturbation and degradation of natural systems. In general, these have been due to agricultural expansion, fisheries, deforestation, mining, the introduction of alien species, the establishment of cities and major urban centres, and migrations to new

areas. As a result, ecosystem-based management should focus on the role of people as an ecosystem component, and their interactions with other components of the system. Thus, **human actions should be the focus of ecosystem management.**

If human interactions within the ecosystems are the target, what kind of actions do ecosystem managers undertake? Examples of such actions (see below) are provided by Maltby *et al.* (1999):

- **adjusting the chemical conditions** by controlling pollution or altering the input of nutrients and contaminants to the atmosphere, waters, soils or more directly to vegetation;
- **regulating the physical parameters**, for example by making controlled releases of water from a dam or entry of saltwater into coastal impoundments;
- **altering biological interrelationships**, for example by controlling grazing and predation, or preventing the colonization of grassland or heathland by bushes and trees, or intervening in vegetation development or dynamics by burning or cutting;
- **controlling human use of biological productivity**, for example by limiting the use of fertilizers and pesticides, or regulating fish net sizes; and
- **intervening in cultural, social and economic processes**, for example by compensating farmers for reducing the intensity of their operations in the interests of conservation.

So far, the discussion has focused on some basic definitions and notions that help clarify what ecosystem-based management is about. They do little in the way of explaining how one goes about managing ecosystems. This requires further examination of the underlying guiding and operational **principles** of management, and how ecosystem managers can increase their chances of success by developing **partnerships** with people and groups having a vested interest in the goods and services provided by an ecosystem. These issues are presented in the next two chapters.

2

Ecosystem-based Management: Principles

The notion of "sustainable development" was promulgated in the 1970s with the formulation of the World Conservation Strategy (IUCN/UNEP/WWF, 1980). Further consideration followed in the 1980s and early 1990s during debates which led to the formulation of *Our Common Future* (World Commission on Environment and Development, 1987), *Caring for the Earth* (IUCN/UNEP/WWF, 1991) and *Agenda 21,* adopted at the United Nations Conference on Environment and Development (1992). Subsequently, sustainable development has been embodied in the policies of many international organizations and national governments.

In broad terms, sustainable development aims to improve and maintain the health of ecosystems and the well-being and livelihoods of people. While sustainable development includes a broad menu of components (e.g. better education, improved access to basic needs such as water, food and shelter, and many others), viable ecosystems are seen as the basic life support system. **A basic tenet is that conserving ecosystem functions and integrity will be, or should be, a fundamental vehicle for sustainable development.** The ecosystem approach is one of the tools for achieving sustainability.

Efforts have been made in recent years to incorporate the basic notions of sustainable development and ecosystem management approaches in national and regional sustainable development strategies, and in policies dealing with biodiversity, conservation and others (see 2.8). Based on experience from implementing these policies at the national and local levels, a number of guiding and operational principles have emerged as being key to success. These principles – eight of which are discussed in this chapter – apply to ecosystem-based management approaches as well as sustainable development. A thorough discussion of these principles can be found in papers prepared for meetings of the Conference of the Parties of the Convention on Biological Diversity and its Subsidiary

Body on Scientific, Technical and Technological Advice (UNEP, 1998, 1999).

2.1 MAINTAINING ECOSYSTEM FUNCTIONS AND INTEGRITY

Ecosystem **structure** relates to the components of the system, while ecosystem **functions** are the physical, chemical and biological processes that take place between these components within its defined boundaries (see 1.2). **A central premise of ecosystem management is that the structure and functional integrity of the system should be maintained,** while at the same time allowing for the use of the goods and services provided by the system (see 1.3).

Ecosystems, however, change naturally with time, and there are few examples of ecosystems having escaped human impact. Thus, there are few reference points that define what a "natural" ecosystem was like before such interventions or changes. Usually it is only possible to infer the characteristics of a natural system. In any event this may be of little value as a guide for ecosystem managers, unless the goal is to conserve that system in as natural a state as possible, for example in a nature reserve or other category of highly protected area. One is constrained to adopt the *status quo* as a starting point.

The **recycling** of materials and the purification of the environment are **important services** provided by many ecosystems. Wetland systems, for example, may have the capacity to clean up water pollution, to break down waste organic material, to detoxify chemicals and to remove heavy metals from circulation. Sometimes, people have used these functions purposefully for direct economic benefit; for example, where artificial wetlands are designed to purify waste waters and to produce nutrients. Such functions have their natural limits. If an ecosystem is burdened with polluting materials beyond the capacity of the system to absorb and recycle them, its character will change, the level of biodiversity will decline and the capacity to remove pollutants or provide nutrients will be lost.

In river floodplains, annual flooding is the key factor supporting the regular cycle of agriculture and fisheries. Floodwaters carry the nutrients that fertilize and maintain the productivity of agricultural lands once the floodwaters have receded. Nutrients support the natural species biodiversity of the area, and often contribute to seasonal fisheries. Wetlands also provide hydrological functions that result in flood protection, and the retention and maintenance of groundwater supplies. These services can only be sustained if ecosystem functions and integrity are maintained.

Box 2. Ecosystem Management

The Importance of Ecosystem Integrity – Wetland Functions in Northern Nigeria

The Hadejia-Nguru wetlands lie in a seasonally inundated lowland plain of some 350,000 ha located within the drylands of the Komadugu-Yobe basin in north-eastern Nigeria. It is a rich agricultural, herding and seasonal fishery area that provides food and a means of livelihood for at least one million inhabitants. It is also an area of international importance to Palaearctic[1] and Afrotropical migratory birds. As long as the seasonal flood cycles remained unimpeded the ecosystem functions and goods and services they provided were optimally balanced. They served to recharge groundwater, reduce the risks of destructive flooding and maintain soil fertility. Since the mid-1970s, the flooding of the wetlands has been significantly reduced by the construction of large dams and irrigation barrages. This has had severe impacts on the ecology and economy of the area.

Recognizing the Global Importance of Forest Ecosystem Functions – Mount Elgon National Park, Uganda

The photosynthesis, evapotranspiration and albedo[2] of forest ecosystems influence the cycling of water and matter at local, regional and global levels. Forest and agroforestry systems have a significant influence on the global carbon cycle. It has been estimated that forest ecosystems contain between 66% and 85% of the terrestrial aboveground carbon storage and approximately 45% of the terrestrial soil carbon. Forests contribute to the removal of carbon dioxide from the atmosphere through carbon uptake and storage in trees and associated vegetation, soil and forest products. In contrast, forest harvesting, fire and organic matter decomposition release carbon dioxide and other greenhouse gases into the atmosphere. Both sequestration[3] and emission influence the global carbon budget. For example, it has been estimated that deforestation accounts for between 10% and 30% of current global carbon dioxide emissions.

Private electricity companies are financing forest regeneration on Mount Elgon with the aim that they will become carbon sinks and offset carbon dioxide emissions. This is being achieved through the planting of 1,000 ha per year under a Joint Implementation Agreement between Dutch companies and the Uganda National Parks. This global action results in locally improved regulation of water flow, greater biodiversity and sustainable supplies of timber, fuelwood and non-timber forest products on Mount Elgon.

Using Ecosystem Functions Productively – Peri-urban Wetlands in Calcutta, India

The informal use of the wetlands created by the municipal wastewater discharged from the city of Calcutta is in the process of being formalized under the Ganga Action Plan. For over a century, these wetlands have been used for irrigating vegetable and paddy fields, and for fish culture. They are now threatened by urban expansion. However, their value for wastewater treatment, and for agricultural and fisheries production, is being realized through the use of improved designs for wetlands constructed specifically for the treatment of wastewater. Local communities, who lease out the fishponds and sell the treated irrigation water to vegetable and paddy farmers, manage them.

Beyond the need to survive, social choices determine what ecosystems are managed for, and how they are managed. Throughout human history this has been the case. Many of the social choices have, however, been the result of *ad hoc*, incremental actions rather than having been based on forward planning. This has often led to the full or partial loss of ecosystem functions.

[1] Palaearctic: the biogeographic region comprising the land mass of Europe and Asia from its northern border to the Sahara and the Himalayas.

[2] Albedo: the proportion of solar radiation which reaches the Earth's surface and is immediately reflected back into the atmosphere.

[3] Sequestration: locking up free carbon (e.g. by forests or in soils), so that it is removed from the carbon cycle for a period.

The nature of human disturbance to an ecosystem will determine the extent to which ecosystem integrity is lost. Ecosystem managers must promote the beneficial use of the system without contributing to its degradation – **use it, but don't lose it**. Attention should focus on the nature of the impacts, the ecological functions affected, and the scale of the impacts in both space and time. A short period of extreme disturbance can have a great destructive force, a fact that should be taken into account in formulating ecosystem management projects. Development activities adopting the ecosystem-based management approach should tailor resource use according to the capacity of the ecosystem to sustain its functions and its integrity.

Three examples illustrate how the management of ecosystem functions affected the outcome of a programme (Box 2).

2.2 RECOGNIZING ECOSYSTEM BOUNDARIES AND TRANSBOUNDARY ISSUES

Ecosystems are assemblages of plant, animal and non-living components "that interact within a recognizable self-contained entity", that is, within an ecosystem's boundary (see 1.1). **The primary focus for actions should be on the human actions affecting the components and processes within the boundaries that define the ecosystem.** Notwithstanding the adoption of this ecosystem focus, two other factors should be taken into account, otherwise the approach will fail. One concerns legal and administrative boundaries that cross ecosystem boundaries; the second concerns phenomena arising outside ecosystem boundaries that influence what happens inside.

Non-ecosystem Boundaries

The processes that link ecosystem components within their boundaries commonly transcend legal and administrative boundaries adopted for other purposes. In fact, it is almost inevitable that this will be the case. For example, within a coastal ecosystem a Ministry of Transport may have the mandate for harbour development, the policies for which clash with those of a tourism ministry charged with maintaining tourism values. An added complication is that the areas under their mandates may overlap. This raises the practical point of how to ensure project effectiveness if one has to deal with more than one administrative entity, each of which may promulgate its own (possibly opposing) resource use policies. This is one of the major challenges of the ecosystem approach. Thus, when practitioners use ecological concepts to design projects, it is imperative to appreciate how such legal and administrative boundaries will affect the imple-

mentation of the project from the ecosystem point of view. Lack of such appreciation has led to many failures.

A common reason for failure is that while project designers may have recognized the boundaries of the *self-contained* ecosystem, they have allowed themselves – for various reasons – to be constrained by other boundaries. Often, an existing legal or administrative boundary has been chosen which crosses an ecosystem boundary. Such a choice is always a compromise. **Boundaries should not be established in such a way that they cut across the major functional linkages of an ecosystem.** It is better to adopt the ecosystem boundaries as the framework and then, within the project, develop strategies for managing conflicts that may arise from the legal and administrative boundaries established for other purposes. Thus, the boundaries of a coastal zone management project would not necessarily coincide with the low water mark or a depth contour of 10 m (an administrative definition adopted in many countries). Instead, the boundary might include components of the continental shelf on the marine side and a land area controlling water, sediment, nutrients and contaminating inputs on the terrestrial side. The decision about boundaries in a project in Guinea-Bissau illustrates this point (Box 3).

Box 3. Determining Boundaries for Coastal Zone Management in Guinea-Bissau

The coastline of Guinea-Bissau is characterized by highly complex systems of rivers and estuaries. Mangrove-lined rivers are found in the interior of the country up to 150 km from the coast. About 60% of the population live within the zone of influence of these watercourses. The ecological goods and services provided by these systems make a significant contribution to the livelihood of the population. The seaward side of the coastline is characterized by an extensive, shallow, sediment-rich continental shelf and a group of islands comprising the Bijagos Archipelago (the shelf system is the widest in West Africa) which also influence the low-lying coastal areas. Thus, the boundaries adopted for developing an integrated coastal zone management plan extend landward to cover about one-third of the country's terrestrial area and extend offshore to around 12 nautical miles.

Influences from outside Ecosystem Boundaries

Boundaries define the spatial extent of the "recognizable, self-contained entity" comprising the ecosystem. However, when boundaries are established using this approach, we must be aware that **ecosystems are not entirely closed**. Ecosystems will interact with, and be influenced by, surrounding systems. External influences arising from outside the adopted boundaries will continue to be important and must be taken into account. In an estuarine ecosystem, for example, freshwater inflows and tidal currents pass through the adopted boundaries. Under normal conditions the fresh water and tides contribute to maintaining the functions and integrity of the ecosystem. At the same time, if the inflows carry pollutants from

sources far removed from the estuary they will contribute to the overall degradation of the system. In the first case they are a vital resource, in the second they are a threat. Similar examples are:

- acid rain falling on northern Europe which carries pollutants from North American industries, and threatens the forest ecosystems on which they fall;
- hydrological changes in wetlands that can alter normal ecosystem functions, e.g. upstream developments such as water extraction for irrigation or hydro-electric power generation; and
- over-exploitation offshore of a marine species that spends part of its life cycle within estuaries, thereby, eventually, causing change to the structure of the estuarine ecosystem.

No habitat or ecosystem should be treated as if it is independent of resources or influences arising from outside, even though it is accepted that the dominant interactions between ecosystem components are the internal ones. Transboundary influences dealt with in the Indus Delta and a national park in Russia are explained in Box 4.

Box 4. Effects of Outside Changes - the Indus Delta and Losynyi Ostrov National Park

The Indus Delta is an area of some 600,000 ha on the borders of India and Pakistan. It is highly arid in character and depends on the outflow of the Indus river to maintain the sediment balance of the delta ecosystem. The delta is comprised of extensive mudflats and mangrove areas – one of the largest arid-climate mangrove areas in the world. The average annual fresh-water and silt outflow through upstream abstraction of water for irrigation has been reduced by 80%. The character of the delta has changed significantly. Those responsible for coastal zone management must recognize the significance of ecosystem changes and that they are brought about by water extraction taking place hundreds of kilometres upstream.

Losinyi Ostrov, or Elk Island, is a national park lying within 5 km of the Kremlin in the centre of Moscow. At its heart, it contains a strictly protected area of wetland and mixed birch and pine forest with beaver and elk. Management issues include pollution and changes in the area's hydrology caused by urban developments outside the park. The importance of the existing ecological corridor connecting the park to forests outside Moscow has been recognized, but the economic pressure for development close to the park, threatens this linkage.

One approach for dealing with transboundary issues is through **bioregional planning** as promulgated by the IUCN World Commission on Protected Areas (WCPA). Through this approach boundaries are adopted at the landscape scale. Within a bioregion there are three basic elements:

- **core wild areas** that contain wild, undomesticated plant and animal communities, and the habitat or site requirements needed for their long-term survival;
- **buffer zones** adjacent to the core areas where human communities manage land and resources in such a way as to minimize negative impacts on core areas; and

- **corridors** that link core areas and buffer zones in a way that allows for plant and animal migrations and provides possibilities for changes, e.g. those brought about by changes in climate.

Core wild areas, buffer zones and corridors are nested within bioregions where resident communities, land owners and resource users live and work. The goal of bioregional management is to "establish, voluntarily, cooperative programmes across the entire region that provide appropriate treatment of those sites critical for biodiversity maintenance and restoration, while supporting local livelihoods and lifestyles" (Miller, 1996; Miller and Hamilton, 1997).

In a similar approach, the Biosphere Reserve concept deals with transboundary issues through adopting specific management schemes for different zones. According to UNESCO (1995), based on earlier work by Batisse (1982), the zonation of a Biosphere Reserve consists of:

- **one or more core zones:** securely protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems, and undertaking non-destructive research and other low impact uses (such as ecotourism and education);
- **a well-defined buffer zone:** which usually surrounds or adjoins the core zones, and is used for cooperative activities compatible with sound ecological practices, including environmental education, recreation, and applied and basic research; and
- **a flexible transition area**, or area of co-operation, which may contain a variety of agricultural activities, settlements and other uses. Local communities, management agencies, scientists, NGOs, cultural groups, economic interests and other stakeholders[4] work together in this area to manage the area's resources to achieve sustainable development.

Many examples of transnational agreements focus on the management of an important resource – fisheries, generating electricity or the use of water. Because of the narrow focus, however, they have rarely taken into account key ecological functions of the system or important socioeconomic differences between countries. The conflicts of interest between the three states managing the development of the Senegal River Valley (see Box 1) impeded progress and illustrate that the tripartite institution set up on this occasion has not been as effective as originally envisaged. This was a result of conflicting national

[4] Stakeholder: an individual or group with a direct interest in the use and management of the natural resource base. In terms of project management, anyone who is directly affected by, and can affect the outcome of, a project initiative.

goals, a lack of well thought out sustainable development objectives, and because there was little account given to the capacity of the overall system to accommodate alterations resulting from new infrastructure or other changes.

On a different scale, various regional agreements have been reached for managing some of the world's river basins and regional seas through a holistic approach. For example, the Mediterranean Action Plan, supported by a regional legal convention, covers the entire Mediterranean basin. This provides a framework for co-operation between countries to ensure that activities taking place in one part of the basin do not have adverse effects on ecosystems in another part. Ideally, such an approach should minimize negative transboundary influence on the smaller ecosystems that comprise the Mediterranean.

Global conventions may also be useful in minimizing negative transboundary ecosystem issues. Where two or more countries share a common ecosystem, these conventions can provide a useful framework for implementing joint agreements for management. With regard to the ecosystem-based management approach some of the more useful frameworks for co-operation are:

- the Convention on Biological Diversity;
- the Convention on Wetlands (Ramsar, 1971);
- the Convention to Combat Desertification;
- the Convention on Migratory Species;
- the World Heritage Convention; and
- several of the protocols to regional seas conventions which focus on some aspects of natural resource conservation.

Ecological Corridors

Increasing development continues to encroach on natural ecosystems causing them to become degraded. In some cases the development activity actually depends on the structure and functions of the ecosystem it degrades! As this process continues, there is a risk of being left with fragmented pockets of natural habitat, which are isolated from each other and can no longer function together as an ecosystem. One approach to solving the problem of fragmentation is to establish **ecological corridors** that link the various critical habitats (often referred to as functionally linked areas). These corridors facilitate the movement of species between habitats and therefore help to compensate for the previous loss of ecosystem functions. The corridors usually require special protection and management to ensure that the linkages are maintained. The overall area for management

then consists of a matrix of habitats connected by ecological corridors. The overall management objective is the maintenance of ecosystem structure, function and integrity. This matrix is often a sub-component of a larger management scheme that allows for sustainable use outside of the critical habitats and connecting corridors. In some ways this approach is similar to that of Biosphere Reserves. The Mata Atlantica Biosphere Reserve, and recent initiatives in eastern Europe, illustrate this (Box 5).

Box 5. Considering Wider Geographical Areas – Corridors in Eastern Europe and Brazil

A recent eastern European forestry initiative has drawn together foresters in European Russia, Ukraine, Poland and Hungary. An examination of the status of the major types of forest in each country – boreal, mountain, riverine and maritime forests, and the conservation and wise use issues associated with each – culminated in an interdisciplinary meeting of experts from all four countries. One of the major policy recommendations was for the development of a network of strictly protected natural forest territories, connected by a wide network of ecological corridors. The Russian component would connect Siberia to the countries of Central and eastern Europe.

The Atlantic Forest once covered a continuous area of over 1,000,000 km^2 along the north-eastern, south-eastern and southern coastline of Brazil. Climatic conditions stabilized by the Atlantic Ocean current systems offshore and a wide variety of geophysical features favoured the establishment of some of the highest biological diversity in the world. However, the pressure on this forest for timber extraction and clearance for sugar cane and coffee production has resulted in only 4% of the primary forest and another 4% of secondary formations remaining. Remaining forest areas are mostly fragmented and form small 'islands', except along the mountains in the south and south-east. The decrease in forest cover has led to dramatic reductions in biodiversity. Through the initiatives of five concerned states, the Mata Atlantica Biosphere Reserve was established in 1990. Fourteen other states have now adopted the same management principles. The area now covers the original extent of the Atlantic Forest ecosystem, ensuring that there is a common approach to management for both the forested areas and the corridors between them.

International agreements may be needed for effective management of similar systems in several countries that should be linked by ecological corridors. These would create more coherent objectives and a common management framework. Such agreements should not take away the responsibility for management from local institutions, but strengthen them. On the basis of this framework, more local management plans need to be designed and implemented to augment the framework.

2.3 MAINTAINING BIODIVERSITY

Ecosystems consist of plants, animals (including humans) and non-living components (air, water, minerals) and the processes that link them. The frequency of occurrence of different species within an ecosystem defines its species diversity. The frequency of occurrence of different ecosystems is a measure of ecosystem diversity. The goods and services provided by ecosystems all contribute to life

on Earth and, in many cases, are vital to its survival, if not the quality of life of its inhabitants. Loss of ecosystems, their species components and the processes that link them can lead to the loss of the goods and services that ecosystems provide (see also 1.2). A decline in diversity can lead to the loss of valuable biological resources – for example when forest conversion causes the disappearance of medicinal plants or food sources used by forest-dwelling communities. **A basic principle of ecosystem management is therefore to maintain biodiversity.**

The components that characterize diversity in ecosystems are highly varied. For example, animals living in polar ecosystems are adapted to cold temperatures, high annual variations in temperature and food supplies, and to surviving on ice flows, while in tropical conditions animals are adapted to higher temperatures with less seasonal variation, and to cycles of rainy periods and drought. There are many other examples of such variations in adaptation. While the basic ecosystem processes, for example predator-prey relationships, may be similar the actual components making up different ecosystems are highly diverse (for example polar bears compared with lions).

While ecosystems vary considerably in their characteristic biodiversity, some patterns are worth mentioning. Generally, ecosystems in continental situations in the humid tropics contain a greater biomass, have higher productivity, and contain a greater diversity of species than ecosystems in colder, more arid situations, or regions that have been exposed to dramatic environmental fluxes such as repeated glaciations. Isolated habitats – like those of remote islands – are also naturally low in diversity, although they may be rich in **endemic**[5] species. A species-poor ecosystem can maintain a wide range of ecosystem functions and exhibit both integrity and resilience. However, if its integrity depends on just a small number of species, it will be relatively more vulnerable than a system with high diversity. Therefore, irrespective of the level of species diversity in an ecosystem, **it is important to monitor biodiversity since changes can be a sensitive indicator of damage to the ecosystem.**

Efforts in fisheries management during recent decades demonstrate what can happen when ecosystem integrity is not maintained. In the 1960s, the common approach was to monitor the population size and year class distribution of species to be harvested. On the basis of this information, calculations were made on maximum sustainable catches. These were translated into recommendations about

[5] Endemic species: any plant or animal species confined to, or exclusive to, an area.

fishing effort that should be expended. The aim was to lower fishing effort and set catch limits when it appeared that exploitation was excessive. At least three important problems arose.

First, the approach was flawed. It concentrated only on catches of the target species and ignored the interaction of that species with the other components (for example other fish and marine organisms) of the ecosystem of which it was a part. When target populations were reduced, and the predominant year class ages were lower than usual, it was not only due to fishing effort but also to the fact that other species were able to replace the reduced populations of target species by taking over their position in the food web. Competition thus became easier because there were fewer of the target species.

Second, while it was possible to monitor catches of individual, or groups of fishing boats, there was no convenient mechanism in place to convert this information into catch effort and the combined catches of all fishing fleets. By the time new catch limits could be set it was too late.

Third, many of the fishing grounds were outside the limit of national or other jurisdictions. As a result, the industry could ignore the recommendations with impunity and, as explained in section 1.3 for the orange roughy, it was the most economical approach for the industry to do so.

Attempts are underway to deal with these problems but, in the meantime, many commercial species such as cod, salmon, king crab, halibut, abalone, sea cucumbers, sharks and swordfish have been drastically reduced in some regions.

A Species Focus as a Tool in Ecosystem Management

People may be an integral part of ecosystems but, in general, many find it difficult to identify with concepts of ecosystem processes. On the other hand it is often easier for them to identify with a particular species such as a panda, whale, dolphin, elephant or flamingo. In some cases this can be used to the advantage of an ecosystem management project. By identifying **a flagship species** that can serve as a symbol for an ecosystem management project, it can serve as the focus for environmental education programmes and building public support. Box 6 illustrates how this approach was useful in Cameroon.

Some species are also used as a focus because they are indicators of the health of the ecosystem. Migratory birds, for example,

depend upon a series of feeding and nesting areas strategically located along flyways. If one link in the ecosystem chain is damaged, e.g. the loss of a specific wetland where migrating birds spend part of the year, their numbers will decrease. This focus on migratory birds, or migratory species in general, has led to the identification of habitats and areas requiring protection. The Nature Conservancy has used this approach successfully for Neotropical migratory bird conservation (see Box 6).

Endemic species have a certain intrinsic value because of their uniqueness. Examples include the remnant Coco de Mer forest in the Seychelles; and flightless cormorants, land tortoises, Darwin's Finches and marine iguanas of the Galápagos islands. Under the Convention on Biological Diversity, countries have a particular responsibility to safeguard such species and the ecosystems that support them. The concept is that because endemic species are unique to an area, interest in their survival transcends national interests. In addition, they can be a useful indicator of the health and functional integrity of their ecosystems.

Box 6. Using Migratory Birds and Flagship Species to Promote Ecosystem Management

The Nature Conservancy's Bird Conservation Programme uses birds migrating between North and South America as conservation tools to identify crucial habitats in breeding and wintering areas. State-of-the-art information systems and partnerships between organizations in both continents have been used to track Neotropical migratory species, to identify regionally important ecosystems to be protected, and to encourage co-ordinated management.

The Kilum-Ijim Mountain Forest Project (supported by BirdLife International) in Cameroon has used one of the globally threatened species found there, Bannerman's Turaco *(Tauraco bannermani)*, as a flagship species to promote the project. This bird is well known locally, having an almost legendary status among the 300,000 people who depend upon the forest for their livelihood. Environmental education activities that demonstrate the link between the survival of this species and sustainable management of the environment by the local people, including better soil conservation and improved farming practises, have provided the impetus for implementation of the project.

2.4 RECOGNIZING THE INEVITABILITY OF CHANGE

Ecosystems are dynamic: they undergo constant change. They do not exist forever in a static equilibrium, or a pristine state. Changes result from the normal shifts in the life stages and abundance of components that make up the system and their interactions with each other; from disturbances from outside the system (see 1.1 and 2.2); and human actions. Such changes are inevitable. **Ecosystem managers must recognize the inevitability of change** and plan accordingly.

Gradual **changes within ecosystems** are generally associated with what ecologists refer to as "**succession**". When plants and ani-

mals colonize or settle in an area, each passes through a series of life stages. As they do, the interrelationships between the various species and their surroundings change over time, for example, their demands for energy or inorganic nutrients. As an illustration, young forest trees and associated woody plants may provide sufficient cover (habitat) for particular species of nesting birds but, as the forest grows and underbrush is reduced because of diminished sunlight, the habitat becomes more open and certain bird species leave. Succession also often leads to changes in the landscape – for example, lakes and wetlands fill with sediment. General changes brought about by the process of succession are fairly well recognized in a number of ecosystems like forests, prairies, coral reefs, and wetland marshes (although this does not imply they are understood in detail). However, since no two ecosystems are the same, the rates and detailed differences for succession, or change, for each ecosystem must be considered separately. Managers must, for much of the time, work on the basis of inference, until detailed information is available.

Major **disturbances** such as floods, storms, forest fires and similar phenomena cause changes to ecosystems. Often they are considered as external to the normal successional changes that ecosystems undergo. At the same time, some caution is required. Many contemporary ecologists argue that these so-called outside influences are simply one of the many processes that characterize an ecosystem. In other words, a lightening strike which results in a forest fire should be considered as a normal process in the succession of some forests, and storm surges that break down a coral reef system are a normal part of reef dynamics, and should be accepted as such. For each project it will be necessary to decide on the extent to which such phenomena are taken into account. An event that is frequent will be more important than one that seldom happens – for example, every few years or less *versus* once in 500 years.

Throughout history, **people have dramatically changed ecosystems**, usually by transforming the patterns of vegetation and fauna across landscapes. Modern developments, especially through industrialization, pollution, intensive agriculture, dam construction, and the canalization of river systems have had the most noticeable effects. Major change has also resulted from the redistribution of species by breaking down biogeographical barriers. One such example is the widespread tendency to convert former mixed forest to monocultures using exotic rather than indigenous species, such as planting Australian *Eucalyptus* in many parts of the world because of its fast growth characteristics, or converting whole islands to banana, sugar or coconut plantations.

At the global scale it seems likely that the augmentation of the natural greenhouse effect by atmospheric pollution will bring world-wide climate change and sea level rise. The best models suggest increases in global mean temperature of 1°C to 3°C, with marked regional variation. A 1°C rise in temperature would shift the zone of tolerance of plant species some 120-150km towards the poles, and 130-140m vertically. It is expected that there will be significant effects on the Earth's hydrological cycle and, as a result, weather patterns will change. These changes are certain to have major impacts on ecosystems. According to the United Nations Framework Convention on Climate Change, 1992, the result will be a redistribution both in human land use patterns and natural ecological configurations.

With the possible exception of some of the changes brought about by human actions, ecosystem-based managers will not prevent many of these changes and will have to adapt to them. It is necessary then, to accept that **change is inevitable** and that some currently valuable ecosystems will become less valuable for human use, e.g. the silting up of lakes that support valuable fisheries. However, within the ecosystem-based management approach, there is the possibility to mitigate against change, to encourage changes that result in some advantage, or to adapt. To a great extent this will depend upon social choice – for example, by deciding to modify existing uses in order to preserve a core function.

2.5 RECOGNIZING PEOPLE AS PART OF THE ECOSYSTEM

People, like other species, are dependent for their survival on the basic goods and services that ecosystems provide: air, water, food and shelter. However, human societies distinguish themselves from other species in their ability – and their quest – to exploit systems far beyond obtaining these basic requirements for survival and, in doing so, have had far-reaching effects. Aside from survival, the goods and services of ecosystems support the acquisition of wealth, development of culture, infrastructure for travel and communication, and many other elements that contribute to the establishment and maintenance of societies. In tropical rainforests, long thought of as pristine systems, humans have interacted with other components of the ecosystems over many millennia and played a significant part in bringing about the configurations we see today. The intricate rendition of animals in the cave paintings in Europe leaves no doubt about humans being a component of Palaeolithic ecosystems. The notion that humans are somehow apart from ecosystems and control them from outside (e.g. we tame nature) is not a viable paradigm. **People are an integral part of most ecosystems.**

Few places on Earth are devoid of human populations, in spite of the fact that in some places their densities may be very low, as in desert areas or polar regions. Even fewer places have escaped some modification through human impact. Oil spill residues can be found on the remotest of shorelines. Remnants of terraced irrigation systems are visible in the highest mountains of South America and the Arabian Peninsula. Abandoned grain storage systems can be found in deserted canyons in the American Southwest and the Northern Frontier District of Kenya.

More human decisions currently taken about exploiting ecosystems are probably based on social and political factors, rather than on survival factors. The decision to obtain drinking water from a stream may be in the realm of survival for some individuals or communities, while a decision to regulate access to a stream in order to protect spawning areas for trout that will be caught for sport is in the realm of political and societal choice. Similarly, decisions about land use for agriculture and forestry, or fisheries, are societal choices, as is the expansion of urban and industrial areas. As people make the social and political choices about exploiting ecosystems, these same people should be involved in ecosystem management projects. Ecosystem-based management projects can assist in making political and societal decisions by providing the framework for collecting and analysing information, and formulating alternative options.

While people are indeed an integral component of ecosystems, there are other reasons for involving people – in particular, local communities – in the ecosystem management process, as:

- they have a particular interest in the management process, being dependent on the services the ecosystem provides;
- they often have considerable, relevant knowledge of the ecosystem and of the ways in which it can be managed;
- in some cases, the cultural, ethical and spiritual values of local communities have evolved on the basis of a long-standing interaction within an ecosystem, so their interest goes beyond simply deriving material benefits from the system; and
- in many cases, they have developed traditional use or tenure systems that can be adapted to the aims and objectives of an ecosystem management programme.

Aside from these positive reasons, people are often the greatest threat to ecosystem functions and integrity and without their cooperation ecosystem management efforts will run a high risk of failure.

Stakeholders are those people who use, affect, or otherwise have an interest in the ecosystem. An analysis of their needs, values and

perspectives is fundamental to ecosystem management. The satisfaction of human needs is as critical to the success of conservation initiatives as it is to development. Stakeholders, in particular local communities, will usually have more interest in safeguarding the ecosystems they exploit if their rights to access and exploitation are recognized. Experience has shown that when governments classify

Box 7. Respecting Traditional Knowledge and Rights of Users of the Ron Palm Ecosystem, Niger

The ron palm (*Borassus aethiopium*) of Dallol Maouri, Niger covers an area of about 30,000ha. The benefits of the forest to the local communities (about 50,000 persons) are multiple and include provision of foodstuffs, animal fodder, materials for producing handicrafts, and sources of traditional medicines. In addition, the forest system contributes to maintaining soil fertility and preventing soil erosion.

A programme to manage the forest, which had a traditional sectoral approach, was initiated, the main aim being to maximize wood sales. The needs of traditional users, interested in sustainable, non-timber products and services, were not taken into account. In time, due to human pressures on the system, coupled with uncoordinated management, the ecosystem began to degrade. This led to recognition of the complex inter-relationships that existed between the various ecosystems within the forest system and the surrounding areas, such as wetlands and rangelands. Traditional patterns of land use including grazing, fishing and use of the areas surrounding the forest, and their effects on the forest itself, became apparent. As a result, the forest management programme now devotes more effort to the problems of livestock grazing and fisheries issues in the areas surrounding the forests and to helping in the definition and redefinition of the rights and responsibilities of local communities and their external partners e.g. local government services and administrations, national research bodies, and NGOs. This required changes in legislation so that responsibilities could be transferred from the Forestry Department to local communities, and the recognition by local administration of community management structures and their rights of access. It has also resulted in the formulation and implementation of a series of management plans involving local community groups.

While the emphasis of the programme has changed, the ron palm is still used as a flagship species for the programme because of its importance to local people.

land as belonging to the state or other government body, local communities often lose interest in managing it. Sometimes they treat it as common land and are not concerned if it is over-exploited or abused in some other way. Of course this all depends on the value of the resource, but the **recognition of land tenure, rights of access or rights to use the natural resources in an area strengthens local incentives for management**, and represents an important component of ecosystem-based management. Joint management agreements between local people and state agencies recognize that access rights to natural resource benefits may be coupled with responsibilities for management (see Box 7 and 3.2 where stakeholder analyses are explained).

2.6 RECOGNIZING THE NEED FOR KNOWLEDGE-BASED ADAPTIVE MANAGEMENT

In an ideal situation the actions to be taken in an ecosystem management project would be based on thorough knowledge of the phys-

ical, chemical and biological structure of the system and the functional interactions between the different components. Included would be information on the human components and their interactions, that is, information on socioeconomic factors as well as legal and administrative factors and their boundaries of jurisdiction. Existing information, scientific and socioeconomic assessments, and traditional knowledge held by local communities would be the normal sources of such information. However, it is rare to be able to assemble all of the necessary information to develop conceptual models or to formulate different options for courses of action before launching an ecosystem management project. By the time all of the necessary information is available, it may be too late. Therefore **ecosystem management projects should incorporate a knowledge-based adaptive management approach.**

If information is gathered, and options developed before consulting with users, the approach becomes "*top-down*" – it is seen as being imposed from outside. As such, it may not be well received. A better option is to include information gathering as an integral part of the project (including local and traditional knowledge) and adapt the activities accordingly over time through an iterative process. In addition, ecosystem management should be adaptive because change is inevitable and, with the passage of time, different management methods and tools may be required. Box 8 gives an example of an adaptive management experience from Guinea-Bissau.

Box 8. Adaptive Management Based on a Study of Trends

Formulation of the coastal zone management plan for Guinea-Bissau took several years of intensive surveys, during which previous data from literature (including Portuguese maps from the 1950s and satellite images from 1975) were updated. New information was added on habitat types, land use, types of vegetation, population types and densities, resource use characteristics in 10 coastal areas, political and administrative constraints, and other features. Data were supplemented by interviews with local communities to assess the development potential in each area. From 1989 to 1992, data processing of old and recent information led to a good understanding of the dynamics and trends of the socioeconomic, cultural and environmental processes taking place in the coastal zone and Bijagos archipelago. A series of national, provincial and local management guidelines was produced, adapted to the main social, economic, cultural and environmental features. The information was stored in a Geographical Information System[6] set up by the French Research Centre in Brest and later transferred progressively to the Coastal Planning Office in Bissau in order for it to be used on a daily basis for advising the government and the private sector on development and conservation priorities in the coastal zone.

Notwithstanding the constraints outlined above, ecosystem management practitioners need to describe and define the ecosystem and its processes and, on the basis of this:

[6] GIS: Geographical Information System: a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information (i.e. data identified according to their locations).

- develop at least a conceptual model of the system;
- evaluate management constraints; and
- formulate different options for achieving different outputs.

Success in achieving these steps is dependent on understanding the characteristics of the ecosystem and the factors driving change within it. However, given the constraints outlined above, there needs to be an interactive relationship between management actions and information requirements. The needs of management must be used to set the priorities for ecological and socio-cultural information to be gathered, and management actions should be adapted in accordance with this new information. It would be unwise to be prescriptive about management measures to be taken far into the future without having access to the correct information base. Figure 3 illustrates this iterative approach.

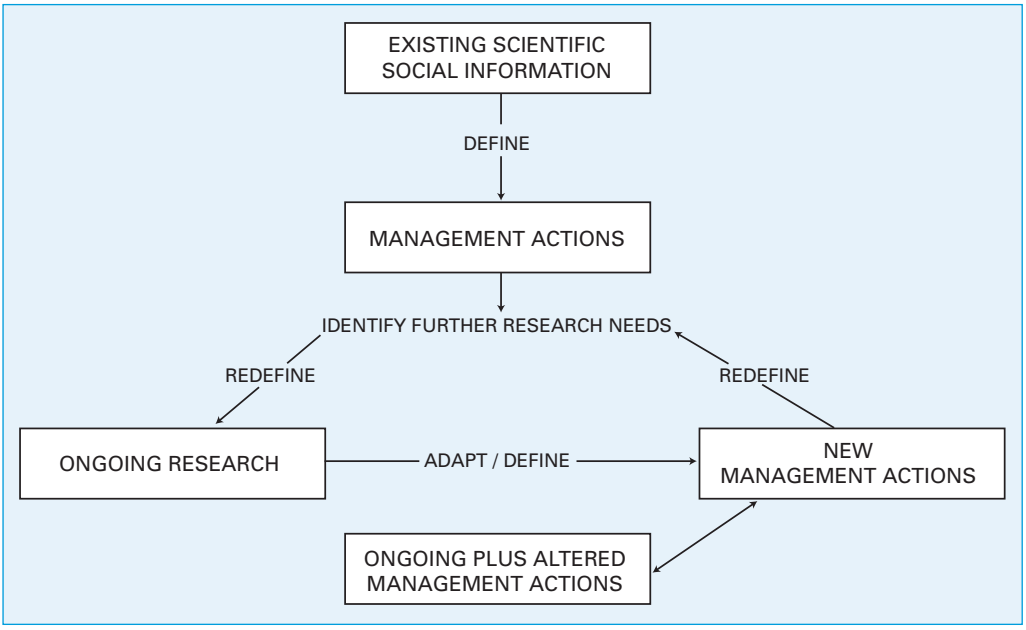

Figure 3. Interactive relationship between management actions and information requirements.

Data collection is an important element of ecosystem management, both in the initial stages to provide a baseline, and during implementation to detect and monitor trends. The types of information to be collected must be carefully chosen since gathering irrelevant information is wasteful of resources and does not contribute to decision-making. Conversely, too little information does not enable ecosystem management practitioners and stakeholders to take rational decisions.

It is essential that those charged with gathering information develop a common understanding with stakeholders and ecosystem managers about the detail required for rational decision-making. A common problem is that researchers gathering information for ecosystem management projects tend to see research results as a goal rather than as an aid to decision-making. Academically oriented scientific research has often failed to generate applicable knowledge. One reason for this is that the information gathered to make management decisions is not usually suitable for producing scientific publications that have to be peer reviewed. Therefore many researchers have a conflict of interest when they are engaged in field projects that are management- rather than research-oriented. A shift in the nature of the reward system for scientific study may be a prerequisite for ensuring it becomes a tool for ecosystem-based management and sustainable development. On the other hand, scientific data, collected regularly, using appropriate tools and analysed to show trends, are particularly helpful because they provide some of the basis for making social and political choices.

Scientific information is not the only type of knowledge that is useful. Local or traditional knowledge built up over centuries of living in an area and using the natural resources – often sustainably – is also important. While this might not be considered scientific knowledge in the strict sense, its value has often been demonstrated, and can save years of detailed scientific study. In some cases, traditional knowledge has proved to be more valuable than the results of scientific research. Therefore, ecosystem management initiatives should use traditional knowledge to guide and complement scientific data collection.

The Precautionary Principle

An ecosystem management objective is to help stakeholders make choices about exploiting ecosystems, usually with limited knowledge of the system. Ecosystem management practitioners and users need to work within the constraints of the system to optimize productivity, while maintaining ecological functions and biodiversity in a way that future options are not precluded. In such cases it is wise to adopt the **precautionary principle**.

The precautionary principle is based on the idea that ***"it is better to be safe than sorry"***. In other words, it is sometimes better to avoid activities that may have negative, sometimes irreversible, impacts on the system, even if the proof of this likelihood is not yet available. If we wait for all the evidence, it may be too late. If we forego an immediate decision to take action, our options are still

open when we do have the evidence. Exercising the precautionary principle is another form of adaptive management. Delaying action to divert a river is a practical example of the precautionary principle in use. The capacity of the river to maintain ecosystem functions, if diverted, is determined and management actions are then based on the results. The need for assessment and monitoring in these situations is self-evident.

Monitoring will also be needed to track ecosystem changes that result from management interventions, such as deciding to extract water from a river, or to use it for waste disposal. As soon as it becomes clear that functional integrity of the system is at risk then resource-use levels will need to be adjusted. Ecologists often refer to such limits in terms of the **limits of acceptable change**[7], or **critical loads**[8].

2.7 RECOGNIZING THE NEED FOR MULTI-SECTOR COLLABORATION

Ecosystem management is a holistic process. It requires the input of many different disciplines, sectors and stakeholder interests. This is necessary to build up and analyse information, on the basis of which collaborative decisions can be made about using the goods and services provided by the system. By contrast, most ecosystems are studied, managed and exploited on a sector by sector basis. No single group or agency possesses the broad information base or broad focus necessary to manage the whole ecosystem. Therefore, it is vital that the various sectoral interests and other stakeholders **recognize the need for multi-sector collaboration.** As a result, ecosystem managers must promote collaboration of the different sectors.

Ecosystems are made up of many components, for example, soil, water (lakes, rivers, ponds), vegetation (prairies, forests), animals (wildlife). Man-made ecosystems include urban and industrial centres and agricultural systems. To manage an ecosystem it is implicit that the interrelationships that exist between the various components of the system are understood. For example, manipulation of one part of the system (such as diverting water for irrigation) will affect other

[7] Limits of acceptable change: the threshold limits of deviation in an ecological feature which are likely to be the result of natural variation or cyclical change. If these threshold limits are exceeded, management action should be taken (see, for example, Rowell 1993, in the context of monitoring UK Sites of Special Scientific Interest).

[8] Critical load: for a particular receptor/pollutant combination, the critical load is the highest deposition load that the receptor can withstand without long-term damage being caused.

parts of the system (in this case perhaps degradation of a downstream mangrove). To understand these interrelationships, ecosystem managers need to draw from a wide information base, gleaned from a variety of resources. In addition, they need to develop a good knowledge of the ecosystem's structure and the extent to which different components can be exploited without risking the loss of the ecosystem's functional integrity.

In contrast to the ecosystem management approach, exploitation of the materials and processes provided by ecosystems, in general, is controlled and managed on a sector by sector basis. Forestry departments are responsible for forests, fishery departments for fresh-water and marine products, and energy departments for building and maintaining dams for hydroelectric power generation. Each sector has its own mandate, authority and agency to which it reports and which is usually responsible for promotion and development within its sector. Each sector has its own information base. The attitudes and interests of each sector naturally tend to have a restricted focus. Such a situation is counterproductive to the ecosystem-based management approach.

This is really a matter of common sense, but the lack of familiarity of interacting, the lack of formal pathways for coordination, or existing tensions between agencies, mean that staff may prefer not to co-ordinate (and indeed sometimes compete) with their counterparts. This is particularly true between the economic- or infrastructure-oriented agencies (e.g. ports and water development agencies) and the more environmentally sensitive agencies (e.g. ministries of environment or parks departments). Ecosystem managers should be aware of such potential difficulties.

Conventionally, different disciplines often specialize in separate sectors, so that hydrologists, foresters and fisheries biologists, for example, usually belong to different institutions between which there may be little formal contact. Law and economics are often given secondary importance, even though a project's success ultimately depends on them. A composite picture of the characteristics of each ecosystem is therefore important in order to achieve a broader, more balanced, holistic point of view, whether it is in choosing the most appropriate line of research, or achieving consensus about the actions to be taken. Since, in general, no single group or agency possesses all the information or capabilities to manage a whole system, ecosystem managers must promote the appropriate collaboration of the different sectors. One of the best ways to promote collaboration is to create networks and partnerships that link sectoral interests and stakeholders together.

Multi-sectoral networks and partnerships are useful for:

- reviewing policies of different sectors to identify areas of conflict and compatibility;
- sharing information about methods, activities and results;
- finding out where data may be stored and how these should be processed in a way that ensures maximum usefulness for a range of agencies;
- sharing ideas for project actions based on other organizations' experiences;
- coordination and integration of information-gathering activities;
- avoiding duplication and achieving synergy of action;
- spreading the workload and responsibility for management; and
- identifying sites and habitats that are critical to the provision of ecosystem services and that require special forms of management and co-operation.

Networks may be national or international. They often provide the basis for partnerships for joint action, since potential partners can be identified through the network.

2.8 MAKING ECOSYSTEM-BASED MANAGEMENT A MAINSTREAM DEVELOPMENT APPROACH

Ecosystem management requires a broader point of view than conventional natural resource management. While it is concerned with exploiting the goods and services provided by the ecosystem, it focuses on doing so while maintaining the integrity of the system, in other words, on sustainability. The basic notion of sustainable development is that the quality of life should be improved while, at the same time, the structure, functions and diversity of the world's natural systems on which human existence depends are protected (the United Nations Development Programme – UNDP has adopted the phrase "*sustainable human development*"). In other words, sustainable development is seen as dependent on maintaining the functions and integrity of the Earth's ecosystems.

As the ecosystem management approach is one of the tools for achieving sustainability, **ecosystem-based management should be mainstreamed into sustainable development programmes or projects.** How this approach was used in The Sierra Nevada de Santa Marta is explained in Box 9.

At the national level, many governments are adopting National Development Plans, National Environmental Action Plans, Biodiversity Action Plans and Conservation Strategies in which achieving sustainability is an overall aim.

Box 9. Using Ecosystem Management in Sustainable Development Strategies in the Sierra Nevada de Santa Marta, Colombia

The Sierra Nevada de Santa Marta, Colombia, is the highest coastal mountain range in the world. Within 42 km of the Caribbean coast, the Sierra rises to altitudes of over 5,700 m. The Sierra has 32 watersheds that supply water to over 1.5 million inhabitants and to the vast farming areas on the surrounding plains. Water from the rainy season is retained by the rich forest cover and continues to be available during the dry season.

It was widely recognized that the water supply function of the entire montane forest ecosystem, from high altitudes to the coastal plain, was critically important to the region's economy and needed to be maintained. A Conservation Strategy for the Sierra Nevada de Santa Marta was prepared through an extensive participatory process initiated in 1991. Consultations involved wide representation of different interest groups and stakeholders, including national and local government institutions, forestry and agriculture sectors, NGOs, grassroots groups, local communities and their leaders, ethnic groups, armed groups such as guerrilla and paramilitary factions, and the church.

Initially, the main objective focussed on increasing the capability of the stakeholders to "stop current trends of environmental and social degradation of the Sierra Nevada". After four years the general aim shifted, "to conserve, protect and recuperate the natural resources base of the Sierra Nevada", in order to "ensure the survival of its different cultural groups and the sources of water that may support the sustainable development of the whole region". The three main principles for achieving this were recognized as: "respect, equity and participation". Five objectives identified in the strategy are:

- ecosystem conservation;
- strengthening the cultural identity of native groups;
- stabilization of the peasant communities;
- strengthening the fundamental rights of the population; and
- institutional modernization.

The Fundacion Pro-Sierra Nevada de Santa Marta is taking the lead in institutionalizing the plan by promoting the commitment of all sectors in allocating technical, financial and human resources to 10 field projects involving forest conservation and watershed protection.

Formulation of such national actions plans and strategies are steps towards integrating ecosystem management into overall policies, but ecosystem-based management principles should also:

- be incorporated into all strategies for sustainable development, whether they relate to nations, regions, or local areas;
- be used when preparing or updating economic and social development policies for a country, region, or community; and,
- be incorporated in sectoral policies and programmes at the national, regional or local levels.

An ecosystem management initiative that does not take into account the national or sectoral policies already in existence risks becoming isolated, and/or being seen as irrelevant. The result will no doubt be ineffective. If existing policies do not incorporate ecosystem approaches, then ecosystem-based projects should be used as a vehicle to advocate their adoption.

Ecosystem-based management projects are implemented at the local level and must relate to local social and economic conditions.

In addition, most of these projects will depend on local capacity to participate in, or undertake management responsibility for, implementing the projects. While implementation may be carried out at the local level there will be linkages with other projects, and with regional and national programmes and policies. It is therefore important for local projects to take these policies and programmes into account and *vice versa*. This is often referred to in terms of **top-down *versus* bottom-up** management. Ecosystem management practitioners and all stakeholders should determine how to achieve the best balance between the two extremes.

The discussion in this chapter has focussed on information and decision-making concerning sustainable exploitation of ecosystems. **Ecosystem rehabilitation projects require similar approaches.**

3

Ecosystem-based Management: Partners

Ecosystem degradation is usually caused by a variety of social and economic forces, for instance, population pressure, urbanization, over-exploitation of natural resources, and developments that change hydrological and other ecosystem characteristics. The ecosystem management approach tries to address these by influencing the ways in which local people (and others) use the natural resources and benefit from the ecosystem functions. Local communities are most often the immediate beneficiaries of successful ecosystem management.

There are several reasons why local communities must be involved in the design and implementation of ecosystem management programmes (see also 2.5):

- they are part of the ecosystem;
- they tend to have a particular interest in the management process, being dependent on the services the ecosystem provides;
- they often have considerable, relevant knowledge of the ecosystem and of the ways in which it can be managed (this is particularly true for many indigenous peoples);
- in some cases, the cultural, ethical and spiritual values of local communities have evolved on the basis of a long standing interaction within an ecosystem so their interest goes beyond simply deriving material benefits from the system;
- in many cases, local communities have developed traditional use or tenure systems that can be adapted to the aims and objectives of an ecosystem management programme; and
- in many cases, local communities are a threat to the integrity of the system and, without their involvement, ecosystem management runs a high risk of failure.

Experience in sustainable development and ecosystem management projects has shown that if local communities are not involved they lose interest. If they are not involved in formulating ecosystem management projects, they may assume that activities are being

imposed upon them from elsewhere and will not want to be involved during any future implementation.

Successful ecosystem management usually depends upon the creation of partnerships between the different users and beneficiaries. Partnerships can be established between different sectors, between sectors and stakeholders, sectors and NGOs, or through other combinations. Networks and partnerships established between government agencies, NGOs, international organizations and funding agencies are one of the most effective means of accumulating a broad information base that can assist in making management decisions.

This chapter focuses upon partnerships with local communities as they are often the most significant. At the same time, however, they are often the most neglected element. Box 10 summarizes the experience of involving local communities in project formulation in Nigeria.

3.1 CRITICAL FACTORS FOR PARTNERSHIPS

Several critical factors contribute to developing partner relationships with local communities, including:

- local communities need to see and appreciate that they will benefit from ecosystem management initiatives; they should be involved in choosing the activities that will be carried out;
- the sooner benefits can be realized after the initiation of activities, the easier it will be for local communities to be convinced that ecosystem management is valuable and practical. This is especially important where the benefits of ecosystem rehabilitation may take time to become evident. In the early stages of a project every effort should be made to implement activities that will generate early positive results;
- communities must receive tangible benefits from taking on the responsibility for managing an ecosystem, either through improved quality of life, security of access to resources, or financial reward;
- expertise should not be perceived as being imposed from outside the community. "External experts" or project managers should try to learn about how an ecosystem is used, based on local and traditional knowledge (as well as from other sources), act as facilitators and gain trust within the community rather than impose their points of view;
- the distribution of benefits should be equitable, taking into account the needs of stakeholders, and should be perceived as such;
- communities must be assured of their right of access to resources and the benefits derived from them. If this right is uncertain, there is little incentive for local communities to become involved; and

- partnerships should involve the sharing of responsibilities for decision-making and for implementing the decisions. Local people are often the most appropriate persons to carry out such actions and to monitor the effects of management decisions. Shared decision-making gives a much greater incentive than simple consultation on decisions taken by outside agencies.

Box 10. Involving People in the Design of Project Activities, Northern Nigeria

The Hadejia-Nguru Wetlands Project and the North-East Arid Zone Development Programme being implemented in the Kamadugu-Yobe basin of northern Nigeria have provided lessons in the importance of involving local communities and using local knowledge at every stage of project design, from formulation to implementation and the evaluation of community-based activities.

When the projects were formulated and initiated, local communities, which had not been involved up to that point, were presented with ready-made packages of activities and techniques that engendered little sense of commitment because they could not see any relevance to their own situation. For example, the establishment of community-operated tree nurseries did not match the needs of the communities, e.g. poverty alleviation. Rather than receive nothing from the projects many of the communities accepted to undertake the nursery activities, but there was little interest or commitment.

After 5-8 years of implementation, it emerged that the communities had initiated a number of activities themselves, which they perceived to meet their needs, or were flexible enough to be adapted according to local knowledge. Examples are:

- the construction of bunds to improve recession-based agriculture in the floodplains;
- production of mud stoves;
- increased provision of rural drinking water supplies;
- introduction of new practices for intensive cereal farming requiring low external inputs; and
- production of local handicrafts for sale.

Having perceived that such activities would improve their own situation, local communities were interested in, and committed to, these activities. While it can take a long time to secure trust within local communities, and ensure their involvement, in the long-run, programmes that do not take such an approach run a high risk of failure.

If the local communities are assured that they have legal rights of access they will be more willing to put effort into managing their ecosystem and safeguarding their natural resources. **Ecosystem management agreements therefore require a clear definition and legal recognition of access rights for local communities and other stakeholders.** The rights of indigenous peoples are often associated with land tenure issues. Their involvement has to be encouraged through addressing their traditional rights to land, water and other natural resources.

Land tenure issues are complex and have the potential for many conflicts of interest. Securing property and access rights may require changes in legislation and the setting up of property registers. If land tenure issues are identified as a significant barrier to assuring local communities of continued access to the benefits of the ecosystem, then specific action may have to be taken to address legislation changes. This point is illustrated in Box 11 by a project that granted access rights to resident fishing communities in Guinea-Bissau.

Box 11. Granting Access Rights to Resident Fishermen in the Rio Grande de Buba, Guinea-Bissau

The Rio Grande de Buba supports a community-based, small-scale fishery. At times, large numbers of foreign fishermen overexploit the fish stocks. Since 1992, local communities have collaborated with the Ministry of Fisheries, and other government institutions and NGOs in the formulation and implementation of a series of integrated, sustainable development activities. One of the schemes was for the Ministry of Fisheries to grant exclusive fishing rights to communities of the Rio Grande de Buba, and restrict non-residents to fish under a quota system. In support of this scheme a series of activities was implemented including:

- studies on the biological and socioeconomic aspects of fisheries resources;
- setting up systems of credit and operating funds in support of fisheries development;
- assistance for fish processing and marketing;
- support to sustainable crop cultivation in order to protect forests in the river catchment;
- resource management guidance to stakeholder committees in charge of monitoring and regulations; and
- training schemes for communities in health, sanitation and numerical literacy, and for partner organizations to eventually devolve the project.

After six years, changes in legislation giving exclusive fishing rights to local communities, and controlling outside users, have given the communities a vested interest in managing the resource. This has not only improved fish stocks, but also forest resources and the general standard of living.

Collaborative management agreements (see 3.4) can serve as a vehicle to address many of these issues.

3.2 DEVELOPING ECOSYSTEM MANAGEMENT PARTNERSHIPS

Guidelines for Building Partnerships

Developing partnerships with local communities and other stakeholders should be one of the aims of ecosystem management activities. An analysis of the case studies summarized in this Guide shows that while working with communities can be a long process, when the approach succeeds it often generates a demand for further community involvement. There is an increasing body of evidence from which it has been possible to derive a number of guidelines concerning partnerships.

- **Information provided by local communities should be a key element in management planning.** Local and traditional, indigenous knowledge is often of great value. Traditional knowledge can have as great a value, if not more, as scientific knowledge available from outside experts. The process of exchanging information with local communities has the added value that local communities will usually develop a feeling of being **part of the process rather than being apart from the process.**
- **Ecosystem management through community involvement must be the main concern for project planners and managers.** Building relationships with local communities should start as early as possible in

the planning and implementation phases of a project. Creating good partnerships requires a sense of receptivity, modesty, honesty and sensitivity on the part of ecosystem management practitioners. It is also important to avoid creating unrealistic expectations.

- **The relationships between a community and its environment can be complex and need to be understood in order to succeed in ecosystem-based management.** The roles of different groups and individuals – men, women and children of different age groups, different social classes, skill and user groups – need to be known so that the appropriate groups or individuals are involved in developing the management plans and implementing the activities. Understanding historical, cultural and ethical traditions are equally important.
- **The use of local languages is essential for effective communication** about natural resources and indigenous uses, and for collaboration in developing management initiatives. Local languages should be used to the greatest extent possible.
- **Building trust with local stakeholders depends on establishing good communications and mechanisms for providing feedback concerning progress.** This is especially important for demonstrating how information and local knowledge has been used and how a project is producing tangible benefits.

Box 12 illustrates how a number of these issues applied in Sian Ka'an, Mexico.

Box 12. The Tangible Benefits of Local Management in the Sian Ka'an Biosphere Reserve, Mexico

Since the revolution in 1910, the land area around Sian Ka'an on the Yucatan Peninsula of Mexico has belonged to local communities. Traditionally the Mayas have exercised their right to collect and hunt wild resources. In the early 1980s, steps were taken to establish the area as a Biosphere Reserve. The management plan for the reserve: recognizes the traditional rights of the Mayas and local communities concerning land ownership; includes the development of a community forestry programme; and establishes a system of 90 year concessions for agricultural plots within the reserve.

With the full participation of the local communities (sometimes grouped as the "Forestry Producers Society") a Pilot Forestry Plan was formulated with the assistance of a multidisciplinary, cross-sectoral group of experts. According to the plan the core decision-makers concerning land use planning and resource management are the local user communities. Within its first year of implementation the individual income of forest workers increased by a factor of 19 compared with the income of workers in the commercial timber company which had operated prior to the establishment of the reserve. This success led to expansion of the original plan from 100,000 ha to 420,000 ha and now involves about 9,000 families.

Since 1985, no deforestation has occurred; expansion of cattle ranching has been stopped; improved land-use regulations have been adopted; sustainable harvest of key resources has improved (including a scheme that enhanced the management of coastal resources such as spiny lobsters); and representative samples of inland, coastal and marine ecosystems have been granted increased protection. In addition, other activities have been initiated including captive breeding, horticulture, ecotourism and regulated hunting.

A key element in the development of the reserve has been extensive participation at the local community level, as opposed to plans being imposed from elsewhere.

Working with stakeholders

When starting to develop ecosystem management partnerships, one of the first tasks is to carry out a stakeholder analysis. Key questions (from Borrini-Feyerabend, 1997) that should be answered are listed below.

- Who is, or has been, participating in the management of the ecosystem?
- Who are the main stakeholders using the natural resources?
- What are the perceived needs of stakeholders for natural resource use and improvement of their quality of life?
- Are there other stakeholders whose actions affect, or are affected by, the integrity of the ecosystem, e.g. polluters, downstream water users?
- Are there social factors affecting the ability of stakeholders to participate in natural resource management?
- Are the stakeholders organized?
- Have all stakeholders been informed, contacted or heard about the new management initiatives?
- Is there political support for the initiative and for local participation among local, regional or national leaders?
- Is there a legal and institutional framework that favours participation?
- What specific channels and mechanisms for participation exist?

Stakeholder analysis provides a description of the different groups and organizations that should be included in ecosystem management for the area, and helps define appropriate roles for groups and individuals, and identify problems that have to be overcome. Results should be used to guide the development of partnerships.

It is often easier and more appropriate for a project to work with existing groups of stakeholders, rather than trying to create new interest groups. These groups may be formal community-based organizations, e.g. women's groups, village welfare groups, farmers, herders or fishermen's cooperatives. They may also be more informal. Such groups can provide a focus for joint action – for example, education and training to build capacity for ecosystem management, control of illegal uses of the natural resource, and advocacy for establishing their rights to natural resources.

A mechanism should be sought for bringing together representatives of the various stakeholders for the purpose of reviewing progress, making collaborative management decisions, airing differences and resolving conflicts (see 3.3). This could be achieved through establishing a conservation council, collaborative management commit-

tee, or other device. What such groups are called is not too important. What is important is ensuring that a group's terms of reference and mandate carry sufficient authority to make decisions, or at least recommendations that require that actions be taken by another authority. The latter, of course would not be as effective as a collaborative management agreement (see 3.4).

Aside from formalized management bodies there needs to be a mechanism that ensures there is sufficient communication and coordination between different stakeholders in the partnership arrangement. In some cases, a formal mechanisms should be established for sharing information.

While these mechanisms can help address the immediate needs of an ecosystem-based project they can also contribute to a future objective – **to build the capacity of local institutions and community groups to assume responsibility for the long-term implementation of ecosystem management activities after the project is terminated.** Building the capacity of local groups can be achieved through environmental education and training in both participatory techniques and in ways of organizing themselves. If there are specific tools and methods for managing the ecosystem and its resources, the skills of the local groups can be enhanced through targeted training sessions. In particular, training should be given in monitoring the environment and in making decisions based upon the information from monitoring.

Ecosystem management requires a commitment from the stakeholders in communities and local institutions. As management initiatives build a record of success, it is often the case that other groups or individuals express the desire to participate. When this happens it may be useful to establish criteria to which new participants have to comply before becoming formal partners. These criteria might include:

- demonstrating that the uses of an ecosystem contribute to the survival of the community, or to improving its quality of life;
- making a contribution to management planning;
- agreeing to establish institutional arrangements and to delegate responsibilities within the community for ecosystem management; and
- demonstrating a willingness to become involved in sustainable management of the ecosystem.

Often the main focus of ecosystem management at the level of local stakeholder communities is identifying alternative options for

conservation and sustainable use of natural resources. Another common focus is determining how to gain added value for the products and services the ecosystem already provides. These may include:

- developing alternative sources of income for local communities so they are less dependent upon local natural resources;
- improving the efficiency of using natural resources and thereby reducing wastage, e.g. introducing more efficient wood burning stoves, solar water heating, or fish processing techniques;
- improving the quality of products being marketed in order to achieve a greater financial return, while using less of the resource;
- providing added value to ecosystem products by introducing new processing stages (e.g. building furniture to sell rather than selling the timber from which it is made); and
- introducing mechanisms to discourage or eliminate illegal exploitation of natural resources.

Ecotourism projects are often proposed as alternative sources of income. However, ecotourism projects commonly fail to provide benefits to local communities. In some cases, local communities actually provide a net contribution to others such as tour operators, e.g. by providing access and logistical support, or by foregoing the implementation of other, more lucrative, options of resource use/management. User fees, if they exist, often do not fully compensate for these services. Profits go to tour operators and hoteliers outside of the region (see example of Keoladeo National Park, India, Box 13). Care must therefore be taken to ensure that local communities receive benefits rather than suffer net losses.

3.3 ENVIRONMENTAL CONFLICT MANAGEMENT

Wherever there is multiple use of natural resources, there is potential for competition and conflict between the different users. Typical examples are: a conflict over the consumptive use of forests to produce timber or fuel wood, *versus* non-consumptive use for tourism; or the use of a wetland for purification of waste water instead of maintaining its use as a fish spawning area. The potential for conflict will probably increase with growing population because more users will be trying to use the same, usually diminishing, resource. This is particularly true where more than one community is exploiting the same resource in order to survive (Box 13). An aim of ecosystem-based management is to ensure that a number of different uses can be made of a system, simultaneously, while minimizing conflict, or loss of values.

While conflicts over resource use are never favourable, when they do occur they can be used to demonstrate the need for an

Box 13. Traditional Resource Use and Conflict Management in Keoladeo National Park, India

Keoladeo National Park is a small (2,873 ha) artificial wetland system located near Bharatpur on the Ganges plain. The wetland was created in 1750 by local royalty to attract migratory birds for hunting. Today, over 350 bird species, including the highly endangered Siberian crane, *Grus leucogeranus*, inhabit the park seasonally. In 1982, Keoladeo was declared a national park.

Water buffalo, traditionally allowed to graze in the park, a water weed (*Paspalum distichum*) growing in the wetland, and the Siberian crane co-existed in a three-way relationship. The buffalo grazed on the weed, controlling its growth. Short-cropping of the weed by buffalo made it possible for the cranes to dig up plants tubers, one of its few food sources. In 1983, however, the Wildlife Protection Act prohibited the grazing of buffalo. As a result the weed grew unchecked to maturity, thereby creating a physical barrier that prevented the cranes from accessing their main food source, which led to a dramatic decrease in the numbers of cranes in the park.

The Wildlife Protection Act was formulated and implemented without consultation with local communities, even though they had used the park traditionally – not only for grazing but also for visiting temples in the park, for collecting fruit, and as a source of animal fodder. The Act basically cut them off from their traditional uses of the area. This situation led to a serious conflict between the local communities and authorities. As a result, illegal harvesting of resources and poaching increased, and seven people were killed during violent confrontations.

It is noteworthy that other related actions failed to contribute to the aims of the Protection Act owing to inadequate consultations with local communities. These included designation of the area as a Ramsar site (1981), a World Heritage site (1985) and the construction of a 2 meter high wall around the park.

A decade-long study, costing nearly US$1 million, indicated that grazing buffalo were key to controlling growth of grasses and water weeds and, therefore, the Siberian crane and other bird populations. Local communities already knew this.

Obviously every effort should be made to avoid such conflicts taking place at all. But given the existing situation, the park authorities, a team of natural resource specialists (representing government and NGOs) with the help of the World Wide Fund For Nature (WWF) initiated a process of conflict resolution and reconciliation through a three week workshop in 1995. The exercise sought to: determine areas of agreement and disagreement between local communities concerning conservation objectives of the various officially adopted plans; identify new, potentially successful management options; and propose terms of reference for local management committees to be charged with implementing the new measures. The work was based on:

- a number of rapid rural assessments to document the existing situation;
- participation of all stakeholders in the workshop;
- determining ways to provide the maximum benefits to local communities; and
- widely publicizing the results of the workshop through local language media.

The exercise showed that local communities already had adequate methods to "regulate, control or exercise restraints over their use of resources", which was a valuable tool for ecosystem-based management of the park.

ecosystem management approach. Serious conflicts usually occur in fairly dynamic settings, a characteristic that can often be used to promote adaptive ecosystem management. Put simply, if there is no conflict then there is little perceived need on the part of stakeholders to jointly manage an area. On the other hand, if several users are competing with each other and the conflict is great, their motivation to solve the problem will probably also be great. Ecosystem management practitioners should try to take advantage of such situations.

In reality, conflicts over natural resource use are rarely completely resolved, but specific agreements may be reached over the scale, location or zones, and the timeframes governing resource uses. **The main aim in conflict resolution should be to attain a balance between different uses, while ensuring that overall exploitation is kept within the capacity of the system** (also the aim of sustainable development). While the overall aim may seem fairly clear a certain amount of flexibility needs to be built into the process. For example:

- environmental conflict management has to be consultative and always requires a diplomatic approach; and
- agreements may have to be renegotiated on a regular basis depending upon changing conditions or when new uses are introduced, including:
- when monitoring indicates that existing levels of use are too high, the limits may be reduced; or conversely
- when monitoring indicates levels of use can be increased without adverse effects, the agreed limits may be revised upwards; or
- a decision is made to exploit a new resource.

Clearly, conflict resolution requires a high level of skill in negotiation and mediation. It is better if these skills are applied within an overall framework of conflict resolution rather than in an *ad hoc* fashion. A typical framework might follow the outline below.

a) Wide communication of reliable and generally accepted information about the situation.

b) Individual discussions with different stakeholder groups – the responsible government agencies, private landowners and users, and the communities – to determine what types and levels of resource uses are required from their point of view. Points to bear in mind during these discussions should include:
- the need to ensure the sustainable use of resources;
- that multiple use of the ecosystem is necessary;
- that to grant exclusive use to just one group is rarely possible;
- that needs may be related to the viability of the community or some enterprise; and
- the viability of the ecosystem and its biological diversity may be at stake.

c) Discussions between the stakeholder groups, to ensure that each understands the perceived needs and concerns of all other groups. Talks should be used to discover where there are conflicting, as well as compatible, uses of the ecosystem. It is unlikely that conclusions can be reached without conducting a series of meetings. Compro-

mises between stakeholders may be facilitated by introducing the possibility of changing use patterns, identifying alternate sources of goods and services provided by the system, or through other incentives (e.g. assisting in finding alternate sources of income).

d) On the basis of discussions between stakeholders, formal agreements on the types and levels of resource use may be set out. These should be incorporated into the management plan, and should clearly state the responsibilities of each group. The use of legal and traditional authorities may be used to back up these agreements.

e) A system for continued conflict management might be established which would provide the vehicle for renegotiating formal agreements as the situation changes with time. This system could be institutionalized as an integral part of the long-term management plan for the ecosystem.

3.4 COLLABORATIVE MANAGEMENT

Collaborative management is a partnership in which government agencies, local communities and resource users, NGOs and

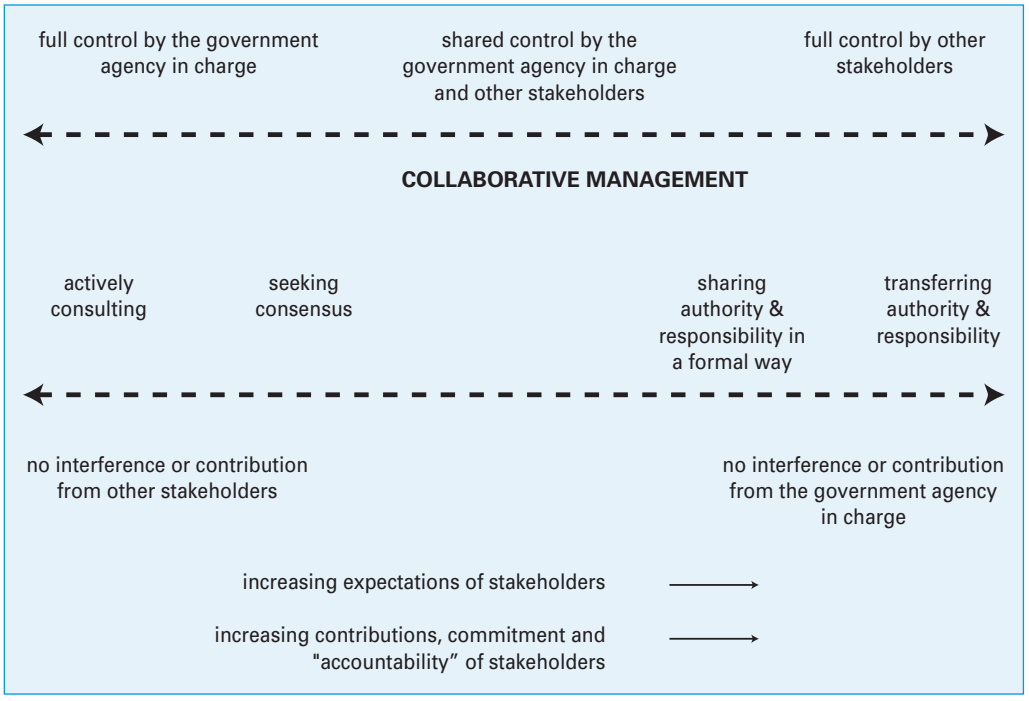

Figure 4. Variations in collaboration and control by different stakeholders in collaborative project management (from Borrini-Feyerabend, 1996).

other stakeholders agree on the responsibility, authority, rights and duties they each have for the management of a specific area or set of resources. Other terms which have been used for the same process are co-, joint, participatory and multi-stakeholder management.

Since collaborative management agreements devolve significant authority and responsibility to local communities, and define their rights as well as duties, they will also require a re-definition of the role of government agencies, as well as the communities involved. On the one hand, government agencies should have a clear role in ensuring that the overall natural resources of the country are maintained and used wisely in order to formulate national policies and provide overall coordination of resource use in the country. On the other hand, central governments can decrease their involvement in the extensive day-to-day responsibility of resource management at the community level through collaborative management agreements. In many cases devolving resource management authority and responsibilities to communities may be the most effective and efficient means of achieving a sustainable level of resource use. This usually includes providing the legal authority to prevent illegal use or over-exploitation of the allocated resources. While legislation may provide local communities with the right to manage the resources, governments usually retain the right to intervene if the agreement is not being fol-

Box 14. Building the CAMPFIRE Partnership, Zimbabwe

The CAMPFIRE Programme in Zimbabwe aims "to give full control of wildlife management to rural communities which actually stay with wildlife and bear the costs of living with this resource". It has made good progress towards demonstrating that community-based natural resources management is a viable alternative to a more centralized approach.

Central to the management and implementation of the programme is the CAMPFIRE Association and its associated CAMPFIRE Collaborative Group (CCG). The Association is linked to Village Committees. Representatives from these committees are elected to Ward Committees (each Ward consisting of six villages). Ward Committees oversee the work of Natural Resource Monitors and Game Scouts who provide information on wildlife populations and their management. In addition, the Ward Committees are represented on District Committees which are responsible for providing technical support to the programme. The CCG includes the Wildlife Department, the Centre for Applied Social Sciences, the Zimbabwe Trust, the Africa Resources Trust and the World Wide Fund For Nature (WWF). The CCG provides services to all partners including political and administrative support, ecological and socioeconomic research, assistance in land-use planning, technology transfer, networking, and publication and dissemination of results and awareness materials.

In order for a community to participate it must ask for legal authority to manage its wildlife resources. This authority is granted on the basis of:

- the presence of natural resources, especially wildlife, forests and fish, which can form the basis for benefits to the community, e.g. through hunting or photographic safaris;
- willingness and ability to establish and participate in village, ward and district CAMPFIRE committees; and
- a willingness and potential ability to manage wildlife which would be recognized through adoption of a Rural District Council Resolution.

lowed. Figure 4 illustrates various options for establishing collaborative project management arrangements.

Although partnerships are based on formal agreements they must ultimately be built upon trust between the communities, groups and institutions involved. Good communication plays a critical role for efficient and mutually beneficial partnerships. The devolution of authority and responsibilities to local institutions that are in a better position to take immediate action – if needed – is illustrated by the CAMPFIRE partnerships in Zimbabwe (Box 14).

The major role of government agencies in collaborative management arrangements is one of support and facilitation. These activities might include:

- helping communities plan for sustainable use of natural resources;
- facilitating conflict resolution among groups of resource users;
- providing assistance to groups of users who attempt to implement joint management regulations, but who are unable to enforce them;
- ensuring that negotiated agreements take into account the interests of diverse groups within communities. This might include monitoring the equity of costs and benefits shared among stakeholders;
- providing support for information-gathering by local communities where it is clear that the information base is insufficient for sound management; and
- providing advice on technical matters (possibly through extension services) where required.

In addition to government involvement, NGOs are increasingly seen as essential partners in collaborative management agreements. The roles of NGOs (national or international) include:

- mobilizing funds from external stakeholders interested in resource conservation;
- forming umbrella organizations acting at the national level, such as coalitions representing the interests of smaller groups of local people;
- acting as intermediaries between government agencies and local communities;
- providing technical advice and training for local management groups;
- providing channels for funding for specific projects undertaken by local management groups;
- acting as champions for the cause of groups excluded from participation, or those held back because of deficiencies in the governmental process; and
- monitoring the role of various interest groups (men, women and children of different age groups, different social classes, various

skill and user groups – fishers, foresters, farmers) to ensure that they are involved in the appropriate way.

Box 15. Collaborative Management in the Western Ghats Forestry Project in Karnataka, India

Colonial and post-independence forestry policies in India had the similar aims to fulfil industrial and commercial demand for timber products. By the 1980s, the forests in Karnataka State had been reduced to about 22% of their original extent. Less than half of the remaining forest had a crown density of more than 40%. This degradation had a profound effect on local communities that depended on the forest and its non-timber products. Dissatisfaction has been voiced for many years.

The 1988 National Forest Policy, in a sharp departure from previous extractive polices, stressed the importance of forests for maintaining environmental stability and ecological balance, and for meeting the subsistence needs of rural people for fuelwood, fodder and small timber.

Within the context of this policy, the Western Ghats Forestry Project was established to involve local communities in managing the forests with the aim of conserving and protecting biodiversity, while maintaining sustainable productivity. This was brought about through a Joint Forest Planning and Management (JFPM) scheme. The JFPM is a consultative process involving local communities, the Karnataka Forestry Department (KFD) and other forest users who discuss the state of specific forest areas and the scope for that area to satisfy the needs of each user group. In some cases, areas are zoned and designated for joint management, in which case the responsibilities for management and partitioning of benefits between KFD and other users are negotiated and agreed.

Since 1992, the Western Ghats Forestry Project has organized 151 communities into village forest committees that share responsibility for management. There is now greater interaction between KFD and local communities, leading to easier solution of problems. There is clear evidence that forest areas under the JFPM scheme are well-protected and subjected to only low intensity grazing. The project has also provided a sharp focus to questions of equity and livelihood requirements of ordinary people versus the more sectorally or politically dominant factions of the communities.

Whatever the balance between the different roles of community groups, government agencies and NGOs, collaborative management agreements represent a formalization of local community involvement. In some cases the process leads to a clear empowerment of the communities to manage their ecosystems. In some countries, legislation has been passed to specify the procedures and responsibilities. At the local level, the recognition of specific responsibilities and rights is endorsed through the adoption of bylaws and formal agreements. In order to work effectively, collaborative management has to be strengthened by building the capacity of local institutions and groups to take management decisions on sustainable use and to implement them based upon sound technical and social advice. Box 15 illustrates how management of forests was devolved to local communities in the Western Ghats of India.

Part 2

Ecosystem-based Management: Tools and Practice

Part I *briefly reviewed some ecosystem concepts and a definition of ecosystem-based management with some guiding and operational principles to be taken into account during project formulation and implementation. These were* ***intended to provide some insight into why ecosystem-based management aims to safeguard essential ecosystem structure, functions, services and benefits****.*

Part II *provides more details on specific elements of this concept, as well as methodologies, activities and tools that should be used during different steps in the design, formulation and implementation of ecosystem-based management projects.* ***Chapter 4 concentrates on tools, the focus being on key elements*** *that need to be included in the formulation of ecosystem-based management projects.* ***Chapter 5 focuses on the steps that need to be taken, and elements that need to be included in a typical development project*** *prepared by operational officers in institutions such as the World Bank or UNDP.*

The format used for Part II closely follows that of a handbook. It includes a number of checklists (indicated by a tick in the margin) to allow ease of use by project managers. These are generalized checklists and should be supplemented by guidelines relating to the particular ecosystems being managed – coral reefs, tropical forests, wetlands, estuaries, drylands, or other ecosystems.

4

Ecosystem-based Management: Tools

Ecosystem management projects are made up of a number of elements. To formulate such projects, a number of approaches or tools can be used, the most important of which are outlined below.

4.1 ECOSYSTEM-BASED MANAGEMENT PLANNING

One of the first steps in formulating an ecosystem-based management project is to develop an overall management plan. Management planning needs to address a number of issues. One of the first is to develop the contents of the management plan which, in turn, must be based on baseline or background information about the area to be managed. Other issues include determining boundaries, setting objectives, making provisions for monitoring the implementation of the plan, and establishing institutional and financial arrangements. These are discussed below.

4.1.1 The management plan

An ecosystem management plan should describe and address the following issues:

✔ Issues to be covered in a management plan

a) Description of the main components of the ecosystem, for example:
- Physical – climate, soils, hydrology, oceanography;
- Biological – flora and fauna;
- social – people and communities living in the area, stakeholder analysis;
- existing natural resource use; and
- existing management measures and structures, including protected areas.

b) Analysis of ecosystem functions, linkages and boundaries;

c) Analysis of opportunities and threats, causes and effects;

d) Definition of the ecosystem management objectives, including the need for rehabilitation of soils, vegetation cover, and/or specific ecosystem functions;

e) Description of management measures to be undertaken to address the opportunities and threats, for example:

- Physical measures – fencing, hydrological management and pollution control, including specific measures for ecosystem restoration;
- Biological measures – replanting, re-introduction of species, control of pest species, harvesting and weed control;
- social measures – social fencing[9], protection against poaching, alternative energy sources, zoning for multiple use;
- research – filling information gaps, pilot studies;
- analysis of the current legal and jurisdictional overlaps or gaps, and whether or not customary laws, bylaws and institutions already exist to strengthen the management regime; and
- economic measures – incentives, income-generating alternatives, marketing for natural resource products, ecotourism.

f) Expected outcome of key management activities;

g) Description of monitoring measures, including indicators, regularity of measurement and methods of analysis;

h) Requirements for adaptive management;

i) Institutional arrangements and decision-making processes;

j) Involvement of stakeholders – decision-making, implementation and enforcement, monitoring, education;

k) Reporting and communications; and

l) Budget and financing.

Ecosystem management planning should not be based simply on desk studies. Unfortunately many management plans have been drawn up based upon scientific assessment, without having involved the people living in or around the area to be managed. Such plans

[9] Borrini-Feyerabend (1996, 1997) defines social fencing as being "a protection provided to a body of resources by a group of people, local institution, a partnership arrangement and/or a traditional system of stewardship, which is often more effective and sustainable than one provided by physical fencing".

have had difficulties with implementation or enforcement. **Stakeholders must be involved in the design of any management plan.**

4.1.2 Determining the boundaries

Deciding on the boundaries for an ecosystem-based management effort is an early task (see Box 16). The boundaries should be large enough to encompass the complexities and linkages of the ecosystem in order for the solutions to the problems to be effective. At the same time, socioeconomic, administrative and political boundaries need to be taken into account in order to achieve common management policies and actions for the entire ecosystem. Political and administrative boundaries may be adopted as working boundaries if they relate to ecosystem components such as biomes, or specific resources. For example, the management plan could encompass areas occupied by ethnic groups with similar resource use patterns.

Box 16. Problems of Demarcating and Enforcing Boundaries at Mount Elgon, Uganda

During its initial phase, forest managers implementing the Mount Elgon Management Programme were primarily concerned with surveying and re-demarcating the boundaries of the national park after more than 20 years of civil unrest. This was made difficult because many people had been carrying out activities inside the original park boundaries, such as cultivating land, wood cutting and, in some cases, burying their relatives. Their attitude was that after the absence of any park authority or infrastructure for 20 years, the land they had been using was being confiscated from them. Because of its size and inaccessibility it became obvious that patrolling the park was not feasible. All partners in the project recognized that normal law enforcement procedures were impractical and that the only option was through establishing a collaborative management arrangement with local people. This approach made demarcation of the park boundaries more feasible.

When boundaries are chosen, the ecosystem linkages and effects of human or other activities arising from outside the area must be considered. This is true in particular when action may be required to influence water and land use practices outside the project's adopted boundaries. Within the area itself, internal boundaries and zones may be set up to deal with multiple-use issues and conflicts, for example by adopting the zonal approaches used for bioregional planning and Biosphere Reserves (see 2.2).

4.1.3 Management objectives

Through a process of consultation, stakeholders should agree on a common vision for the area as well as on a set of **management objectives**. Common vision statements should be in accordance with the general aims of sustainable development. Specific management objectives for each of the zones, or for specific development sectors in these

zones, should also be determined. These may relate to levels of activity or the balance between implementing different activities. Examples include deciding on acceptable levels of pollution or water abstraction rates.

The emphasis on the needs and concerns of local communities does not mean that national or regional interests should be ignored in the management plan. All interests – national, district and local – must be considered and a balance sought. Where there are conflicts of interest between different levels of government, or between different sectors, every attempt should be made to resolve them through discussions and dialogue.

National interests often take priority (for example, the building of a road or dam, or the creation of a national park). When this occurs, the process of ecosystem management planning should aim to ensure that the national interest is implemented with greater sensitivity for local communities and through maintaining the integrity of the ecosystem. Ecosystem management plans should also aim to agree with, and influence, regional, district and local plans. Planning authorities are important stakeholders and should be closely involved at all stages of the planning process.

4.1.4 Monitoring and analysis

Provision for monitoring and analysis of information needed for decision-making should be a key part of the management plan (see also 1.2). This includes the identification of indicators and their significance, e.g. per cent increase in population of a depleted, or endangered species, an increase in the number of individuals with access to drinking water, or an increase (by weight) of fish products that can be marketed. The plan should also outline arrangements for public access to ecosystem management information, and for publicizing the decisions taken.

4.1.5 Coordination and institutional arrangements

The management plan should clearly define the institutions and stakeholder groups that are participants in the management plan. For each, there should be a clear indication of who is responsible for the implementation of different tasks. The plan could include terms of reference for the involvement of each participating group. Formal arrangements for coordination should be stated in the plan, including descriptions and purposes of planning meeting, reporting, review of results, and so on. This could also include arrangements for making adaptations to the plan on the basis of results and new information.

4.1.6 Budgetary and financial arrangements

Budgetary and financial arrangements should be clearly stated. A distinction should be made between funds allocated for project administration, field activities (including investments targeted at the community level), training and capacity building, communication, and monitoring and evaluation. For each project, a decision should be made about how the budget will be administered.

4.2 ENVIRONMENTAL ASSESSMENT TOOLS

✔ Some environmental assessment tools

A number of tools can assist in the process of ecosystem management planning and in ensuring that the plan is being implemented because they may be used both in the planning stage and for monitoring. They include:

- **Environmental Economic Assessment** for highlighting the economic value of functions and products of the ecosystem which might be, or have been, undervalued or overlooked (see Box 17);

Box 17. Economic Valuation of Wetland Functions of the Hadejia-Nguru, Nigeria

A partial evaluation of the wetland benefits of the floodplain of the Hadejia and Jama'are rivers showed that the agricultural, fuelwood and fishing benefits to the local population are substantial on a per hectare basis, and in terms of the minimum and maximum amount of floodwater required to sustain them. The current value of the aggregated benefits was at least US$32 per 1,000 m^3 of water, whereas returns from wheat and other crops grown on the Kano River Irrigation Project were only US$0.15 per 1,000 m^3. Conventional valuation of project benefits usually takes the production per hectare as the standard, but since water is the limiting factor for development, calculations should be based upon the production per unit of water. Other benefits such as groundwater recharge and livestock grazing, which may exceed the value of agriculture, fuelwood and fisheries, have not yet been included in the analysis. Integration of these additional benefits into the planning process would make the allocation of water to the floodplain an even more economically sensible option.

- **Strategic Environmental (Impact) Assessment (SEA),** which takes a longer-term overview of the area under consideration, and the cumulative pressures upon it. Such broader assessments are multisectoral and should include social and health impact assessments. SEAs should have a broader cross-sectoral and regional remit than conventional environmental impact assessments (EIAs), which often focus on the environmental consequences of one particular development, and usually look at a broad perspective (see Box 18);

- **Environmental Review and Audit** which considers an existing activity, its impacts upon the environment, and compliance with environmental regulations and its own environmental procedures. Most often

Box 18. Strategic Environmental Assessment of Developments around Victoria Falls, Zambia/Zimbabwe

The governments of Zambia and Zimbabwe were becoming increasingly concerned about the rate of development of tourism facilities at the Victoria Falls World Heritage Site on the Zambezi River. A process was started, with the assistance of IUCN, to carry out a strategic environmental assessment. This involved a multi-sectoral review of the existing situation, with inputs from urban and land use planners, tourism planners, sociologists and cultural experts, landscape architects, wildlife and plant ecologists, aircraft noise specialists, hydrologists and environmental economists, from both sides of the border. The SEA took a 10-year time horizon and, using scenarios for low, medium and high growth rates for tourist numbers, the team made assessments of the environmental impacts for different types of tourism facilities and associated urban growth. A skeleton management plan for the whole area, with a 30km radius around the Victoria Falls was prepared, and recommendations for cross-border coordination presented at the final public meeting of stakeholders. Both governments made public commitments to set up a cross-border institution for managing the area.

carried out on businesses, the environmental audit can also be applied to communities and ecosystem management plans (see Box 19).

Box 19. Environmental Audit in the Indus Delta, Pakistan

Port Qasim is the second largest port in Pakistan, situated some 45 km up the broad mangrove-lined Korangi Creek system in the northern extremity of the Indus delta. It consists of wharves for bulk cargoes of fertilizer, grain, coal, iron ore, oil and liquid petroleum gas. In addition, the Port Authority manages an associated industrial estate. As the agency responsible for about one-tenth of the delta area, it has the potential for beneficial and adverse impacts on the mangrove ecosystem. An environmental audit carried out as part of a mangrove rehabilitation project identified significant shortcomings in the environmental management of the port, and made recommendations for institutional changes, training requirements and the enforcement of environmental standards. As a result, Port Qasim Authority set up a small unit with responsibility for environment, health and safety to implement the findings of the audit. Through this, a better liaison was established between the Port and the Sindh Forest Department concerning rehabilitation of the mangrove forests. However, without a concerted environmental training and awareness programme for both management and staff, it is likely that good environmental management of the port will take a long time to be put into practice.

4.3 INFORMATION MANAGEMENT

Information is needed for assessments (see 1.2) and to assist decision-making, not only at the early stages of project planning, but also during implementation when adaptations have to be made to modify the initial plans.

Information is key to the iterative approach and to monitoring the efficacy of the activities being implemented. For information to be useful it has to be made available on a timely basis. Usually the information used in ecosystem management is derived from many sources. Therefore it is important to establish a network of contacts based in various institutions and stakeholder groups that can contribute this information according to the needs of a project. The different steps

that could be included in establishing an information management system are presented below.

4.3.1 Identification and selection of type of information needed

A selection needs to be made of the information required for applying ecosystem-based management to the site. An important prerequisite is that the information needs to be screened for its suitability, applicability, and short- and long-term effectiveness. Too much information on some subjects, or details that do not contribute to management decisions should be avoided (see 2.6). Data gathered should be aimed at addressing a number of the tasks outlined below.

✔ Information required for ecosystem management

a) Characterizing the system:

- Description of the ecosystem, its components, their interactions and the boundary of the management unit;
- Description of the current ecosystem functions and values, including hydrological and geophysical aspects;
- Descriptions of the system based on traditional and indigenous knowledge of local communities and individuals; and
- natural resource status, uses and threats, based on scientific and indigenous knowledge.

b) Evaluating options for management objectives:

- assessment of the potentiality of the system and constraints imposed on management by the need to maintain ecosystem integrity; and
- economic assessment of resource uses and potential, as a basis for cost-benefit judgements on alternative ecosystem management measures.

c) Analysing societal factors affecting ecosystem management:

- anthropological, social and cultural aspects including the roles of various groups in the community (e.g. age, social class, and gender differences in resource use);
- human health and educational status of resource users, especially those factors that may constrain the project and influence its orientation (e.g. towards poorer communities);
- societal, including political and cultural imperatives; and
- stakeholder analysis to determine which organizations and groups have interests in the system (see also 3.2).

4.3.2 Collection of relevant baseline data

Existing information should be identified and located (using database searches, reviewing published and "grey" literature, govern-

ment files and archives, querying museums, and finding sources of traditional knowledge). Usually, such information will be obtained from basic research studies, surveys, assessments, environmental monitoring programmes, sectoral reports, and similar sources. Often, local institutions can be engaged to gather and review data available at the national and regional level and from various sectoral sources. Examples are:

✔ Examples of relevant baseline data

- physical measurements of climatic data, tide and current movements;
- hydrological measurements;
- geological and chemical analysis;
- biological assessments;
- sociological, economic and political surveys;
- public hearings; and
- consultants reports.

Data collected should be stored so that it is readily accessible and easy for managers to analyse. In designing an information system, the need for periodic assessment and synthesis in the context of a number of thematic issues should be kept in mind. Openness and public accessibility of information are important considerations, or the participation of stakeholders may be jeopardized. Systems should be established within national or regional institutions as a way of building their capacities. In addition, this may provide the opportunity to introduce new methodologies such as GIS and other database approaches, and mapping (see 4.3.5).

Traditional knowledge and the experience of local communities and individuals should complement such information. A method that could be useful in this respect is Participatory Rural Appraisal (PRA)[10], which helps draw on human memory for information about previous ecosystem and social conditions.

4.3.3 Remedies for information deficiencies

An assessment needs to be made as to whether there are significant deficiencies in the information needed for management planning and decision making. A compilation of gaps in the information base should be prepared together with suggestions on how the miss-

10 Participatory Rural Appraisal is a semi-structured process of learning by, with and from communities about their own situation and way of life.

✔ Information synthesis and interpretation

ing information can be obtained (the thematic areas suggested for synthesizing and interpreting information suggested below can be used as a framework for this exercise). Suggestions for steps to be undertaken can include gathering more baseline information (additional desk studies), and undertaking field surveys, or other assessments. Stakeholders should participate in this process to the extent possible (see Box 19).

4.3.4 Synthesis and interpretation of information

Information should be analysed and synthesized so that it can be easily used for making decisions about the elements to be included in projects during their formulation, or in making management decisions in ongoing ecosystem projects. **Information should be presented in such a way that it helps in addressing a number of important thematic issues,** including:

a) The ecosystem and its boundary
This includes data on the status of the ecosystem, including its biological and geophysical components, and the key processes that take place. On the basis of this information, suggestions should be made for the ecosystem boundary. Data on the biogeophysical factors affecting the system from outside its boundary should also be presented.

b) socioeconomics, politics and local communities
Societal, cultural, and economic data at the level of local communities, and other stakeholders. Information on political or similar constraints that might be encountered at the local, regional or national level.

c) Stakeholder's uses of, and impacts on, the ecosystem
Natural resource uses by various stakeholders and the environmental consequences and impacts on the ecosystem of such uses.

d) Legal and administrative boundaries
Boundaries of legal and administrative jurisdictions should be assembled so they can be compared to the proposed ecosystem boundary. From this information, areas of potential conflict and compatibility can be identified.

e) Monitoring indicators
Information that can help with the identification of potential monitoring indicators. This should include indicators for changes in: (i) ecosystem structure and function, (ii) social and cultural changes, and (iii) economic trends. It is important to remember that indicators

should be chosen to show trends over appropriate time scales, to be representative of the issues and changes expected, and to be cost-effective in helping decision-making.

The thematic areas suggested above are intended only as a guide. Each project should develop an information system designed specifically to address issues with which it is concerned (see Box 20).

Box 20. Data Collection, Use and Storage

Applied Research and Pilot Studies

Between 1986 and 1990, the Sindh Forest Department of Pakistan carried out a series of trials on different species of mangroves and nursery techniques, and experimental plantations being developed on barren islands in the Indus Delta. This work, supported by UNESCO, laid the foundation for more extensive rehabilitation of mangroves throughout the delta. The trials proved that indigenous species were most viable under the extreme, arid conditions. Exotic species either did not survive or grew very slowly, and so were not considered for later rehabilitation measures.

Information Storage and Retrieval

The Fundacíon Pro-Sierra Nevada de Santa Marta in Colombia has developed a geographical information system to record, analyse and produce graphic and statistical information about many different aspects – environmental, social and economic – of the sierra ecosystem. The information was collected over a five-year period of extensive interaction with the many social groups involved in the collection of baseline data. The foundation now considers that its information system is vital for regional planning and producing maps for discussion with the different groups.

Data Collection by Local Partners

In building partnerships with organizations with which they work in the Important Bird Areas in Africa programme, BirdLife International have called upon individuals known to be interested in birds, either professionally or as a hobby. Many thousands of volunteers have helped collect local information on species diversity, abundance and threats in the countries concerned. They have also helped to establish "patron" groups living near particular sites to monitor changes in bird populations and their environment, and to report to a central part of the network.

4.3.5 Using maps

One of the most useful ways of summarizing and presenting information is by compiling it on maps. Maps make it possible to provide detailed information on the location of key natural resources, ecosystem features, jurisdictional boundaries and information about the communities which use them. By presenting information visually it is often easier to make comparisons, visualize the distribution of ecosystems and other components, and demonstrate where there are conflicts and compatabilities concerning resource use, boundaries, conservation and development plans.

If sufficient funds are available, information can be collected and compiled from satellite imagery and aerial photographs. Two common difficulties are, however, encountered when using this approach. First, many projects are in areas where satellite imagery may only provide very basic information. Second, aerial photographs, in par-

ticular older photographs, may be inaccurate. In both cases, it will be unlikely that the imagery will have been calibrated or tested for accuracy through field surveys to carry out "ground-truthing" exercises. In the absence of the possibility of using imagery, traditional surveys will have to suffice. Whichever approach is adopted, it is important to engage local communities in surveys and mapping.

One of the easiest ways to manipulate data and prepare a specific maps for comparisons of various features and factors is by using a GIS. In addition to making comparisons of current information it is also an excellent tool to compile time-series data in order to follow trends in the various factors that characterize a system. Such an approach is especially helpful when compiling information on indicators, as discussed below.

4.3.6 Indicators

In the current context, indicators are factors that provide information on the status of an ecosystem, in the same way that temperature level or pulse rate give an indication of an individual's health. In an ecosystem, typical indicators are the number and distribution of species over time, the level of specific pollutants in a body of water, or the salt content of soil in a floodplain. Some requirements pertaining to data on indicators are that they are:

✔ Requirements for data relating to indicators

- indicative of the status of an ecosystem and the associated local communities;
- conducive of timely collection and delivery;
- usable, routinely, in decision-making;
- checked for quality and accuracy; and
- made available to the stakeholders for assessment of their overall relevance.

To the extent possible, stakeholders should participate in data collection and analysis. Stakeholders usually have the advantage of being in close proximity to the system being managed, where they can more easily obtain information, and eventually take part in implementing management decisions based on the analysis of the data gathered.

4.4 PARTICIPATORY PROCESSES

The participation of local communities and stakeholders in planning and implementing ecosystem management initiatives and in sharing the responsibilities of decision-making, is a key feature of the ecosystem approach. The development of partnerships has already been discussed in Chapter 3, therefore only some participatory skills and tools are presented here.

4.4.1 Stakeholder analysis

Stakeholders may be individuals or households, complete communities and community-based organizations, interest groups, such as conservation or development-oriented NGOs, and commercial groups and companies. Institutional stakeholders include ministries and agencies responsible for using, regulating or managing particular natural resources. The approach to working with stakeholders has already been discussed in 3.2.

4.4.2 Building consensus

Building consensus among stakeholders about the objectives and levels of use of natural resources is essential for ecosystem management. This is a similar process to environmental conflict management (discussed in 3.3). It requires mediation skills and facilitation of discussions between groups in an attempt to find common ground. It will not always be possible to achieve a complete consensus on all issues, nor is it essential. At the very least, an attempt should be made to get stakeholders "to agree to disagree", while at the same time accepting whatever compromises may be necessary for ecosystem management to move forward, otherwise it will be impossible to ensure that management actions will be respected.

4.4.3 The participatory process

The participatory process attempts to ensure that the views of all stakeholders are taken into account in the formulation and implementation of an ecosystem-based management project. Generally, the process involves a planned series of **consultative meetings in which the stakeholders participate**. Meetings can either involve specific groups that represent a fairly narrow perspective, or mixed groups with a broad set of views. Often there is a feeling that the most equitable approach is to allow direct participation by all persons with opinions, information, dependence on the ecosystem, and concern about distributions of benefits. One of the challenges will be to have broad representation of stakeholders without including so many individuals in the meetings that they cease to be effective. It may be necessary for stakeholder groups to select a few individuals to represent them at the meetings. The aim is to exchange information and opinions about using ecosystem goods and services in the hope that a commonly agreed approach can be adopted. Whatever the degree of representation, it is important that communication and feedback to all stakeholders and stakeholder groups is effective. Box 21, describing a project in Bolivia, illustrates this point.

Box 21. Ensuring Information Feedback to Communities

One of the key problems in the Chiquitano Community Forest Management Project, Lomerio, Bolivia, was the over-reliance by the supporting agencies on a second tier, indigenous organization (CICOL), formed in 1983 to organize and represent the communities of Lomerio. This placed CICOL in a position to make decisions on behalf of the communities. Shortcomings in feedback and communication to the local communities led to frustration and a low-level of participation by community members in CICOL.

The **participatory process** can take place to varying degrees. Different levels of consultation with the stakeholders, which may be appropriate at various times during the project, are:

- the simple provision of information about a project or development, with only a limited opportunity for feedback;
- consultations, in which the stakeholders are informed about decisions to be taken, their opinions are sought, and these are taken into account by the decision-makers; and
- full participation of all stakeholders who share responsibility for making decisions about the use of the ecosystem and, subsequently, taking responsibility to monitor and follow-up on implementation of the decisions.

✔ Degree of consultation with stakeholders

4.4.4 Tools to assist in the participatory approach

A number of methods have been developed that focus on the participatory approach. Some of techniques and methods useful for ecosystem-based management projects include:

- Participatory assessment;
- Planning, negotiation and conflict management;
- Participatory monitoring and evaluation; and
- Participatory rural appraisal.

Box 22. Participatory Processes in the Sierra Nevada de Santa Marta, Colombia

Stakeholders have defined the objectives of a strategy for conserving the watersheds of the Sierra Nevada. Between 1991 and 1996 a large number of field workshops were organized involving community leaders, experts from a large number of institutions, representatives from municipalities and several ministries, the church, and leaders of guerrilla groups. The aim was to define threats, alternative solutions, human rights issues, potential conflict-resolution mechanisms, and environmental education priorities, of concern to the users of the watersheds. This detailed participatory process was supported by three field stations established by Fundacíon Pro-Sierra Nevada de Santa Marta and by two Associations of Community Leaders and Municipalities. In future, these will take the lead responsibility for programme design and project implementation.

Many of these involve rapid appraisal techniques, which are a result of efforts to minimize the length of time taken to collect, analyse

and use conventional social survey data. Participatory rural appraisal involves using a variety of information sources and techniques. It is flexible, informal and takes place within the community. The people themselves become involved in on-the-spot analysis. It encourages a self-critical approach and tries to offset biases within the team. Specific information on the application of these participatory techniques can be found in: Borrini-Feyerabend, 1996, 1997; Chambers, 1994a, 1994b; IIED, 1993; Theis and Grady, 1991. Box 22 illustrates the results of participatory approaches and processes in Colombia.

4.5 THE ROLE OF DEVELOPMENT ACTIVITIES IN ECOSYSTEM-BASED MANAGEMENT

If a community is not able (or only barely able) to meet its basic needs for survival (air, water, food, shelter) it may very difficult to promote ecosystem-based management ideas and concepts in the initial stages of project formulation or implementation. The community is more likely to be inclined to expend its efforts on survival, even if it means over-exploiting the natural resources.

Two points made earlier in this Guide were that: **people are an integral part of the ecosystem**; and that **the ecosystem approach can help stakeholders and managers plan for and achieve sustainability.** The aim is to use ecosystem goods and services, but in a way that does not degrade the functional integrity of the system. For example, exploit forest products but at the same time conserve the integrity of the forest ecosystem – use it, but don't lose it. Thus, while maintaining the long-term aim to establish a framework for ecosystem management, in the short-term it may be more sensible to implement some fairly basic development activities, especially those that help communities meet their basic needs for water, food and shelter. Using this approach can help communities achieve a level of development that allows them to spend less time on survival and more time on managing the ecosystem upon which they ultimately depend.

As a starting point, a sound knowledge base should be compiled on the ecosystem, the potential for exploiting its goods and services, and the possibilities for development activities. Based on this background information, priority activities should then be identified through detailed discussions with local communities. It is rare that activities can be defined during the project preparation stage, since such discussions will not have taken place. Therefore, ecosystem management projects should include provision for both the definition of development activities and their implementation. For practical purposes it is convenient to classify development activities into two characteristic types:

- micro-development or "starter" activities; and
- sustainable development activities.

4.5.1 Starter activities

Often, before a broad ecosystem management approach can be promoted within communities that are more concerned with day-to-day basic needs, it may be necessary to win their trust and co-operation through initiating development, or "starter" activities with which they can more easily identify. While starter activities have their own legitimate development objectives they are intended to have the added value of creating confidence in the project and self-confidence within the community group. These activities may not necessarily have a direct link with eventual ecosystem management objectives, however, they should be compatible with activities foreseen later. These projects should also serve as a vehicle for initiating discussions on the more broadly focussed ecosystem approaches to be undertaken later, as well as demonstrating that something beneficial is happening early in the project. Starter activity projects should be identified and implemented in an environmentally sound way. For example, they should be subjected to environmental impact assessments before implementation, in the same way as any other project activity.

Strategies used for specific types of starter activities will vary with the characteristics of the ecosystem and the local communities, but may include:

✔ Examples of starter activities

- digging wells;
- restoring water supplies;
- providing credit for grain mills and other equipment such as farming tools, fishing nets, sailing gear, fishing boats, vehicles;
- providing improved seeds;
- improving local health services and education facilities; and
- improving local road systems.

One of the most frequent problems with developing trust through starter activities is that false expectations may be given about the overall objectives of the initiative. The local community may become dissatisfied when activities eventually are more clearly linked to broad environmental management objectives and the original, starter type development activities, may be cut back. One way to avoid this is to select projects for which there is a potential for a seamless continuum between the initial activity and one that is anticipated to be initiated later. This, of course, is difficult but should be attempted whenever possible.

A second problem is that when a starter activity is underway there are often requests by the local communities to expand its scope. Box 11 described an original starter activity in Guinea-Bissau, that initially focussed on establishing vegetable gardens and was later expanded to assisting small-scale fisheries in the Rio Grande de Buba.

4.5.2 Sustainable development activities

Sustainable development activities have similar aims to starter activities and should be defined through detailed discussion with local communities and aim to build confidence in the project and self-confidence in the community. The focus of sustainable development activity projects falls somewhere between the narrow objective of a starter activity and the broadly focussed objective of an ecosystem-based management project. Some of the conditions to be met in formulating sustainable development activities include:

✔ Conditions for success of sustainable development activities

- an obvious link to community development priorities;
- a link to conservation objectives;
- environmental soundness;
- a focus on gender and other social issues;
- full co-operation and support of the affected community groups;
- availability of local knowledge and technology that can minimize the need for extension services; and
- objectives that can be met in the short-term, thus demonstrating early results and maintaining community support for continuation.

A basic principle for these activities should be to increase the capacity for income-generation from existing activities by reducing wastage and providing added value. This reduces the pressure on natural resources. Another principle is to reduce the pressure on resources by finding cheaper alternatives to direct exploitation.

Examples of sustainable development activities illustrated by the case studies reviewed in this Guide include:

✔ Examples of sustainable development activities from case studies

- restoration of forests, fisheries and grazing resources;
- control of crop damage;
- assistance in production of rain-fed crops;
- production of handicrafts and improved marketing;
- improvement of fish products, honey production and others;
- production of wood stoves; and
- ecotourism.

One of the dangers of successful sustainable development activities that focus on income generation is that as they become popular

Box 23. Development Activities for Income Generation

Using Development Activities for Ecosystem Management – Mount Elgon National Park, Uganda

An initial objective of the Mount Elgon project in eastern Uganda was to improve the farming system outside Mount Elgon National Park in order to reduce the farmers' need to expand cultivation into the protected area. This approach did not target other threats such as harvesting poles and firewood or from grazing livestock inside the park. The project did little to foster community involvement in managing the park.

To redress this situation, the project initiated a series of sustainable development activities such as fodder production, upgrading local herds for more intensive animal production, tree planting for poles, firewood and stakes, promotion of improved wood stoves, bee-keeping, and others. Agreements were signed between the National Park Service and two local communities concerning collaborative management of some sections of the park. As a result, encroachment has stopped, pit-sawing of timber has been greatly reduced, and there is a growing recognition among the target groups that the forests in the park must be maintained as a source of drinking water and non-timber forest products.

Development Activities in the Non-timber Forest Product Project – Palawan, Philippines

The Haribon project in the buffer zone of Saint Paul's National Park, Palawan has fostered community-based management of non-timber forest products as a means of enlisting Tagbanua and Batak tribal minorities to participate in sustainable ecosystem management activities. This involved assisting local communities to gain control over non-timber forest products (such as rattan, honey, and *almaciga* – the resin derived from *Agathis philippinensis*) so that profit increases from direct marketing would provide incentives for sustainable management of the protected forest. However, the earnings gained did not compensate for lost agricultural income, and off-take levels reached unprecedented levels.

A new approach was adopted which focused on discerning the real problems encountered by indigenous people, such as the ban on upland agriculture, inadequate food supplies, public health crises, and the absence of a system governing resource use and land tenure. As a result, development assistance was provided in numerical literacy, health and sanitation, sustainable agriculture, and management and processing of non-timber forest products. In addition, options for tenure or usufruct rights were explored. The new approach has proved valuable in increasing the delivery of economic benefits to the local communities, in removing some of the immediate causes for unsustainable resource exploitation, and in ensuring a higher degree of participation in ecosystem management.

they may create additional stress on natural resources. When this happens, one set of ecosystem problems may be substituted for another. However, through this approach participants should be more aware of the ecological constraints, and become more experienced in dealing with them through discussion and agreement with other stakeholders. The success of income-generating activities will give the communities greater economic freedom to manage new pressures on natural resources. Box 23 illustrates two specific examples.

4.6 INSTITUTIONAL COORDINATION

Coordination and facilitation of contacts between stakeholder institutions and individuals has to be a key feature of ecosystem-management projects. The effectiveness of their involvement and the eventual success of a project will depend on this. Usually one organization takes a lead role in facilitating coordination. Care has

to be exercised in choosing the lead organization, or focal point, in order to avoid the appearance of giving more authority to one organization than to the rest. In many situations this will be a very sensitive issue. The lead organization cannot direct what is to be done and should not use its position to usurp the responsibilities of other participants. Instead it has to facilitate the actions and responsibilities of others, without being unduly influenced by its own vested interest. Lack of sensitive coordination will lead to confusion and inaction that, in turn, will hinder the achievement of project objectives. Careful selection of the lead agency is equally important from the point of view that it may be perceived as having the ultimate responsibility for the success of the initiative. In an ideal situation it is best if stakeholders negotiate and agree on which agency or individual takes the lead coordinating role. Characteristics of a lead agency should include:

✔ Characteristics of a lead institution

- willingness and capacity to take on the role of lead agency;
- at least a basic understanding of ecosystem management and the system to be managed;
- an appreciation of the role of local and traditional knowledge in management;
- an appreciation of the importance of involving local communities in management;
- negotiating, participatory and facilitation skills;
- ability to establish and provide a point of coordination for the network of stakeholders; and
- a high degree of political sensitivity.

The key to coordination lies in good communications between the different stakeholders or institutions – government agencies, the private sector, communities and NGOs. Good facilitation skills are needed to reach consensus on management decisions to be taken. Once taken, it is then up to the different stakeholder organizations responsible to carry out those decisions. If there is a lack of consensus there is a risk that some of the stakeholders will become less cooperative.

Another factor that will influence the effectiveness of coordinating mechanisms concerns the role of the stakeholders themselves. In many cases it will not be possible, nor would it be effective, to include all individuals in a stakeholder group in coordination meetings. It will be more effective if an individual is designated to act as a focal point. In this case it is important that representatives have enough authority to allow them to negotiate on behalf of their stakeholder group. Projects sometimes fail because representatives may not be authorized to take decisions without referring elsewhere. When this happens frequently it slows progress. Therefore, struc-

turing the coordination arrangements takes some care in order to ensure that stakeholders understand the aims of coordinating mechanisms. In this regard, good communication within each institution is important. Focal points, or representatives, should be given the responsibility to keep their colleagues informed and to consult with them about the results of coordination meetings, in particular about decisions.

Cooperation among sponsoring and donor agencies is also an important factor and must be integrated with overall efforts to ensure coordination amongst stakeholders (see Box 24).

4.7 CAPACITY-BUILDING

Ecosystem management projects often include a component to strengthen the capacity of the institutions involved. This should include training in:

✔ Training to build institutional capacity

- understanding ecosystem processes and the potential for sustainable production;
- understanding ecosystem management;
- the importance of flexibility, and the use of monitoring for adaptive management;
- technical skills required for the ecosystem to be managed; and
- participatory and facilitation skills.

Box 24. Development-assistance Agency Coordination in the Nepal-Australia Community Forestry Project

Unfortunately, there are many examples where development assistance agencies do not plan or work closely together. This frequently results in divergent policies, implementation of conflicting activities, duplication of effort from similar programmes, progressive disinterest of the stakeholders who receive too many unclear messages from donors and, sometimes, cynicism with the donor community itself.

One of the keys to success of the forestry assistance programme in Nepal is the fact that most donors (e.g. the World Bank, the Department for International Development (UK), the Swiss Development Cooperation, DANIDA and AusAID) co-ordinate their objectives and activities very effectively. There is also close interaction between project staff and senior decision-makers in the Ministry of Forests and Soil Conservation. The formation of this powerful consortium of agencies has promoted changes in policy and legal reform for community forestry. In addition, donor assistance has been very consistent (over nearly two decades in the case of AusAID). This has undoubtedly helped project programmes to be highly effective in meeting the expectations of the recipient groups.

Capacity-building should not only be limited to training. It should also include assisting stakeholders to increase their capability to participate, for example, by providing boats, or boat repair facilities to fishermen, or by providing equipment to monitor water pollution.

In addition to local communities and government agencies, potential participants in an ecosystem management project might include university departments, research institutions, government departments, private companies, national and international NGOs, community-based organizations, and other institutions from within and outside the country. Care should be given to securing partnerships with the largest possible range of such institutions. A realistic assessment will have to be made of their capacities to participate, to make contributions, and to guide decisions on the quality and quantity of work to be delegated. This assessment should then be linked to a capacity-building and training plan.

4.8 COMMUNICATING THE IMPORTANCE OF ECOSYSTEM-BASED MANAGEMENT

The actions required to manage an ecosystem sustainably mean that people may have to change their perceptions, attitudes and behaviour. Unless the affected people and user groups appreciate the reasons for change, and the benefits they will derive from this, they will have little motivation to change. Therefore, communication and public education are essential to the success of ecosystem management initiatives. Alternatives for a new management regime and the reasons for adopting it need to be clearly explained in a fashion that is understandable and, in particular, in a way that emphasizes the benefits. As part of the efforts to strengthen the participatory dialogue with the widest range of stakeholders, an ecosystem management initiative should develop its own communications strategy. An overly generalized public awareness campaign is of little value on its own, but can be very effective if supplemented by specialized communications for specific target groups.

A communication strategy should identify:

✔ Elements of a communications strategy

- **the main problems**, e.g. pollution affecting the breeding grounds of fish;
- **options for sustainable use**, e.g. substituting multiple sustainable harvest of non-timber forest products for logging;
- **the main target audiences**, e.g. municipal authorities, polluting industries;
- **their perceptions about the issues**, e.g. "our wastes are not polluting";
- **messages the initiative wants to convey to bring about change**, e.g. "pollution kills young fish"; "fish are an important economic resource";
- **communication channels to be used**, e.g. meetings with and between municipal authorities and industrialists; visits to other areas where similar problems have been solved;

- **other institutions that can help to convey the messages**, e.g. chambers of commerce or trade bodies;
- **the sort/level of information required**, e.g. water treatment facilities available and costs; and
- **the financial resources available for the communication strategy.**

The same kind of analysis should also be carried out for communications concerning community issues, and for other target groups of stakeholders. To implement such a communications strategy, many different tools which will have to be adapted to match the message, the medium used and the target group. Among these tools are:

✔ Tools for implementing a communications strategy

- publications, newsletters and newspaper articles;
- round tables, seminars and meetings geared to the appropriate level;
- working with opinion leaders and local groups;
- radio programmes, videos and films; and
- theatre, puppet shows at local festivals, fairs and other events.

The long-term sustainability of any conservation initiative will depend on changing young people's attitudes through education. This can involve a variety of educational activities at primary, secondary and tertiary levels. Young people respond most positively to such activities and provide the ecosystem managers for the future. In addition, educating children to adopt more sustainable values often serves as a vehicle to change the attitudes of their parents.

Regular information updates about the ecosystem and its management are essential in any communications strategy. **In a changing situation, it is more useful to make available regular information on results, which, of course should be sound but not necessarily entirely proven, rather than rely upon scientifically robust results published at the end of the project.** At the very least, regular publication encourages a dialogue, which may lead to further ideas for improvement.

4.8.1 Advocacy

Advocacy for specific ecosystem management issues should be an important part of the communications strategy. Successful projects have been able to underpin their actions through the support of key decision-makers. Advocacy involves taking a particular stance on an issue and is much more focused. Advocacy will often be most effective if it is communicated through the media, by lobbying, by publishing policy papers, and through meetings. It must take place at the local and national levels: there is little point if support stops at the ministerial level, if the local administrator is not convinced, or if

the village headman will not collaborate because he does not see the value of the activity.

At each level, advocacy must stress the benefits to people – in the local community, province or nation. At the national level, the use of environmental economics can show the economic importance of resources that may be considered as worthless. At the local level, the best approach to advocacy is through action that produces benefits for local communities.

4.9 MEASURES FOR ECOSYSTEM REHABILITATION AND CONSERVATION

4.9.1 Ecosystem rehabilitation

Ecosystem rehabilitation is the process of restoring the functions and components (flora and fauna) which have been lost from an ecosystem due to human activities or natural phenomena. A specific choice is made to do this, because these lost functions and components are considered valuable. It usually involves a range of activities that manipulate the ecosystem in such a way that the functions are progressively restored.

In many cases, ecosystem management projects will be set up to protect ecosystems that are functioning well, or at an acceptable level. Little or no direct ecosystem manipulation is required, and activities are oriented towards management of the different land and water uses in the project area. Zoning of multiple uses and control of potentially damaging activities are important, allowing the ecosystem to rehabilitate itself. Given the resilience of many ecosystems, natural regeneration is probably the best (and possibly cheapest) form of ecosystem rehabilitation, although it may not restore the ecosystem to its original configuration.

In other instances, ecosystem rehabilitation may require more extensive measure. For example, these can include:

✔ Ecosystem rehabilitation measures

- reforestation, and replanting of trees;
- prevention of soil erosion;
- fencing off areas to allow natural re-vegetation;
- introduction or re-introduction of key species of animals and plants, including domestic animals, which play a critical role in the food web;
- re-introduction of traditional natural resource use practices;
- re-establishment of hydrological functions, e.g. releasing water from a dam to restore the floodplain, re-introduction of annual flood regimes;

- cutting reeds and other vegetation at the right time of year;
- enforcing fish net mesh sizes and fishing seasons;
- controlling destructive activities, e.g. fishing with explosives or poaching; and
- controlling air and water pollution in the surrounding areas.

4.9.2 Assessment of ecosystem health

The need for ecosystem rehabilitation measures should be determined in the ecosystem management planning process (see 1.1). This should include an assessment of the health of the ecosystem and an analysis of threats. This is usually carried out through ecosystem surveys as described earlier. Experienced scientists can recognize the indications of ecosystem degradation, for example, by identifying:

✔ Signs of an ecosystem in poor health

- the absence of certain species which used to be there, or would normally be there;
- the presence of other species which have invaded or predominate under changed conditions;
- the health of sedentary or less mobile species – both plants and animals, e.g. coral;
- an absence of user groups, e.g. nomadic herders or fishermen that would normally benefit from ecosystem productivity;
- pollution levels – air, water and soil; and
- a failure of ecosystem functions, e.g. hydrological controls.

Many species populations show cyclical variation, which may be annual or may extend over several years. Some ecosystems show even longer-term natural patterns of change. Comparison of previous conditions (e.g. of forest cover through satellite imagery and aerial photography) and continuing observation may therefore be necessary. **Care has to be taken not to misread indicators of ecosystem health that may vary according to seasonal, yearly or other time-related cycles, or to prevailing climatic conditions**. Time-series observations for longer periods of time may be necessary. Loss of productivity in agriculture and fisheries and the well-being of farming communities can serve as socioeconomic indicators of ecosystem health. Participatory rural appraisal (see 1.4.4) techniques can facilitate the comparison of earlier ecosystem conditions with the present.

The assessment of ecosystem health should consider the linkages between the different components and issues. Techniques, such as problem tree analysis (Figure 5), allow an easy appreciation of the linkages. Problem tree analyses also enable possible courses of action for rehabilitation to be identified and selected. A decision to carry out active rehabilitation depends upon an analysis as to whether the

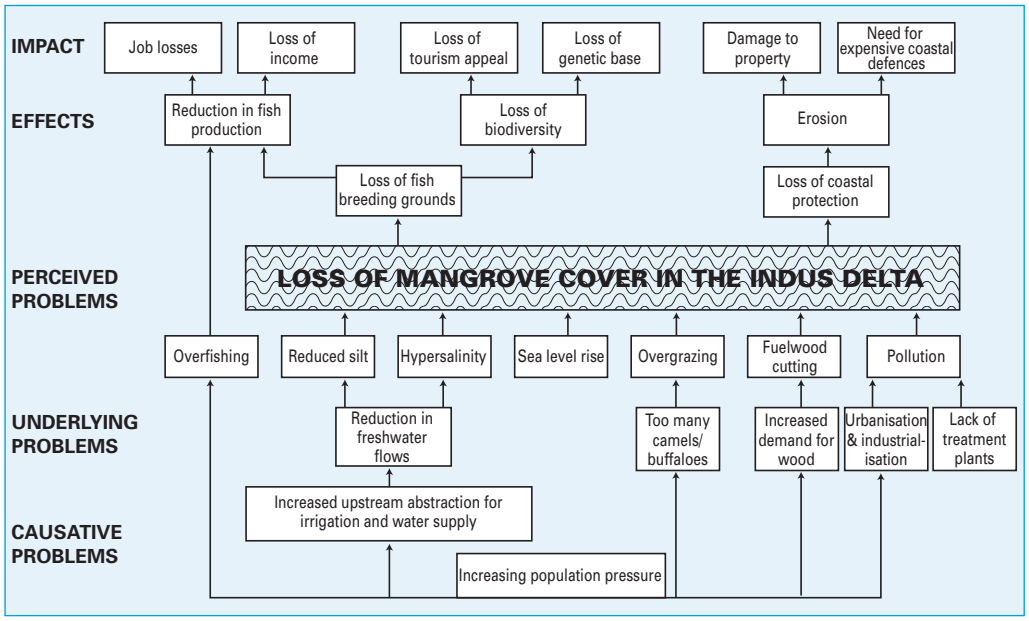

Figure 5. Example of problem tree analysis of mangrove degradation in the Indus Delta.

ecosystem will recover naturally or whether interventions are necessary. If the latter, then rehabilitation measures should be undertaken, preferably through a series of progressive steps.

4.9.3 Replanting with exotics

Planting of **exotic plant species** instead of indigenous species is sometimes considered for ecosystem rehabilitation, often because some exotics grow faster or have greater value than indigenous species. In some cases, the introduction of exotics has had disastrous effects upon the local ecosystem, for example, plants that grow so rapidly they smother all other vegetation, or plants that deplete ground water. Another effect of exotics can be to hinder normal processes of succession[11] within indigenous plant communities. By contrast, there are many examples of introduced exotics that do not survive in their new environment; in these cases, investment in replanting has been wasted.

Where decisions are taken to plant exotics, extreme care must be taken in the choice of species. Exotics should not be introduced with-

[11] Succession: change over time of biological communities until a stable, climax community is reached.

out extensive trials to test their viability and safety. National laws on alien species introduction should be respected. Sites for replanting need to be carefully surveyed to make sure that the topography and environmental conditions are suitable (see Box 25).

Box 25. Regeneration of Vegetation Cover – Caution Needed

The typical approach to rehabilitating Indian forest lands has been to protect areas from cutting and grazing and to allow natural regeneration to take place. This has been more effective than plantation schemes.

This approach does not, however, work in the Sahel region. There, because little or no grass was left after the dry season, it was assumed to be a result of overgrazing. However, when areas were put under protection from grazing the expected natural regeneration of the desired grasses did not occur. Instead, the areas became dominated by species of grasses that were unsuitable for livestock. Contrary to conventional wisdom it was found that allowing grazing to continue was the best approach for maintaining the desired plant cover.

Fast growing exotic tree species were introduced in arid and semi-arid lands projects in Kenya to rehabilitate degraded areas as they could produce quick results. It transpired, however, that these species were much more susceptible to disease and drought and, with time, the plantation schemes degraded. As a result, there has been a shift to planting indigenous species or, in some cases, a mixture of exotics and indigenous species.

These three cases illustrate the importance of taking a cautious approach and tailoring management strategies to individual ecosystems.

5

Ecosystem-based Management Approaches in Development Projects

A number of donor agencies and NGOs have, on the basis of past experience, developed approaches to identifying, conceiving and formulating projects. Over time, they have established a logical sequence of events or steps to follow in this process. Not all are the same, but many are similar.

The following series of steps and checklists conform to the projects cycles of many organizations routinely working on ecosystem-based management. These are intended only as a guide as each situation is different and will have to be modified to fit the circumstances encountered for each project.

5.1 PROJECT IDENTIFICATION

5.1.1 Timing and timeframes

For any new project, choosing the right timing for establishing the project in the field is crucial. Project designers should be aware of situations that provide opportunities for introducing the ecosystem approach. Some examples follow.

✔ Opportunities for introducing the ecosystem approach

- **Return to political stability**. Ecosystem management projects are difficult to operate in a state of political uncertainty but, as the situation stabilizes, there may be windows of opportunity when official institutions are in a state of flux and new ideas may be more readily accepted.
- **Enabling policies**. Changes in economic policies and strengthening of environmental policies often create conditions under which the ecosystem management approach may be more acceptable. National Conservation Strategies, National Plans to Combat Desertification, National Environmental Action Plans, and other similar initiatives under the UNCED process, have encouraged countries to produce strategies to conserve biodiversity. Ratification of international conventions is a good opportunity for a country to review its environmental policies, legislation and practices.

- **Changing legislative context**. Changes in policy are often followed by changes in environmental and other legislation that can create opportunities for ecosystem management projects to be identified and promoted.
- **Changing institutional context**. The creation of new institutions, the re-structuring of existing ones, or an extension of the mandate of existing bodies to fill identified gaps in natural resource management, may all provide new opportunities.

Ecosystem management projects require significant periods of time to implement. Areas that may have taken only a few years to

Box 26. Windows of Opportunity and Timeframes for Ecosystem Management

The success of many ecosystem management projects is highly dependent on getting the timing of their initiation right or recognizing windows of opportunity. Four examples from the field illustrate this.

Windows of Opportunity – Political Stability and Changing Policies

During 20 years of political instability in Uganda it was impossible to carry out forest conservation activities in the Mount Elgon area, including in the national park, in spite of the potential commitment of several assistance agencies to fund activities. Once stability was regained, work again became possible.

In the Sierra Nevada de Santa Marta, Colombia, the instability and, at times, armed conflicts prevented the initiation of many activities aimed at maintaining the watersheds. Nonetheless, during the same period it was possible to hold wide-ranging consultations with all stakeholders, including guerrillas and paramilitary groups, concerning the Conservation Strategy for the Sierra. This contributed to more peaceful solutions to a number of conflicts affecting the watersheds.

Niger introduced a policy to devolve responsibilities for resource management to regional and local communities. This made it possible for interested local communities to be given an official role in the rehabilitation and sustainable management of the ron palm forests. A similar policy shift by the Government of the Philippines created an opportunity for community level management of fisheries resources.

Timeframes for Ecosystem Management

Rehabilitation of degraded ecosystems can be a lengthy process. For most biomes, visible evidence that restoration efforts are working usually takes 5-10 years. Thus, ecosystem management initiatives should be designed with long time horizons, e.g. 10-15 years in order to be sure that recovery has been effective. Examples from the field are:

- the Aga Khan Rural Support Programme in Pakistan was started in 1982 and is aimed at increasing productivity in arid mountain areas. Its philosophy continues to be "learning by doing";
- the Chiquitano Community Forest Programme began with resources inventories in 1984 and, by 1994, had developed long-term management strategies; and
- in another "learning by doing" effort, the Community Forest Project in Nepal started in 1978 and continues to adjust the scope of its activities on the basis of experience.

It is obvious that long-term commitment of donor agencies is required for successful results and the sustainability of ecosystem initiatives, almost irrespective of the size of their financial investment.

Building capacity, like ecosystem rehabilitation and management, takes a long time and, therefore, a long-term commitment is also required on the part of the assistance agencies. This is exemplified in the coastal zone management programme in Guinea-Bissau, which has helped establish several government institutions, fostered the formation of natural resource focussed NGOs, and provided structural and technical assistance for over a decade. This was made possible by the long-term time horizon of 9-12 years adopted by the Swiss Development Cooperation.

become degraded may take decades to recover, even with focused rehabilitation measures. At the project identification stage, the likely time-scale required for project preparation and any proposed initiatives must be appreciated by the project designers. In turn, they must convince governments, the communities and donors to adopt realistic expectations and to encourage their commitment to the process of resource conservation and sustainable management. Scientific information and previous experience should be used to promote such an understanding. If uncertainties about methods and timeframes persist, consideration should be given to designing the project in phases. Box 26 provides information on windows of opportunity and timeframes from four field projects.

5.1.2 Key actors

Project designers should be aware of four key roles that have been identified in successful natural habitat and ecosystem projects. Collaboration with key individuals, especially at the early stage, may be needed to enter into a constructive dialogue with stakeholders and to win acceptance that the goal and objectives of the project are a true reflection of their needs. Descriptions (from IUCN, 1995) of some of these key roles follow.

- **The Champion** – who either has the idea, or promotes it at an early stage, so that it becomes accepted by different institutions and the government. The champion is a publicist able to convince others, including those working outside the project.
- **The Scientist –** who understands the ecosystem and its potential, and is often the source of unbiased, impartial technical advice.
- **The Strategist** – who develops the idea, draws up the plans and produces the documents. The strategist also has to be able to work with the different actors, helping define their parts and drawing together their views. The strategist should be a facilitator for public participation and able to interpret the views expressed.
- **The Executor –** who manages and implements the strategy in the field. The executor is a practical person, who is able to get things done both within his or her own institution, and with the people and communities around the project area. The executor has to interpret the strategy in the light of the situation on the ground and be flexible enough to make changes where necessary.

✔ Key actors in ecosystem management projects

5.1.3 Issue identification and stakeholder participation

The project identification stage should be used to highlight the issues to be addressed and develop a deeper understanding of the interconnections, the causes and effects, and the options for address-

ing them. Problem tree analysis (Figure 5) and conventional project preparation tools can be used.

Stakeholder involvement is an essential, though time-consuming, element of project identification. It is almost never too early to start contacting and involving potential partners and stakeholders, to enlist their help in identifying projects and to obtain their ideas and reactions. These are the people who will be affected – adversely or beneficially – by the project and who, by their actions, can affect its success. Care should, however, be taken about raising expectations.

First, through stakeholder analysis, it is necessary to identify the stakeholders, and their interests and needs. Discussions must be held with relevant organizations and groups to clarify the ideas and generate a feeling of involvement in the process from the beginning. This will help strengthen commitment.

5.1.4 Defining the overall objectives

Ecosystem management projects are no different from any others – they require well-defined, clear objectives. The overall objectives

Box 27. Ecosystem Management Objectives

CAMPFIRE, Zimbabwe

The CAMPFIRE programme (see Box 14 for further background information) aims "*to give full control of wildlife management to rural communities which actually stay with wildlife and bear the costs of living with this resource*". The following objectives have guided implementation:

- to obtain the voluntary participation of communities in a flexible programme which incorporates long-term solutions to resource management problems;
- to introduce a system of group ownership, with defined rights of access to natural resources, for the communities resident in the target areas;
- to produce and strengthen the appropriate institutions under which resources can be managed legitimately and exploited by the resident communities for their own direct benefits; and
- to provide technical and financial assistance to communities which join the programme to enable them to realize these benefits.

Non-timber Forest Products Project in Palawan, Philippines

The goal of the project (see also Box 30) is "*to develop a system for community-based sustainable management of non-timber forest products which, by contributing to the achievement of local economic objectives, would enlist local participation in sustainable ecosystem management and biodiversity conservation*". This was to be achieved through:

- poverty alleviation and community development; and
- collaborative management and biodiversity conservation in a protected area and its buffer zone.

Hadejia-Nguru Wetlands Conservation Project, Nigeria

The goal of this project (see also Box 17) is "*to maintain the natural resources and functions of the Hadejia-Nguru wetlands through the promotion of the wise use of wetland resources and the continued functioning of the wetland for the benefit of its human population and its wildlife*". Specific objectives are to:

- establish an integrated water resources management system for the Komadugu-Yobe basin;
- develop, jointly with local farmers, appropriate technologies for sustainable utilization of wetland resources;
- improve the management of protected areas; and
- provide guidelines for the wise use of wetland resources.

of the project should be based upon discussions with stakeholders and an understanding of the ecosystem issues and courses of action to address them. Ecosystem management goals and objectives are often defined in terms of:

- the structure, functional dynamics, products and potential products of the system;
- the quality of the environment and its relationship to human quality of life;
- the socioeconomic well-being of the people who use the natural resources and the desired livelihood outcome; and
- the status of natural resources in the project area and the desired conservation outcome.

✔ Issues addressed in setting objectives

Definition of these goals and objectives starts the process of working out how progress can be measured – in other words, it anticipates monitoring. Examples of the range of ecosystem management objectives used in selected projects are given in Box 27.

5.2 PROJECT FORMULATION

5.2.1 Project design principles

Project formulators should bear two major design principles in mind:

Design for adaptive management

- A flexible process, with a clear aim and methodology for reaching decisions about outputs and activities which are realistic and necessary;
- Milestones should be defined, indicating that these decisions are to be reached and reviewed;
- Monitoring and evaluation mechanisms should be specified, for identifying and measuring indicators of success to show achievement of the overall aims; and
- Detailed outputs, which have not been discussed and agreed with all partners and stakeholders, should be avoided.

✔ Major design principles: adaptive management

Design for sustainability

The ultimate aim is that management, conservation and sustainable use of the ecosystem continue indefinitely after the end of the initiative. This implies **institutional sustainability**, that is:

- the local institutions responsible for long-term management of the ecosystem should have the capacity to carry this out by the end of the project;

✔ Major design principles: sustainability

- they should be technically capable and able to take adaptive management decisions based upon information coming from the ecosystem and its use;
- the project should avoid becoming an institution in its own right, but should progressively devolve its management and co-ordinating roles to local bodies; and
- an exit strategy should be designed at the beginning of the initiative. This needs to envisage the final management and coordination structures, so that the project is designed to create and strengthen these. Project managers need to anticipate that these designs will change as the project progresses.

The initiative should be designed to ensure that the long-term ecosystem management is **financially sustainable** by the time the initiative comes to an end. This implies that a self-financing strategy should be developed to ensure continued funds to manage the ecosystem. This may come from:

✔ Requirements for financial sustainability

- revenues generated from the products and services from the ecosystem;
- harnessing the entrepreneurial spirit of local people who have an interest in managing the ecosystem wisely; and
- a system whereby external beneficiaries can contribute in the long-term.

The value of the ecosystem needs to be recognized through an ongoing commitment to financing its management. This is necessary if the value cannot be realized in strict market or income terms. Where non-tradable goods and services are derived from the ecosystem, e.g. national park or watershed protection, an annual contribution for ecosystem management from the government may be appropriate. The approach of several projects to ensuring continuity is illustrated in Box 28.

The conventional tools of a logical framework analysis may be used for project formulation, through conceptualizing the problems and linking project objectives and activities. The main issues in formulating the details of ecosystem management initiatives fall into the following areas:

✔ Issues in project design

- defining the boundaries, scope and time-scale;
- meeting preconditions and minimising risks;
- drawing on community involvement;
- building partnerships;
- building in monitoring and evaluation; and
- designing for funding.

Box 28. Ensuring Sustainability

Continuity of Project Achievements

A major challenge in ecosystem management projects is ensuring continuity of project implementation. This is particularly true for long-term projects. In some countries the overall scarcity of human resources increases the likelihood that continuity will be disrupted even if only a few project personnel leave. Other factors can be high turnover of staff because of regular counterpart staff movements within the government structure and competition between projects for staff, including projects being led by non-government institutions. A realistic assessment of such problems should be made as early as possible. Once capacity has been assessed, every effort should be made to establish working partnerships at all levels of the decision-making and implementation process, and to help build the technical capacity of national and local institutions and groups to implement activities. Assessment of capacity can be a very delicate process and should be approached with sensitivity. Ensuring continuity in projects in Guinea-Bissau, Nepal, Niger and Uganda depended on the extent to which the project acted as a facilitator rather than implementer, on how it worked through partnerships, and helped build the technical capacities of national and local institutions and community groups.

An Exit Strategy for the Mount Elgon Project, Uganda

One aim of all ecosystem management projects should be to reach a point where long-term objectives of the project can continue to be achieved in the absence of further outside financial or technical assistance. Thus, from the outset, every project should have a built in exit strategy designed to ensure that necessary management actions do not cease because a project is formally terminated. The ideal end-of-project situation is where the objectives and activities of the project have become integrated within other national sustainable development actions to the point where the identity of the project diminishes. In the case of the forest project for Mount Elgon (see Boxes 2, 16 and 23 for more information), there has been a continuing effort to research, design and implement a series of community-based income-generating activities that can be self-sustaining. Local communities have field-tested several generations of these activities in an attempt to ensure maximum programme sustainability once the project has terminated. This has been time-consuming, but has been invaluable in contributing to the programme's exit strategy.

Tourism Revenues can contribute towards Economic Viability

In Nepal, the Annapurna Conservation Area Project provided training in ecotourism. The increased revenue derived from tourism (from 7% of the project budget in 1987 to 30% in 1996) is largely attributed to the dramatically improved tourist products and services that resulted from training provided by the project. Since the revenues remain within the area, they help cover ongoing management costs.

By contrast a detailed assessment of costs and benefits of the Keolado National Park, India, revealed that through their involvement in helping to manage the park's ecosystem the local communities were actually subsidizing the costs of visiting tourists. The main beneficiaries of increased tourism were tour operators and owners of guest houses – all located outside the park and none of whom contributed to the cost of managing the protected area (see also Box 13).

5.2.2 Defining the boundaries, scope and time scale

Defining the boundaries around a project imposes limitations but makes the project manageable. Sometimes this will require technical guidance. Boundaries which should be considered and issues concerning them that should be addressed are given below.

✔ Project boundaries, scope and time scale

Physical boundaries

- What areas of land and water should lie within the project area? Does the area make up an integral ecosystem unit?
- Does this area cut across any major ecological types or boundaries? If so, is this significant in terms of management?
- What are the likely environmental influences from outside? Are these major influences and, if so, should the boundary be extended to include them, or can they be dealt with as an externality?
- Does the area cut across any major social groupings? If so, is this significant in terms of ecosystem management? Should the project include those left out or include them in a later phase?
- Does the area cut across any political or administrative boundaries? Could the project area be extended so that it has greater ecosystem integrity? Will the bureaucratic hurdles be too great if this is done? Is it possible to create two complementary and co-ordinated projects on either side of the political or administrative boundary to achieve greater ecological integrity?
- Is the optimum size of the area – from an ecosystem perspective – too large to be manageable? Will the terrain and questions of access limit the project's effectiveness over a large area? Should it be broken down into a series of more manageable units with similar ecosystem objectives?

Scope

- Does the scope of the project fall within the overall national sustainable development strategy?
- What are the main issues that the project will address? Are there any linked issues that have been left out, and will these omissions jeopardize the success of the project?
- What are the options for management? What constraints are imposed by the structure, composition and location of the ecosystem, and by past and current human impacts?
- Are there any conditions or situations outside the control of the project, but which may affect it? What has been done about these?
- Is ecosystem management the main focus of the project, or a component within a larger development project? If it is just a component, how should ecosystem management principles influence the design of the overall project?
- Is there a strong sectoral focus, e.g. fisheries or forestry? If so, how should the linkages with other sectors be explored adequately and the scope broadened to encompass any major linkages, e.g. with wildlife or tourism?
- Is the focus too diffuse, and can the ecosystem management goal and objectives be made more explicit?
- Are indicators of success or failure sufficiently detailed to assist in achieving the outputs and/or triggering corrective action?

- Is there an adequate balance between the technical and social dimensions of the project?

Time scale

- Is the proposed time scale realistic in terms of ecological processes and functions? Will rehabilitation initiatives have had sufficient time to become established, or for success to be demonstrable?
- Is the proposed time scale realistic in terms of social and institutional capacity to absorb and master the skills required? Is there sufficient time for attitudes to change, e.g. with respect to community participation in management of natural resources?
- Is the ideal time scale manageable in terms of social, political and donor commitment? If not, would it be possible to design the project in more manageable phases?

5.2.3 Meeting preconditions and minimizing risks

Methods of risk analysis should be used to identify the most critical assumptions and risks for ecosystem projects, and through answering the following key questions:

✔ Key questions in risk analysis

- Is there enough scientific and other knowledge available to proceed directly to the design of field activities? If not, a dedicated survey, information gathering and experimentation phase may be necessary.
- Will the project have significant environmental or social impacts? Even environmental management projects may have adverse impacts. It should be subject to the same environmental (and health) impact assessment criteria as other development projects.
- Has there been previous contact with the local communities? If not, a preliminary consultation phase may be needed to build confidence and good working relationships between the project and the local people.
- Are there legal barriers which may prevent satisfactory implementation of the project activities? For example:
  - Wildlife and environmental legislation which may not be compatible with the sustainable use of natural resources;
  - Land tenure and access to natural resources for local communities – if security of land and access to the benefits is not clear, local communities cannot be expected to take responsibility for management; and
  - Legal boundaries of a protected area which are not clearly defined, making implementation of management measures difficult.
- Do the partner institutions have the capacity to start implementing various project activities? Is a preliminary training phase nec-

essary? Should capacity-building be a component right through the project?

- Are there other institutional barriers, e.g. the responsibility for management lying with an inappropriate agency? An initial phase of the project may be designed to produce a legal and institutional profile and to prioritize urgent changes in legislation. An initial phase may also be needed to sort out more appropriate institutional mechanisms.
- Have sufficient tests been carried out on the methods for rehabilitating degraded ecosystems? Should a pilot phase be used for testing such methods or for introducing exotic species?

Box 29 illustrates how in Guinea-Bissau the knowledge base was augmented to help in project design and how local communities in Bolivia assisted in improving the information needed for project formulation.

Box 29. Improving Information

Filling the Knowledge Gaps for Coastal Zone Management in Guinea-Bissau

In developing a coastal zone management plan for Guinea-Bissau, it transpired that a key to future success would be a good knowledge of the resource use patterns by the diverse ethnic groups living there. Another key to success was to develop a good understanding of the various aspirations of different community groups, the technologies they employed for using resources and their willingness to adopt new strategies and practises. As a result, a significant investment was made in social analyses carried out through partnerships with research institutions from within and outside the country. Comparatively less effort was invested in biological and zoological surveys. Due to the intricacies of the resource use patterns by the Bijogo people and the complexity of their social and cultural features, it took almost seven years to produce a zonation plan for the Bijagos Archipelago Biosphere Reserve, which covers over 80 islands.

Improving Maps, Inventories and Annual Forest Censuses with Local People in Bolivia

The community forest management project of Lomerio (Bolivia) seeks to assist the Chiquitano community in developing sustainable forest management practices. Initial efforts in 1984 focused on developing inventories of natural resources in 60,000 ha of forest. This led to the progressive definition of management strategies in 1994. These promoted reducing damage from logging, increasing forest productivity, and promoting a series of community-based activities including the construction of a sawmill, establishment of nurseries and tree plantations, agro-forestry projects, and the production of honey and other non-timber forest products. One of the problems encountered was that early surveys and maps did not adequately illustrate land-use patterns, forest types and their composition and productivity, or the wildlife values of various areas. Subsequently, however, through years of cooperation with local communities in gathering information and contributing to annual censuses it has been possible to improve the information base considerably. The Rural Intercommunity Association for Eastern Lomerio (CICOL), representing the local communities, and its partners, has built on these improvements to produce more effective community-based management strategies. Ten years after project initiation, land consolidation to strengthen access rights of indigenous people is much less of a problem than before, conflicts with outside forest companies are basically non-existent, and regeneration of key species is widespread, especially on abandoned lands.

5.2.4 Indicators for success – building in monitoring and evaluation

Flexibility should be a key feature of the philosophy of ecosystem management project implementation and monitoring. A programme for monitoring the success of project activities and the state of the environment should be developed, capable of informing project managers and adapting implementation to a constantly changing situation. With better knowledge of the biophysical, ecological, socioeconomic and institutional conditions, the initial indicators chosen to reflect progress may also have to be adapted.

A well-designed monitoring system should allow for regular adjustments of the project goal, objectives and activities in the light of successes achieved and errors made in the course of project implementation, as well as to reflect changes in the conditions of the environment. Donors should view such regular adjustments as a key component of project management that provides an indication of the project capacity to plan responsibly, and to adapt the objectives constantly to ensure that the long-term vision of the project is maintained. Therefore, in developing projects particular attention should be given to:

✔ Key themes of project monitoring

- Describing the tasks involved to ensure adequate monitoring; and
- Allocating the necessary time and resources for these tasks to take place.

Ecosystem management projects have often made a point of working with local people to develop a monitoring system which can be used by them. Local groups will be more likely to collect information which they can analyse and use themselves in managing the ecosystem. The same information can be used by the project to complement other monitoring activities. General criteria for choosing ecosystem management indicators are:

✔ Criteria for choice of indicators

- Relevance or cause/effect linkage to the issue concerned;
- ability to show changes within the timeframe;
- value in indicating the successful output of the desired products;
- speed of analysis and feedback to project managers;
- ease of measurement; and
- cost-effectiveness.

Summarized below are four main types of success indicators that should be considered.

Those relating to **practical and visible project outputs.** These can be assessed easily by the project staff and outside visitors. For example:

- The production of maps describing ecological patterns, including distributions of key species, centres of biodiversity, and resource-use potential;
- the production of land use maps;
- the adoption of a decree by the Council of Ministers;
- the number of boats built to provide support to small-scale fishermen;
- the establishment of a community NGO responsible for overseeing a new management regime for a given buffer zone; and
- the number of training courses implemented.

Those that check the **progress made in changing existing resource use practices.** These indicators cannot be easily assessed on a one-off basis unless the project benefits from a sound research plan and from a monitoring system designed to keep these truly strategic parameters in view. For example:

- Improvement in the status of a given species;
- an increase in the productivity of a particular resource;
- the amount of human migration into and from the project area;
- changes in the access rights to a specific piece of land; and
- changes in development indices.

✔ Categories of indicators of success

Those relating to the **state of ecosystem health.** For example:

- Changes in **biological diversity** (e.g. through aerial surveys of wildlife in a grassland savannah, or through selective sampling of different forest species);
- Changes in **food chain characteristics** (e.g. through regular assessment of the densities of herbivores and carnivores – often a more difficult task;
- Measurements of **ecosystem productivity**: this may require a large sampling effort, even for a relatively small ecosystem (e.g. monitoring changes in floodplain vegetation along a 30km transect will require the commitment of a specialized team over several years); and
- Assessment of **ecosystem functions**: this may be necessary, in addition to the above, since adequate biodiversity and productivity cannot be considered reliable proofs that ecosystem functions are not being degraded. Likewise, important ecosystem functions (such as groundwater recharge and discharge in a floodplain ecosystem or water quality in a forest ecosystem) can be maintained (and even enhanced) despite a depletion of key wildlife species.

Those relating to **attitudes, awareness and behaviour**. These indicators are even more difficult to assess without effective monitoring, although they clearly reflect progress made towards modifying the behaviour and practices of one or several interest groups. For example:

- Changes in the understanding of sustainable resource use issues in specific rural communities;
- Changes in awareness on conservation and development issues of a given group of decision-makers; and
- the effective devolution of decision-making in resource use practice to a specific target group.

Success indicators should be selected from the four types outlined above, with the understanding that the relative importance of a given type of indicator may vary through time, with a growing importance of the latter two categories. In any case, individually or together, success indicators must be chosen to provide an insight into the sustainability of project results, looking several years ahead, especially after the end of the project itself. Too many projects have failed to be sustainable because indicators were chosen to test only their most visible outputs, and consequently did not guide project managers to deal with the root causes of environmental degradation (e.g. outdated policies, poor planning capacities of stakeholders, and lack of awareness and education).

Testing for long-term sustainability, which may be required for external evaluations, will mean making an informed analysis of the adequacy of project activities in alleviating the fundamental causes of resource degradation. An assessment also needs to be made of the effectiveness of the project in implementing ecologically sound and economically viable sustainable development alternatives. Assessing sustainability will require analyses of, for example:

✔ Tests of long-term sustainability

- the level of understanding – by stakeholders and project staff – of ecosystem functions and benefits;
- the amount of knowledge accumulated on the conservation values of the area, and on the most important threats to ecosystem integrity;
- the amount of knowledge accumulated on the social, cultural, economic and political conditions under which the project operates;
- the capacity of the project to address newly detected threats, and to implement corrective actions in co-operation with stakeholders;
- the rate at which disciplinary, sectoral and cultural "blinkers" are removed;
- the speed at which new knowledge and technologies are transferred;
- the growing ability of the administration and the non-governmental sector to work together to address conservation and development issues;
- genuine participation of communities in the management of specific or newly-restored resources;

- the project strategy for its evolution – from being an executing agency to becoming a support service assisting its partners in implementing the activities themselves; and
- the quality of the processes set in place to secure long-term mutual trust among the broad range of stakeholders.

5.2.5 Drawing on community involvement

Two major lessons emerge from several case studies:

✔ Lessons in community involvement

- the involvement of communities in ecosystem management can be a long and difficult process but, once started, changes can happen quite quickly as the communities build up experience; and
- the presentation of ready-made packages for communities to take up and use, simply does not work. Such packages are invariably inappropriate. Due to the absence of prior consultation, they are almost certain to omit important aspects relevant to the specific community and project.

For project formulation, it is not necessary to specify the details of project activities which draw upon community involvement. However, activities will be better focused if developed jointly with communities and, therefore, it is necessary to indicate that:

✔ Key messages for communities

- there will be activities which will be designed for, and with, community involvement;
- these activities will be identified during the course of the project implementation, through active participation of the local communities; and
- an initial choice has been made for the methodologies to be used for identifying needs and appropriate activities.

5.2.6 Partnerships – which organization plays what role?

Ecosystem management requires wide participation with many partners, and shared responsibilities. Institutional arrangements and the key role of coordination between the different partners have to be sorted out during the project formulation stage. The example of CAMPFIRE in Zimbabwe (see Boxes 14 and 27), shows the roles of different partners, and how its success is built upon the dependence on each institution. Experience from additional case studies points to the following lessons:

- Reliance on one organization, with few experts, to carry out all the project functions is a risky strategy, since if that organization fails to deliver, the whole project may be jeopardized; and

- most successful projects have one fully-committed (governmental or non-governmental) organization which facilitates the process and involves other partner organizations, generating their commitment through action and coordination. The most important features of the coordinating organization are:
- **legitimacy**: it should be recognized as an effective facilitator;
- **transparency**: all partner organizations should be able to see and understand the decisions taken; and
- **openness:** it should be prepared to listen to, and accept, the positions of the majority, where appropriate.

✔ Lessons about partnerships

Coordination does not mean giving orders to the partner organizations, but arriving at informed decisions in collaboration with them and relying upon the partners to implement these decisions.

An institutional analysis of the proposed partner organizations should be undertaken, focusing on the capacity of the partners to become involved in the project and to deliver the relevant outputs. The analysis should include the components listed below.

- **Overall aims and objectives** of the (governmental or non-governmental) organization and the sections likely to be involved. Project formulators should be aware of any possible conflicts of interest between these aims and objectives, and those of the project.
- **Human capacity** – overall and of those sections involved in the project. This part of the analysis should focus on both the number of staff available and their level of expertise.
- **Previous experience** is also important, especially in the facilitation of public participation. There are many excellent, technically-oriented organizations which may be inadequate in this aspect of ecosystem management and feel threatened by the implications.
- **Current and future workloads**. Will the organization be able to take full responsibility for its part in the project, or is there a risk of it becoming diverted onto other activities?
- **Attitudes of personnel.** Will the personnel need training in and orientation towards the approaches used in ecosystem management projects?
- **Training requirements**. Whatever the skills of the organization, it is likely that some forms of staff training will be required, either on-the-job or in specialist courses. Early identification of these requirements will enable the project to be formulated more precisely.
- **Additional personnel required.** Does the organization have the contacts and capacity to hire additional personnel in time for project implementation?
- **Communication and coordination capacity.** Does the organization have good internal and external communications? This should

✔ Institutional analysis of partner organizations

include both the physical communication methods and the willingness to communicate both internally amongst its staff and with outside organizations.

Box 30. Learning by Doing

Learning by doing in the Aga Khan Rural Support Programme, Pakistan

The Aga Khan Rural Support Programme was started in 1982 to assist long-term sustainable development through maximizing the productive capacity of the arid mountain areas in the north of the country. Activities aimed to improve social organization, develop skills and generate income. Although operational principles have always been clearly defined, the project is committed to the philosophy of learning by doing, by which the implementation of activities is based on experience, and on lessons learned from past mistakes. This requires a coherent system of monitoring and programme reviews based on meetings and workshops involving local communities and staff. The participation of villagers at all stages of implementation and in the evaluation of activities has contributed to the creation of a shared planning framework in which farmers are given an opportunity to think about issues and to reach a consensus on the activities to be undertaken. As a result, target groups are more likely to trust project interventions, since they know that their opinions will influence the implementation process through monitoring and feedback mechanisms in which they participate.

Learning by doing in the Nepal-Australia Community Forestry Project

A key feature of the Nepal-Australia Community Forestry Project, initiated in 1978, is its learning by doing approach to ecosystem management rather than being "target driven". Based on progress reports, and taking account of monitoring and evaluation results, indicative targets are established annually through a consultative approach. The in-country project team makes the bulk of decisions regarding project management. In this case the donor and recipient agency have devolved the responsibility for decision-making to the project, but retain a major role in six-monthly evaluations aimed at discussing and agreeing policy and management changes.

Evaluative Culture: the Case of the Non-timber Forest Products Project, Philippines

The Haribon project in the buffer zone of Saint Paul's National Park, Palawan (Philippines) has fostered community-based management of non-timber forest products as a means of enlisting Tagbanua and Batak tribal minorities to participate in sustainable ecosystem management activities. One of the most significant features of the project was to develop an evaluative culture which encouraged project staff and interest groups to continuously scrutinize the quality of project objectives, activities and processes, to assess outputs and suggest ways of improving them. Continuous monitoring and evaluation of project activities was another prominent feature. Monitoring was conducted during village-level participatory assessments, staff meetings and more formal internal reviews. The result was the development of a capacity for local communities and project staff to think and learn quickly about corrections and refinements that needed to be implemented.

- **Managerial capacity and style**. Is the organization very hierarchical in structure, thus inhibiting independence in decision-making and making it rather inflexible? Since ecosystem management depends upon flexibility, this may be an important criterion.
- **Financial control and absorptive capacity**. Has the organization dealt with this size of project before and managed a level of financial complexity similar to that expected? How reliable are its financial control systems? Can the organization absorb the sums of money proposed and use them effectively in the time? Too much money over a short time can be as damaging for a project as too little money.

This sort of analysis should be applied to all potential partners. The real purpose of such an analysis is to identify the institutional risks to the project and, thus, apportion the different roles appropriately. It is also important to engender openness and an attitude of "learning by doing" amongst all organizations involved, and to build their capacity to fulfil these roles. Box 30 illustrates the learning by doing process in Pakistan and Nepal, and development of an "evaluative culture" in a project in the Philippines.

Partnership building is an iterative process. It is better to start small, asking partners to carry out tasks that are within their capabilities, and to build slowly, so that mutual understanding of complex relationships between organizations and groups can be encouraged.

5.2.7 Funding design and donor strategies

Experience indicates that most ecosystem management projects have a variety of donors, including large international funding agencies, bilateral aid agencies, and international and national non-governmental funding bodies. Listed below are a number of key points that designers of ecosystem management projects should bear in mind with relation to funding and donors.

✔ Key points in funding design

- Since ecosystem management projects are likely to take a long time, donors need to be committed to the project for a long period.
- Ecosystem management projects usually require smaller amounts of money over a longer period, than a large sum over a short time. The phasing-in and phasing-out of donor support should be considered, to ensure minimum disruption at the beginning and end of sustainable projects.
- Since there are often several options for ecosystem management, there is always a risk that a demand will build up for changes in the project before the initial plan has begun to generate the expected benefits.
- It may be appropriate to divide the initiative into separate, but connected, projects so that different donors can take individual components. However, this may lead to support for parts of the programme while other equally fundamental parts remain without funds and hold back the overall achievement of the objectives.
- Larger initiatives should aim to arrange a consortium of committed donors, with an annual review and regular flow of funds, according to the work programme submitted by the project and agreed with the donors.

- Donors should accept the principle of adaptive management and not be too rigid about fixing detailed outputs at the beginning. Project proposals should give the broad outline of the goals, objectives and methodology, with a rolling programme of outputs defined through consultation with local communities.
- Donors which are unable to be flexible are unlikely to be suitable, and should be avoided in order to minimize wastage of time and effort. Some local organizations have become dissatisfied with particular donors, especially those which show a lack of understanding of the issues, introduce bottlenecks and delays into the approval process, and appear unnecessarily bureaucratic. Some NGOs have refused to work with some major multilateral and bilateral donors because they appeared to lack the capacity for flexibility.
- The donors' expectation of the capabilities of the local organizations should be realistic in terms of what the organizations can deliver. The initial institutional analysis must be used to gear the project to the capacity of the implementing organizations, rather than to the wishes of the donor (e.g. for faster or broader delivery of the outputs).

The Aga Khan Rural Support Programme in Pakistan (Box 31) shows how donor strategies succeeded in one case.

Box 31. Relationships with donors in the Aga Khan Rural Support Programme, Pakistan

The Aga Khan Rural Support Programme (AKRSP) has developed an overall programme of activities for which it receives funds from a number of different international multilateral and bilateral organizations. While these donors support separate sectors and regions within the overall programme, they all participate in annual Joint Monitoring Missions. This provides the donors with an opportunity to evaluate AKRSP activities based on their individual interests and, at the same time, gives AKRSP an opportunity to learn from the members of the Joint Monitoring Missions. This close cooperation and coordination has helped to ensure a continuity in funding so the overall programme of AKRSP remains coherent and not fragmented.

5.3 PROJECT APPRAISAL AND APPROVAL: EVALUATING ECOSYSTEM-BASED MANAGEMENT ELEMENTS

Project appraisal ensures that the project has been designed correctly and that it is ready to go ahead for final approval for funding and implementation. **Both appraisers and donors approving the project should understand the principles behind the ecosystem management approach.** For sectoral projects that have incorporated these principles in their design, the appraiser should check whether the principles have been correctly applied. Prior discussions with the donors should aim to create an understanding to facilitate the process of timely approval.

Appraisal should include a review of the goal and objectives, the outputs, and the indicators of success which have been identified. In addition to normal project appraisal procedures, key questions which should be asked are listed below.

✔ Questions for project appraisal

- Does the project address issues of ecosystem integrity and maintaining ecosystem functions?
- Do the project boundaries and/or zonation encompass the relevant ecosystems, biomes and habitats, within the limitations of political and administrative borders? Have adequate steps been taken to deal with issues affecting the ecosystem but arising outside the project boundaries?
- Does the project promote the optimal blend of sustainable resource uses in the local context?
- Have human communities been included as a fundamental part of the ecosystem? Are there adequate techniques and resources for involving stakeholders and local people?
- Is the project design flexible enough to manage the inevitable changes which will occur? Will it generate an environment of learning by doing within its partner organizations?
- Does the project draw adequately upon scientific and local knowledge systems to inform adaptive management of the natural resources? Have appropriate indicators and monitoring systems been chosen to highlight ecosystem changes and success in achieving the objectives?
- Does the project involve all the relevant sectors and disciplines? Are there adequate mechanisms for coordination and collaboration between sectoral agencies? Are the roles and responsibilities of government, private sector and NGOs clearly defined?
- Is the project environmentally and socially benign? What environmental, social or economic changes will result from project activities? Does the project conform to the best operational standards for environmental assessments?
- Has sufficient time been allowed for successful achievement of the ecosystem management objectives?
- Are the institutional arrangements and capacity building activities realistic?
- Are there any legal or institutional risks or barriers to achievement of the objectives? Would the project be better phased, to separate out and provide a discrete focus on minimising these risks, or to undertake activities sequentially?
- Does the project clearly define an exit strategy, or an end point in terms of institutional and financial sustainability, to enable the process of ecosystem management to continue after the end of the project?

5.4 PROJECT IMPLEMENTATION

Key concerns in implementing ecosystem management projects include:

✔ Key issues in project implementation

- **the length of time** allocated to the project, to achieve an impact on the health and integrity of ecosystems, is a vital element. Improved ecosystem management and natural habitats restoration may require 10-15 years of work before clear results are apparent;
- **staff competence and commitment** is perhaps the next most important prerequisite for success;
- the **creation of a network of partner agencies and interest groups**, which will progressively take on the implementation of project activities, is vital. This will prevent the project becoming an established institution with its own agenda; and
- **political, institutional and community support** must be secured to fulfil the project goal and objectives.

Project implementation can be categorized as a succession of different, sometimes overlapping, stages, progressing towards the stakeholders taking on additional responsibility for ecosystem management. Four stages can be identified in this process, some of which involve several steps, as summarized and explained below.

STAGE 1	a) building a strong project team b) producing the work plan and building the public image of the project c) establishing committees for guidance
STAGE 2	d) choosing project activities e) non-field activities f) capacity-building g) internal reviews – using and adapting monitoring and research programmes
STAGE 3	a) putting the plan into practice
STAGE 4	a) continuation and forward planning b) strategic planning of future initiatives

STAGE 1a. Building a strong project team

Building a cohesive team of committed individuals, with proper understanding of the project's approach and their role with regard to the stakeholders, is probably the most vital work element for Stage 1.

The key characteristic for project staff members is an ability to listen and adapt themselves to the situation, rather than having any particular discipline, background or gender. Having biologists and ecologists on the staff is not always necessary, provided that such technical advice is available from elsewhere, e.g., through a network. Staff selection requires a strategy to ensure that the project has technical expertise in the most important areas of work described in the project document. The appropriate balance should be reached through careful consideration of:

- the relative number of expatriates, and national or regional professionals;
- gender issues;
- the balance between sectoral experts, with generalists having social and cultural sensitivity;
- providing specialist knowledge of local traditions;
- ensuring strong local language capabilities within the team; and
- ensuring strong capabilities in project management, conflict resolution and facilitation.

✔ Balance of skills in project team

Staff training and orientation towards ecosystem management may be needed. This may be an opportunity to assess the capacity of newly-recruited staff, or even to help the final selection process. Sectoral specialists should be trained in community participation, integrated land use planning, and sustainable development issues. All key staff should be trained in monitoring and adaptive management methods.

Staff should be encouraged to take the time to understand the issues at stake and to acquire the right attitudes to the project work. This may take several months, especially for those who have not been exposed to the ecosystem approach before.

STAGE 1b. Producing the work plan and building the public image of the project

The first task of the core team is to produce the work plan, which should be prepared in a participatory and collaborative manner, using logical framework techniques to facilitate problem analysis and planning.

It will often be necessary to define a research plan and to carry out surveys to collect social and ecological data. As far as possible, the project team should collaborate with local academic and research institutions for this, and should use the capacity of local communities to provide baseline information.

The production of the work plan is a unique opportunity to define a clear public image for the project and to communicate it as widely as possible. This is especially important because ecosystem management is a relatively new concept, which may not be widely understood or appreciated. The best project image is one that clearly promotes it as a capacity building and conflict solving exercise, with a group of unbiased experts working in close association with the various interest groups.

Discussion of work plans with the partners helps establish the project image and builds confidence and trust. However, partners' expectations should not be raised, especially not at grassroot level. Project staff should also be extremely clear about the time needed to identify the problems and to design and implement remedial measures. Project staff should be convinced of the need to explain, in great detail, that the natural resources should be better conserved. In doing so, they should establish themselves as good facilitators in the discussions on the value of natural resources and possible ways of achieving wise use.

Care should be taken when ordering equipment to ensure that it is appropriate to the tasks. The use of unnecessarily expensive equipment, unless justifiable, can be detrimental to the public image of sustainable development projects.

STAGE 1c. Establishing committees for guidance

To facilitate the prioritization of activities, project staff should consider establishing various committees, responsible for providing institutional and/or technical support to the project. Committees should be used as a means of ensuring cross-sectoral co-operation. Great care must be taken to ensure that discussions focus on the most impor-

Box 32. Setting up Forest User Groups in Nepal

During the first two phases of the Nepal-Australia Forestry Project, the emphasis was upon "trees first". This was based on the theory that environmental degradation in the Himalayas was caused by deforestation. In the third phase, this theory was disproved and an understanding of indigenous management systems developed for natural forests in the Middle Hills. This led to the development of Forest User Groups (FUGs), through which local communities were empowered to manage their forests.

Forest User Groups are groups of users who have mutually-recognized rights of access and use of forest products and sites within a forest. Members of a community are represented by a committee, which regularly organizes meetings and acts as a contact group for the Forest Department. The third project phase has shifted its emphasis to developing approaches for supporting FUGs to manage forests and undertake rural development activities, such as:

- capacity building, directly through training and indirectly through strengthening the capacity of the Forest Department to support the FUGs; and
- encouraging the development of income-generating activities.

tant technical issues or activities, rather than just dealing with administrative and operational issues. Steering/technical/partners' committees can also fulfil a useful advisory role in guiding decisions on activities at the central level, thus providing the project with the necessary political support from the highest decision making level. Local committees of resource users and traditional authorities should also be set up to guide project activities in the field (see Box 32).

STAGE 2a. Choice of project activities

✔ Criteria for choosing project activities

Analysis of the data collected by the ecological and socioeconomic surveys initiated during Stage 1 will progressively lead project staff and partners to identify the practical activities necessary to address the issues under consideration. In stage 2, project staff need to prioritize their activities according to a number of criteria. Examples include:

- Are activities policy- or management-oriented?
- Should the activities concentrate on a few activities and/or only on those activities which are most likely to succeed?
- What missing data needs to be researched?
- Should activities offer:
  - obvious alternatives to the most pressing detrimental resource use;
  - the transfer of appropriate technologies to grassroots communities;
  - a significant training component;
  - straightforward development solutions to the most pressing needs of the poorest communities; or
  - a potential for ecosystem rehabilitation?

The project should focus on district level institutions and communities to guide this choice, rather than following an internal project agenda. As in Stage 1, consultants may be brought in to advise on ways of solving sectoral issues and of designing specific activities. However, these consultants should be strategically selected to prevent waste of time, energy and resources.

STAGE 2b. Non-field activities

Most activities will be designed to address resource degradation in the field or to promote positive conservation and development outcomes, but the project may also need to address bottlenecks at the central administrative level, which prevent adequate resource management. A strategy needs to be designed for alleviating such bottlenecks as:

- a lack of understanding of resource use issues amongst decision makers;

✔ Potential bottlenecks

- the way in which land tenure systems inhibit wise use of natural resources; and
- the lack of responsibility for local resource management at regional/district levels.

The project should ensure that future management regimes do not oppose current legislation. A review of existing environmental and natural resource legislation may be needed, and examples of new management regimes may be used to illustrate the practical benefits of modifying the existing legislation and its associated by-laws.

STAGE 2c. Capacity building

Implementation of the capacity-building and training programme is an important task at this stage. Project staff should ensure that provincial and local institutions, and other technical partners, can actually carry out a growing number of priority activities. Formal and field-based training, designed in the light of the earlier training needs assessment of key institutions, should be provided to partners by senior staff and consultants.

In addition, an understanding of the training needs of villagers should be carried out and training sessions provided on subjects such as:

✔ Training for villagers and local institutions

- local legislation;
- literacy and numeracy;
- preventive health and sanitation;
- sustainable management techniques;
- sustainable agriculture; and,
- appropriate product marketing techniques.

STAGE 2d. Internal reviews – using and adapting monitoring and research programmes

Internal reviews are part of the project internal monitoring system, and should take place every six months (or **at least once a year**) to provide an opportunity for discussion, within a wider group, of the results of ongoing monitoring. This type of review is used to analyse the output of each project component with all partners concerned, and to adapt future activities (e.g. the work plan for the following year) in the light of the results of a technical and highly participatory mechanism. Internal reviews are an essential tool for strengthening the overall project capacity to plan and implement activities in a manner which the target groups will find coherent.

As field action unfolds, performance indicators may be adapted to ensure that they reflect the knowledge gained in the first 12-18 months. Assessment of the partners' capacities will play an important role in reviewing baseline indicators and in producing an improved monitoring programme. Similarly, discussion within and outside the project will have provided the technical basis for the definition of an appropriate research programme. Senior staff should use decision-making tools, such as framework analysis, to structure the research plan.

STAGE 3. Putting the plan into practice

Stage 3 is devoted to making the conclusions of the intensive planning work (Stages 1 and 2) a reality in the field. If policy reform is required for project success, these conclusions should also be translated into reality at the central policy level. The following conditions should prevail:

✔ Conditions for effective project implementation

- a series of practical solutions, to alleviate resource degradation and/or to promote positive management outcomes will have become apparent through the results of a blend of integrated, cross-sectoral conservation and development activities undertaken by partners and guided by well-established committees;
- a better understanding should have been gained of the factors reflecting sustainability;
- project staff should have become fully capable of distinguishing those activities which are ecologically sound, and economically and structurally viable, from those which are less likely to be sustainable;
- the project's capacity to plan, implement and react to obstacles in the most flexible manner should have been demonstrated;
- the monitoring system, including strategic reviews and internal evaluations, should be sufficiently well-established to assist project staff in making decisions about adjustments to project activities;
- the project should have developed its own evaluative culture, leading to timely, strategic decisions on the implementation of priority activities. Managers should bear in mind the fact that there are no ready-made solutions, and that efficiency must rely on constant micro-adaptation of the management measures implemented at each site; and
- the project should have a clear view on the need for further specialist training in order to achieve the progressive devolution of responsibilities to the stakeholders.

The project should avoid becoming an institution in its own right, as this would jeopardize its flexibility and prevent the proper delegation of responsibilities to key partners. It would also reduce

the project's capacity to produce unbiased, relevant strategies, resulting in reduced overall sustainability of project activities. Therefore, the project should make all possible efforts:

✔ How to avoid projects becoming institutions

- to develop effective partnerships as a positive project outcome;
- for the donor-funded expert/expatriate input to remain a small coordinating unit with a finite life;
- to reduce the risk of over-institutionalization by making appropriate use of the various agencies and of outside expert networks (which may have to be created); and
- to use project funds mainly in the field (preferably through partners) and not to fuel an oversized project administration remote from the original project goal and objectives.

At the end of Stage 3, the experiences of the project should be significant enough for a worthwhile external evaluation. External evaluations must be planned and budgeted to occur, on average, every 2-3 years in the project cycle. They should carry out a thorough, in-depth review of the overall project concept, its long-term goals and the methodologies that have been developed.

Detailed project evaluations will assess:

✔ Concerns in project evaluation

- the continued relevance of the project design in the light of current environmental, social and economic conditions (i.e. are the problems and opportunities which influenced project design still the most important ones?);
- the adequacy of the overall approach and the implementation strategy adopted by the project and its partners;
- project outputs in relation to the implementation of sustainable management regimes in the field and, in terms of management guidance, policy advice and advocacy at the broader institutional and political level;
- the project's ability to strengthen the partners' management capacity adequately; and
- the effectiveness of financial management procedures.

Project evaluation can lead to major changes in the project objectives and activities, with implications for budgetary allocations for specific project components. All the stakeholders, directly or indirectly connected to the project, should be included in discussions, and their activities and performance subjected to scrutiny.

The evaluation team should consist of outside, independent specialists or facilitators, responsible for ensuring the quality of the conclusions reached, through a fully independent and participatory

process. To ensure the widest possible participation, and to foster openness in the discussions, external evaluations should not address in any way the need to continue or discontinue the project. Such options should fall within the remit of a subsequent strategic planning exercise. A clear distinction between evaluation and strategic planning is therefore essential.

An external evaluation will provide independent advice on those activities that must be forcefully pursued, and those which could be terminated. The recommendations should be used to adapt the work plan for the following stage, and as the basis for an in-depth review of the long-term goal and objectives of the project, together with key partners.

STAGE 4a. Continuation and forward planning

Schematically, Stage 4 can be divided into two parts:

- continuation of project implementation, based on the recommendations of the external evaluation and subsequent discussions; and
- planning the next phase of the project, if required. This may have evolved from the previous phases or may come as a request from the donor agency.

The need for a follow-up project should be assessed in the light of:

- the continued relevance of the project objectives and approach;
- the success of the project in meeting its objectives;
- the capacity of the partner organizations to carry on ecosystem management activities without outside technical support; and
- the success of the exit strategy in allowing for easy transition to self-financing activities and withdrawal of outside funds.

✔ Need for a follow-up project

Towards the end of the project, there is often pressure to complete the agreed series of tasks and to fulfil the success indicators. However, if a further phase of the project is needed, staff and partners should take time to discuss the structure and content of the documents for the next phase.

STAGE 4b. Strategic planning of future initiatives

Ideally, a strategic planning exercise or workshop involving donors and stakeholders should follow the external evaluation. New proposals from the project and its partners should be presented to all potential donors and supporters, with a view to reaching an agreement on the programme and budget for the following phase. After agreement has been reached, project staff should take the lead respon-

sibility for collating inputs for the new project document from the relevant partners, and for editing the various drafts for consideration by the relevant institutions and donor agencies.

Donor agencies must play a major role in strategic planning exercises, since this is an opportunity to make the project more responsive to the needs of implementing partners, and to clear up any conceptual misunderstandings. Since long-term planning should rely on a good knowledge of the successes, failures, opportunities and obstacles encountered by the project, strategic planning exercises should not be scheduled too early in the life of the project. Usually at least 3-5 years is needed to acquire adequate knowledge of the conditions in which the project operates. Since in-depth strategic plans are costly and time-consuming to produce, special attention should be paid to their timing in the project cycle.

All project partners should be involved in the preparation of documents prior to, and during, the planning sessions. Key participants include:

✔ Key participants in strategic planning

- various project committees in which government and non-governmental representatives are present;
- stakeholders, including the local communities concerned; and
- project staff.

Participants should use the results from earlier external evaluations, and any additional studies and surveys considered necessary, to articulate the new project vision. This should include the choice of long-term options (encapsulated in a five-year master plan), the future project components (described in a mid-term development plan) and the activities presented in the first annual work plan. Concerns that should be addressed are given below.

✔ Key elements in strategic planning

- Full transparency, good knowledge of the constraints at the institutional and field level, a capacity to be realistic about expectations for both the project and its constituency, and a good understanding of how to match technical innovations and cultural characteristics, are essential prerequisites for a successful strategic plan.
- Programmes and activities must be clearly agreed between all project partners, who must distil from the discussions a common agenda for cooperative actions. No donor or partner should use this opportunity to impose its own institutional agenda.
- Donors and project staff should ensure that strategic decisions are kept as flexible as possible, to ensure that management initiatives can continue to adapt to the evolving ecological, social and economic parameters.

6

Further Development of Ecosystem-based Management

When ecosystem management is adopted as a concept, and the principles and tools described in this guide are put into practice, both conservation and development practitioners will be able to take into account the interactions between plant and animal species, their physical environment and human activities within the ecosystem. In short, they will be able to manage ecosystems more effectively, together with the full range of stakeholders. They will be able to integrate ecosystem management considerations into those projects which have failed, for whatever reason, to include them, and rectify some of the problems which have arisen.

One of the most important characteristics of **ecosystem management is flexibility**. Naturally, the size of the management unit must depend on the extent to which ecosystem processes and human impacts interact, but within those limits, ecosystem management must be prepared to watch for and adapt to changing conditions and needs, rather than sticking to a blueprint.

Second, as emphasised in previous chapters**, ecosystem management is not just about ecological science**. It has much more to do with drawing upon the ecological, economic, biophysical and social expertise available among multidisciplinary teams and networks at all stages in the project cycle. However, management methodologies are likely to improve as ecological and other sciences progress; indeed, ecological understanding may currently be the weakest link.

Third, much emphasis has been placed on **public and/or community participation in the management of the ecosystems** on which they depend. Participation is undoubtedly an essential element of ecosystem management, i.e. recognising the importance of the human interaction within ecosystems. However, it does not mean that community involvement will automatically lead to success. Local communities may be just as uncertain, divided and eager to strip the resources from an ecosystem as other groups. Nonetheless, local com-

munities do have their own expert knowledge and a much greater incentive to sustainably manage their ecosystem, and the combination of scientific and local knowledge advocated by ecosystem management should therefore lead to more balanced management.

Scientific and local knowledge are both important. It is impossible to force ecosystem management upon groups which are intent upon stripping the ecosystem assets for the shortest-term economic gain, e.g. in high-number, low-value tourism activities. This guide will not assist those groups which neglect the principles of ecosystem management to their longer-term environmental cost, although the examples of good practices may influence their attitude towards their environment and its natural resources.

Only a small number of case studies, covering a very wide range of ecosystems, have been analysed here. The small number of case studies in this guide has hindered a comparison between practices which can be applied anywhere, and those with limited applicability. As a result, generalised guidelines have been developed which are applicable to most ecosystems. Guidelines for specific ecosystem types are still needed to meet the specific requirements of managers.

A limitation has also been the focus of the case studies on the positive aspects of ecosystem management. Little attention has been given to the lessons from the failures and mistakes of ecosystem management. A comparison of the mistakes made in the course of projects which have taken the ecosystem approach, and how they have been corrected using adaptive management techniques, would undoubtedly be very instructive. The implication is that a much greater number of case studies will be required both for specific ecosystems, and for illustrating adaptive management. To achieve this, more cooperation and information-sharing between all stakeholders in conservation and development projects is needed, to ensure that projects are effectively monitored and that the lessons learnt are progressively analysed and disseminated.

In addition, only a few examples of large-scale development projects, designed either along sectoral lines or according to ecosystem management approaches, are studied here. This obviously restricts the extraction of lessons from the development-oriented segment of the management community. It is essential that sponsors, designers and implementers of large-scale projects contribute to the development of improved methodologies for ecosystem management in a much more visible manner than is apparent in this guide. This will help to ensure that planned outputs of large-scale development projects become progressively more sustainable.

In order to amend these limitations, experiences in ecosystem management should be documented and shared, especially on those technical areas for which currently only little information is available (for example, the management of coral reefs or high-altitude arid lands). This is especially valid for the following subjects:

- the **loss of functions and services characteristic of ecosystem degradation** often takes place unnoticed until the socioeconomic impacts of mismanagement are clearly apparent. This means that too often corrective action is sought when degradation has already impaired a number of functional interactions in the systems and when remedial actions are technically difficult and financially prohibitive. To better predict the consequences of human actions on ecosystems, much more information on the characteristics of and threats to essential components of ecosystems is needed, especially for the most fragile of ecosystems (e.g. isolated ecosystems or those in arid countries), and/or for ecosystems submitted to high pressures of human activity (e.g. coastal ecosystems such as mangroves). Any such **ecosystem information system will need to include sets of diagnostic tools** to help identify the main natural or man-induced threats to key elements of the ecosystems.

- **Economic valuation** is widely recognised as one of the most important tools to assess the multiple benefits of ecosystems in a natural or modified state, and to guide decisions on the implementation of improved ecosystem management options. However, methodologies and tools are still limited and their adequacy is often questioned. **The development of innovative, simple and clear ecosystem valuation methodologies is therefore needed,** especially on marketable and non-marketable goods, services and functions.

- To a large extent, the effectiveness of monitoring and evaluation procedures relies on the choice of criteria and indicators to measure progress towards sustainable natural resources or ecosystem management. This lies at the heart of adaptive management. Many development and conservation projects are criticised for being over-planned and inflexible. Therefore, **more attention should be given to the planning of adaptive management strategies** and the institutional arrangements to coordinate these, than to pre-planning the activities of the project itself. Furthermore, strategic indicators will need to be adapted to field conditions and the constraints imposed by project budgets. This precludes the measurement of imperceptible or elusive parameters and the installation of costly monitoring systems.

- As new ecosystem management tools become available, implementers of large-scale development projects and sectoral pro-

grammes will need to introduce them into their polices and practices. Since economists and engineers, who lack experience in ecosystem management and sustainable natural resource use, usually design these programmes, much effort needs to be made to increase training opportunities. The **application of ecosystem management principles and tools at different stages of the project cycle is an especially important training topic.** Likewise, managers on the ground should be provided with the necessary training or refresher courses on the planning, monitoring and evaluation of projects so that they can respond quickly and effectively to the changing needs of the ecosystem and the people dependent upon it.

This guide has provided an overview of the lessons learnt from a wide array of case studies, and the reader's attention is drawn to the boxes describing the following, particularly relevant, examples:

- the **Sierra Nevada de Santa Marta, Colombia** for planning and managing stakeholder participation in the development of a conservation strategy based upon ecosystem principles;
- the **Sian Ka'an Biosphere Reserve, Mexico**, for its sustainable use practices in forestry and fisheries;
- the **Rio Grande de Buba, Guinea-Bissau** for integration of conservation and development in coastal ecosystems management;
- the **Ron Palm forests in Niger** for multiple-use of ecosystems in arid sub-Saharan Africa; and
- the **Keoladeo National Park, India** for environmental conflict management.

These examples are in sharp contrast with the devastation of the ecosystem of the **Senegal River Valley** brought about by the failure to apply ecosystem management principles in project development, and the costly retrofitting of the principles needed to restore ecosystem functions and benefits.

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Appendix 1
List of case studies

REGION		CASE STUDY	ECOSYSTEM TYPE	PROJECT TYPE	COMPILER
AFRICA					
Zimbabwe	1	Communal Areas Management Programme for Indigenous Resources (CAMPFIRE)	3	4,5,9,14	David Mazambani
Uganda	2	Mount Elgon Conservation and Development Project	1,2	2,11	Henk Hoefsloot
Kenya	3	Arid and Semi-Arid Land Programmes	5	1,10,13	Ronald Bisset
Senegal/Mali/ Mauritania	4	The OMVS Programme for the Senegal River Valley	6	1,6	Enda (Senegal)
Nigeria	5	Hadejia-Nguru Wetlands Conservation Project (HNWCP) and North East Arid Zone Development Programme (NEAZDP)	6	1,7	Muhtari Aminu Kano
Niger	6	Community Participation in the Ron Palm Forest of Gaya	3,5	2,10,13,14	Bawa Ousmane
Guinea-Bissau	7	Sustainable Use of Coastal Resources	7	8,12	Pierre Campredon
ASIA					
Pakistan	8	Mangrove Rehabilitation and Coastal Zone Planning in the Indus Delta	7	2,3	Peter-John Meynell
Pakistan	9	Aga Khan Rural Support Programme	1,4	2,9,13	Shafqat Hussain
India	10	Wetland Project for Wastewater Treatment and Resource Recovery in the Calcutta Metropolitan Area	6,8	1,3,13,14	Dhrubajyoti Ghosh
India	11	Western Ghats Forest Project	3	2,13,14	Arvind Khare and M. Satyanarayana

REGION		CASE STUDY	ECOSYSTEM TYPE	PROJECT TYPE	COMPILER
India	12	Participatory Management Planning for Keoladeo National Park	6	4,5,11,12,14	Biksham Gujja
Nepal	13	Annapurna Conservation Area Project	1,4	2,5,9,14	Chandra Gurung
Nepal	14	Nepal-Australia Community Forestry Project	1,4	2,13	Michael Nurse
Philippines	15	Sustainable Utilization of Non-timber Forest Products	2	2,14	Andrew Mittelman
Philippines	16	Community Fisheries Programme	7	3,14	Geronimo Silvestre
LATIN AMERICA					
Mexico	17	Sian Ka'an Coastal Biosphere Reserve	7	2,3,12	Arturo Lopez Ornat
Colombia	18	Strategy for the Conservation of the Sierra Nevada de Santa Marta	1,7	7,10	Alejandro Imbach
Bolivia	19	Chiquitano Community Forest Management	2	2,10,14	John Nittler
Brazil	20	Managing the Atlantic Forest Biosphere Reserve	2	7,10,12	José Pedro de Oliveira Costa
EUROPE					
Russia	21	Management of Losinyi Ostrov National Park	8	11,4	Peter-John Meynell
Russia/ Ukraine/ Poland/ Hungary	22	Eastern European Forestry Initiative	4	2	Pavel Sokolov and Ludmilla Vakarenko
REGIONAL					
(Americas)	23	The Migratory Bird Initiative	9	4,11	Roberto Roca
(Africa)	24	Important Bird Areas Project	9	4,11	Peter-John Meynell

LEGEND

Key to Ecosystem Type

1 Mountains; 2 Humid tropical forest; 3 Dry tropical forest; 4 Temperate forest; 5 Arid land; 6 Freshwater wetland; 7 Coastal areas; 8 Peri-urban; 9 Regional.

Key to Project Type

1 Agriculture; 2 Forestry; 3 Fisheries; 4 Wildlife management; 5 Tourism; 6 Energy/infrastructure; 7 Watershed management; 8 Coastal zone management; 9 Community development; 10 Local conservation strategies; 11 Protected area management; 12 Biosphere reserves; 13 Degraded ecosystem; 14 Provision of basic needs.

Appendix 2
Methodology for commissioning and analysing the case studies

The objective for commissioning case studies was to produce a succinct synthesis of the key lessons learnt to date on how to design and implement ecosystem management projects, highlighting the elements which should be included or excluded and what adverse factors need to be mitigated. The case studies were based on a review of the institutional, technical and operational profiles of a selected number of projects which aim to manage natural habitats and ecosystems, ranging from unspoiled and biodiverse-rich ecosystems to degraded and threatened ecosystems.

The case studies were selected to provide a balance of different types and scales of projects in different parts of the world (see Appendix 1). The selection of projects followed a project description list based on several classifications, and compilers were sent detailed guidelines.

1. INSTRUCTIONS FOR TYPES OF INFORMATION TO BE GATHERED

Compilers were asked to gather all available documentation (project proposals, progress and final reports, evaluation reports etc.) and if necessary to conduct interviews with specific target groups: project staff, associated government staff, key informants from major stakeholders, including adjacent communities where possible, and donor staff concerned with the project. If practicable (and applicable), small meetings of key stakeholders could be arranged to discuss aspects of the project, as highlighted in the checklist below.

2. CHECKLIST OF QUESTIONS AND AREAS OF INVESTIGATION

Project design

1) What special features do the ecosystem or habitats considered by the project contain?
2) What are the particular ecosystem problems and issues which the project seeks to address?

3) Why is it important for this particular ecosystem or habitat to be maintained – ecosystem products, ecosystem functions, ecosystem attributes?
4) What mechanisms for ecosystem management were designed and incorporated into the project proposal?
5) What mechanisms for involvement of stakeholders were used in the design process and in the project itself?
6) What were the explicit aims and objectives of the project? Were there any unwritten or implicit aims and objectives? Were there any hidden agendas?
7) What particular ecological principles or approaches were used in the design and management of the project? Some ecosystem approaches are shown below:
   - Regional planning/priority setting
   - Migratory species as indicators for habitat protection
   - Flagship species protection
   - People as ecological elements
   - Local/site specific management
   - Flows between connected areas
   - Broad geographic scope
   - Island biogeography
   - Modified sectoral programmes taking ecosystem values into account
   - Transboundary ecosystem management
   - Integrating biodiversity protection with local production
   - Environmental economic valuation
   - Traditional ecosystem knowledge and management
8) What role did the donor agency play in determining the final project design?
9) What were the institutional roles of the different agencies involved, and was there any significance about the choice of implementing agency (e.g. character and capacity)?
10) What influence did the project size and availability of funds have upon the approach taken and the scope of the project? What aspects had to be left out? Were any novel funding mechanisms developed?

Project management and implementation

1) How are natural resource use conflicts managed by the project?
2) How have the local communities been involved? Is this project the result of community initiative, or an active programme of community involvement, or has it been imposed upon the local communities?
3) How have the different organizations involved in the project been coordinated? How important have communication and coordination been in the management of the project?

4) How important have official support and government policies been in maintaining the effectiveness of the project?
5) How important have public awareness and environmental education been in maintaining the effectiveness of the project? Were these addressed as part of the project?
6) What mechanisms are available for regular assessment of project direction and progress and for adapting the project accordingly?

Project effectiveness

1) What successes did the project have (is it having) in maintaining the ecosystem functions and values? What failures have been experienced?
2) How important were the component parts to the success or failure of the project? e.g.:
   - research and data collection
   - communication and coordination
   - working with networks and partners
   - education and public awareness
   - technical advice
   - infrastructure design and construction
   - ecosystem management and protection
   - rehabilitation of the ecosystem
   - sustainable use of resources
   - community development
   - community participation in planning and management
   - training and capacity building
   - development of incentives and control measures
   - legislation
   - policy and strategy development
   - monitoring and evaluation
3) How important was the size and structure of the project to its effectiveness?
4) To what extent has the project learnt from mistakes and failures? Has it been able to adapt management measures to improve its effectiveness?
5) To what extent is the project sustainable? Have indicators of sustainability been used in assessing the effectiveness of the project? e.g.:
   - monitoring ecological viability
   - maintaining social and institutional capacity to manage ongoing activities
   - maintaining financial viability
6) What mechanisms have been developed for ongoing financing of activities?
7) Has or can the project be replicated or scaled-up? What would be strengths and weaknesses of the approach in the event of scale-up? Would local institutions have the capacity to scale-up?

3. PRODUCTION OF CASE STUDIES

The case studies were drafted according to a set format, and a model case study ("Mangrove rehabilitation and coastal zone planning in the Indus delta") was provided to each compiler. The main features of the set format are presented below:

Case study summary – one single page with details of the initiative and main lessons learnt.

1) Project/initiative title
2) Location and country
3) Project/initiative type
   - sectoral management
   - integrated management
   - protected area management
4) Main habitat/ecosystem types
5) Start and expected completion dates
6) Funding agencies
7) Scale of funding – very small; small; medium; large
8) Implementation agencies
9) Aims and objectives of the initiative
10) Main ecosystem approaches/components/activities
11) Main lessons learnt for ecosystem management effectiveness
12) Main lessons learnt for ecosystem project logistics
13) Main lessons learnt for community involvement

Project description (2-3 pages)

1) Description of the situation and problems addressed – project context
2) Goals and objectives of the project
3) Brief description of the approaches taken, components and activities
4) Evolution of the project
5) Organizations involved
6) Management structure
7) Donors and funding

Assessment (2-3 pages)

1) Key results of the initiative
2) Factors contributing to or hindering the achievement of results
3) Factors hindering the process
4) Adaptations made during the life of the initiative
5) Main lessons learnt for ecosystem management effectiveness
6) Main lessons learnt for ecosystem project logistics
7) Main lessons learnt for community involvement
8) Factors affecting the sustainability of the initiative
9) Factors affecting replication and scale-up

Significance for ecosystem management and key lessons learnt (1 page)

4. EXTRACTING LESSONS LEARNED FROM THE CASE STUDIES

After all the case studies had been received, the project coordinators analysed the case studies and prepared the synthesis, with support from a working group responsible for making recommendations on the main lessons to be included in the report. This stage also involved the production of the detailed table of contents of the report.

IUCN - The World Conservation Union

Founded in 1948, The World Conservation Union brings together States, government agencies and a diverse range of non-governmental organizations in a unique world partnership: over 900 members in all, spread across some 138 countries.

As a Union, IUCN seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

The World Conservation Union builds on the strengths of its members, networks and partners to enhance their capacity and to support global alliances to safeguard natural resources at local, regional and global levels.

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