ologically Sensitive Sites
Africa

Volume VI: Southern Africa

Botswana
Lesotho
Malawi
Mozambique
Swaziland
Zambia
Zimbabwe

Compiled by the World Conservation Monitoring Centre

For

The World Bank

Ecologically Sensitive Sites in Africa

Volume VI: Southern Africa

Compiled by

World Conservation Monitoring Centre
Cambridge, UK

for

The World Bank
Washington DC, USA

The World Bank
1993

Published by The World Bank, Washington, DC, USA.

Prepared by the World Conservation Monitoring Centre (WCMC), 219 Huntingdon Road, Cambridge, CB3 ODL, UK.

WCMC is a joint venture between the three partners who developed *The World Conservation Strategy* and its successor *Caring for the Earth*: IUCN-World Conservation Union, UNEP-United Nations Environment Programme, and WWF-World Wide Fund for Nature. Its mission is to provide an information, research and assessment service on the status, security and management of the Earth's biological diversity as the basis for its conservation and sustainable use.

Citation: World Bank (1993). *Ecologically Sensitive Sites in Africa. Volume VI: Southern Africa.* Compiled by the World Conservation Monitoring Centre for The World Bank, Washington, DC, USA.

Printed by: The Burlington Press, Cambridge, UK.
Cover illustration: Nairobi City Skyline with Kongoni and Grant's Gazelles, RIM Campbell.

Available from: The World Bank, 1818 H Street NW, Washington, DC 20433, USA.

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PREFACE

During the last two decades, there has been growing evidence that environmental degradation in its many forms constitutes a threat of growing significance to economic development. In addition, the rapid evolution of the environmental agenda has led to an increased understanding of the interdependence among economic activities and their environmental consequences, both within and between countries. The economic and physical interdependence between nations is illustrated by the emergence of new kinds of environmental problems, such as the deterioration of the ozone layer, the greenhouse effect, tropical deforestation, and the transboundary movement of hazardous wastes.

The Bank has been active in the field of environmental protection and, in the last decade, has financed numerous projects containing environmental components as well as several free standing environmental projects, which have had solely environmental objectives, such as reforestation, watershed management and pollution control. Through the introduction on new directives on environmental assessment, environmental action plans, forestry policy, the global environmental facility, resettlement, indigenous people and wildlands, the Bank has definitely distinguished itself as a leader in environmental protection.

Despite the above efforts, it became evidently clear that the Bank's response did not match the changing realities in the degree of effort devoted to environmental matters or in the approaches actually used. This combined with a few well publicised cases in which World Bank projects actually had some negative environmental consequences - such as contributing to the destruction of tropical rain forests and posing threats to wildlife populations, indigenous people, and established human settlements, prompted the Bank to rethink and adjust its policies toward environmental management. In its recent reorganisation, the Bank management decided to bring environmental concerns more systematically into the mainstream of its operation by establishing a Vice Presidency on Environmentally Sustainable Development.

This new action reiterates the Bank's commitment to bringing environmental issues into the mainstream of the lending operations and policy work. Partly influenced by global events such as the Rio Summit and from the Bank's own experience in environmental work, there continues to be a general consensus on five priority areas which will require the Bank's special attention and also the attention of its member countries. These include destruction of natural habitats; land degradation; degradation and depletion of fresh water resources; urban, industrial, and agricultural pollution; and degradation of the "global commons". Although these five areas have been addressed in the Bank's operations through various country focused environmental action plans, through coverage of environmental issues in country economic and sector work, and through actual lending operations, there has been expressed concern by task

managers on the availability of environmental information on which to base certain decisions.

This publication is made in response to requests from task managers in the Africa region who wanted to know the location and properties of the ecologically sensitive sites in Africa to which they could refer while implementing Bank projects in the region. This publication is also made to assist task managers to comply with the Bank's Operational Policy Note No. 11.02 on "Wildlands: Their Protection and Management in Economic Development". The publication has been compiled by the World Conservation Monitoring Centre, UK in collaboration with the Africa Environment Division of the Technical Department at the World Bank. It contains the most up-to-date available data and we hope it will find wider application beyond the Bank's operations.

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SECTION I

ECOLOGICALLY SENSITIVE SITES IN AFRICA

A summary of key issues

INTRODUCTION

> *The challenge facing nations today is no longer deciding whether conservation is a good idea, but rather how it can be implemented in the national interest and within the means available to each country.* (WCED, 1987)

> *In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.* (Principle 4, Rio Declaration on Environment and Development, UNCED 1992)

Environmental concerns are much in the news. Drought, poacher wars and civil strife are evident in many African countries, and a general feeling of malaise affects much of the continent. As a result, the natural and semi-natural ecosystems of Africa are having increasing stresses put upon them, and ecologically sensitive areas are being degraded through mismanagement, rather than conserved through effective management. This has serious implications for human well-being, as a wide range of benefits can result from investment in conserving ecologically sensitive areas. The value of such benefits will vary considerably from area to area and resource to resource, but most will fall into one or other of the following categories:

- Fixation of solar energy through photosynthesis, transfers energy through green plants into natural food chains, providing the support system for species which are harvested
- Maintenance of evolutionary processes and genetic variability
- Maintenance of water cycles, including recharging groundwater, protecting watersheds, and buffering extreme water conditions (such as flood and drought)
- Regulation of climate, at both macro- and micro-climatic levels (including influences on temperature, precipitation, and air turbulence)
- Production of soil and protection of soil from erosion, including protecting coastlines from erosion by the sea

- Storage, cycling and buffering of essential nutrients, including carbon, nitrogen, and oxygen

- Absorption and breakdown of pollutants, including the decomposition of organic wastes, pesticides, and air and water pollutants

- Provision of direct support to local communities through sustainable resource use

- Provision of recreational-aesthetic, socio-cultural, scientific, educational, spiritual, and historical values

Because the benefits of conservation are so important to society, the rate of natural habitat loss (see Table 1) and threats to species in Africa (see Table 2) is a source of great concern throughout the world.

Many development plans fail to recognize that retention of natural systems may constitute the optimal use of certain areas, in economic as well as ecological terms. Instead of conserving the rich resources of forest, wetland, and sea and managing them on a sustainable basis, current processes of development are depleting many biological resources at such a rate that they are rendered essentially non-renewable, thereby potentially reducing the benefits to society in the longer term. Experience has shown that market forces alone will often lead to such over-exploitation, largely because many of the costs are external and simply ignored.

Since biological resources will be inadequately conserved by market forces alone, given current means of assessing costs and benefits, effective government intervention is required to meet the conservation needs of society. Environmental management measures available to governments for promoting conservation include:

- establishing national parks and other types of protected area

- promoting citizen awareness and action through public education and supporting non-governmental conservation organizations

- modifying resource exploitation through legal or administrative means

- implementing international conservation conventions, particularly the *Convention on Biological Diversity*

- establishing government departments or ministries responsible for environmental matters

- implementing special action to conserve threatened species and habitats

Table 1 **Original extent of closed canopy moist forest in four regions of Africa, compared with remaining extent as judged from maps and FAO (1988) statistics for 1980.**

	Approximate original extent of closed tropical moist forests (sq.km)	Remaining extent of moist forests (sq.km)		Percentage of moist forest remaining	
		From atlas maps* (moist forests)	FAO (1988) data for 1980 (closed broadleaved forest)	From map data	From FAO (1988) data
Occidental and Central Africa	1,777,400	488,973	715,040	28	40
Eastern Africa	658,300	–	77,500	–	12
South Central Africa and Indian Ocean	2,301,936	1,234,419	1,189,890	54	52
West Africa	770,760	101,063	111,300	13	14

* Table adapted from table 10.1 in J.A.Sayer, C.S.Harcourt and N.M.Collins (Eds.) 1992. *The Conservation Atlas of Tropical Forests:Africa.* Macmillan, Basingstoke, Hants, UK. 288pp.

Table 2 Numbers, by country, of endemic and threatened mammals and birds

	Known species	Endemic species	Threatened species	Threatened endemics
Angola	1,148	16	26	4
Benin	818	0	12	0
Botswana	723	0	15	0
Burkina Faso	644	1	11	0
Burundi	740	0	9	0
Cameroon	1,145	21	44	8
CAR	877	2	14	0
Chad	630	0	22	0
Congo	700	1	15	0
Cote d'Ivoire	913	2	27	1
Djibouti	?	0	9	1
Equatorial Guinea	576	4	18	1
Ethiopia	1,091	52	39	16
Gabon	807	3	21	4
Gambia	597	0	8	0
Ghana	943	1	21	0
Guinea	719	1	23	0
Guinea–Bissau	484	0	7	0
Kenya	1,376	17	35	7
Lesotho	321	0	9	0
Liberia	783	3	28	1
Libya	156	4	21	0
Madagascar	355	164	81	78
Malawi	825	0	17	0
Mali	784	0	20	0
Mauritania	110	1	19	0
Mozambique	845	2	21	0
Niger	604	0	16	0
Nigeria	1,105	4	35	3
Rwanda	820	0	18	0
Senegal	780	1	16	0
Sierra Leone	761	0	20	0
Somalia	810	19	24	6
Sudan	1,205	7	25	1
Swaziland	428	0	5	0
Tanzania	1,322	25	56	19
Togo	826	1	10	0
Tunisia	251	1	20	0
Uganda	1,304	7	28	3
Zaire	1,501	48	58	19
Zambia	961	3	20	3
Zimbabwe	831	2	15	0

Data from: World Conservation Monitoring Centre 1992. *Global Biodiversity Status of the Earth's Living Resources*. Chapman and Hall. 594pp.

- building information gathering and monitoring capabilities as the basis for improved resource planning
- establishing special training programs for government officials
- promoting integrated rural development schemes which incorporate conservation
- developing *ex situ* facilities for preserving threatened genetic resources, in support of *in situ* conservation programs

However, conservation actions have been underway in Africa many years, yet natural habitats are still being lost at a rapid rate. Experience has taught the hard lesson that traditional protected areas will be unable to conserve most biological resources by themselves. Additional approaches to conservation are required to more effectively integrate protected areas within the broader processes of land-use planning, and to bring about policy shifts in a wide variety of sectors which have impacts on ecologically sensitive areas.

This has been the message of a number of reports and meetings in recent years, and is clearly stated within the articles of the *Convention on Biological Diversity*.

Article 8 of the *Convention* deals specifically with *in situ* conservation. It calls on contracting parties to:

- establish a system of protected areas where special measures are needed to conserve biodiversity
- develop guidelines for the selection, establishment and management of such areas
- manage biodiversity both within protected areas and in the wider landscape
- promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species
- promote environmentally sound and sustainable development in areas adjacent to protected areas
- restore degraded ecosystems and promote the recovery of threatened species
- control or eradicate alien species that threaten indigenous biodiversity
- respect and maintain the knowledge and practices of indigenous and local communities, including the equitable sharing of benefits arising from the utilization of such knowledge and practices

- develop appropriate environmental legislation

These measures are all highly pertinent to the identification and conservation of ecologically sensitive areas, and one of the top priorities in promoting sustainable development must be to encourage countries to ratify the convention. The first step in implementation is to undertake a comprehensive national assessment of the status of, and threats to, the country's biodiversity, its utilization and management, the economic benefits it provides and the costs of its effective management. This process includes the identification of ecologically sensitive areas, both within and outside existing protected area systems. The management of these areas to maintain their ecological integrity, and thus to maximise their potential economic benefits, is then prescribed in the national biodiversity strategies and action plans countries are called upon to produce under Article 6 of the Convention.

Particularly important therefore is the development of management programs using a broad systems approach based on an increasingly sophisticated ecological understanding of ecosystem productivity, processes, and dynamics. Integrated rural development can draw on national conservation strategies, river basin development strategies, environmental impact assessment, Geographic Information Systems and other technologies to promote environmentally sound management of large ecosystems containing both natural and transformed habitats. While such programs can make important contributions to conservation of biodiversity, they also contribute indirectly through stabilizing resource use in areas which are not biologically diverse. These activities focus upon maintaining, or restoring, natural ecosystems so that the ecological and hydrological processes which they support are maintained, and the benefits which they provide to human society are made available on a sustainable basis.

By managing these ecosystems sustainably and stabilizing land-use, the root cause of many human population movements can be addressed, with biological diversity being a beneficiary. For example, in many parts of Africa, forests are being lost because of slash and burn agriculture. In most areas, the expansion of this agricultural practice is a consequence of non-sustainable resource use and declining agricultural productivity in other ecosystems which the rural poor have been forced to abandon. By focusing attention on restoring formerly productive agro-ecosystems, and by maintaining the ecological and hydrological processes which maintain the productivity of these systems, agricultural pressure on the marginal lands can be reduced and they can be allocated to activities which are more conducive to the conservation of biological diversity.

It is apparent that mechanisms need to be developed for identifying ecologically sensitive areas in a systematic manner and establishing minimum quality criteria for managing such areas. To enhance its contribution to sustainable development, the World Bank requires guidelines for rapid identification of ecologically sensitive areas, and needs to develop means of promoting special measures that could be incorporated

in project planning and implementation to maintain the ecological integrity of such areas. The aim of this report is to assist in this process.

However, no simple recipe exists for determining how resources should be used. Ecological, social, political, economic, and technological factors all enter into the decision. Each of these factors can change over time, and because the factors are inter-related, a change in one can affect all the others. Therefore, while this discussion will concentrate on ecological factors, it will consider the others as well. In the final analysis, guidelines need to be applied by people exercising their best judgement given the current state of knowledge. The dynamic state of development in the Africa region is likely to continue, and building the capacity to adapt to constant change will require concerted action.

This section of the report is based on material drafted by Jeffrey A. McNeely, Chief Conservation Officer at IUCN - The World Conservation Union. The section was originally drafted in December 1991, and then revised in early 1993 by Robin Pellew and Jeremy Harrison of the World Conservation Monitoring Centre to take account of subsequent developments.

WHAT IS AN ECOLOGICALLY SENSITIVE AREA?

1. Introduction

1.1 While many natural habitats are being converted into uses -- such as agriculture, aquaculture, or forestry -- which yield greater productivity to humans (at least in the short term), the natural value of some areas is so significant that they need to be converted with great care, or even left in their natural state. Areas of significant value in their natural state can be termed *Ecologically Sensitive Areas* (ESAs) (see Box 1). They may contain unique features, maintain key natural processes, support rare plants or animals and their habitats, or provide important breeding areas for wildlife. Some ESAs are natural, while others have been significantly altered by certain human activities. In terms of management, some ESAs will prosper through "benign neglect" while others will require intensive management to restore or maintain their natural values.

Box 1: Ecologically Sensitive Areas

Criteria for ecologically sensitive areas would include:

- provide protection of steep slopes, especially in watershed areas, against erosion
- support important natural vegetation on soils of inherently low productivity that would yield little of value to human communities if transformed
- regulate and purify water flow
- provide conditions essential for the perpetuation of species of medicinal and genetic conservation value
- maintain conditions vital for the perpetuation of species that enhance the attractiveness of the landscape or the viability of protected areas
- provide critical habitat that threatened species use for breeding, feeding or staging

Source: McNeely *et al.* 1990

1.2 In order to ensure effective management of ecologically sensitive areas, and to avoid inappropriate conversion, it is essential that criteria are developed which can be used to guide decisions on whether an area can be converted freely to alternative uses, can be converted to only certain uses (such as forest production), or should not be converted at all.

1.3 A useful scale for seeking an answer is the ecosystem, a community of organisms interacting with the local living and non-living elements of the environment and forming a system in which life-sustaining processes are maintained. The ecosystem involves the accumulation, circulation, and transformation of matter and energy through such biological processes as photosynthesis and decomposition. The processes often work though the means of water, which provides a means of transfer and storage of energy and materials used by living organisms within the ecosystem.

1.4 The boundaries of an ecosystem are often identified by changes in vegetation, soil, or landscape form. The scale of the ecosystem depends on the purpose of analysis; a small mountain pond is an ecosystem, and so is the mountain on which it is located. Almost all ecosystems are connected with others of various scales. Protected areas with artificial boundaries may be whole or partial ecosystems, depending on the size of the area and the form of the boundary; a protected area surrounded by forest is a much different ecosystem to a similar one surrounded by agricultural land.

1.5 Some ecosystems are relatively robust and resist permanent damage, while others are very sensitive to disturbance and may require long periods to recover from disruption. Grasslands naturally subject to periodic fires, are robust, while mature tropical rain forests may be easily disturbed and require decades or even centuries to recover. Particularly sensitive ecosystems include those which lie on geologically unstable substrata, such as steep slopes subject to landslides, and those which are dependent on influences from outside the system, such as estuaries and deltas. Ecosystems need to be classified according to their sensitivity to certain kinds of treatment by people, and the most useful indicators of sensitivity need to be identified.

1.6 People have shown the capacity to convert almost any piece of natural habitat into agricultural land which can produce a crop for at least a few growing seasons. But areas which are inappropriate to such use quickly degrade into wastelands, such as the great expanses of *Imperata* grasslands found in much of tropical Asia; worse, inappropriate conversions of watersheds, such as through illegal logging, can contribute to very high human costs downstream through floods, erosion, siltation, and other external factors.

1.7 Logically, an objective survey of all remaining natural habitats should first be conducted to ascertain which have the highest value in their present state, and the least value if transformed. In practical terms, and as a working rule of thumb where complete information is not yet available, it may be best to accept the rationale behind the process of selection of protected areas already followed. This would mean that first priority ESAs should include areas which are already given legal protection (though recognizing that not all areas given legal protection really qualify as an ESA); second priority ESAs should include all

areas which have been proposed for protection; and third priority ESAs should be all other areas where natural habitat remains.

2. Legally protected areas

2.1 Areas which have been given legal protection preventing conversion to other uses should be among those not considered for alteration or conversion; their contribution to development is through maintaining their relatively natural state. In fact, the World Bank's policy on wildlands (World Bank, 1986) expressly prohibits the use of IBRD funds to convert legally protected areas to any other uses except under the most stringent and exceptional conditions.

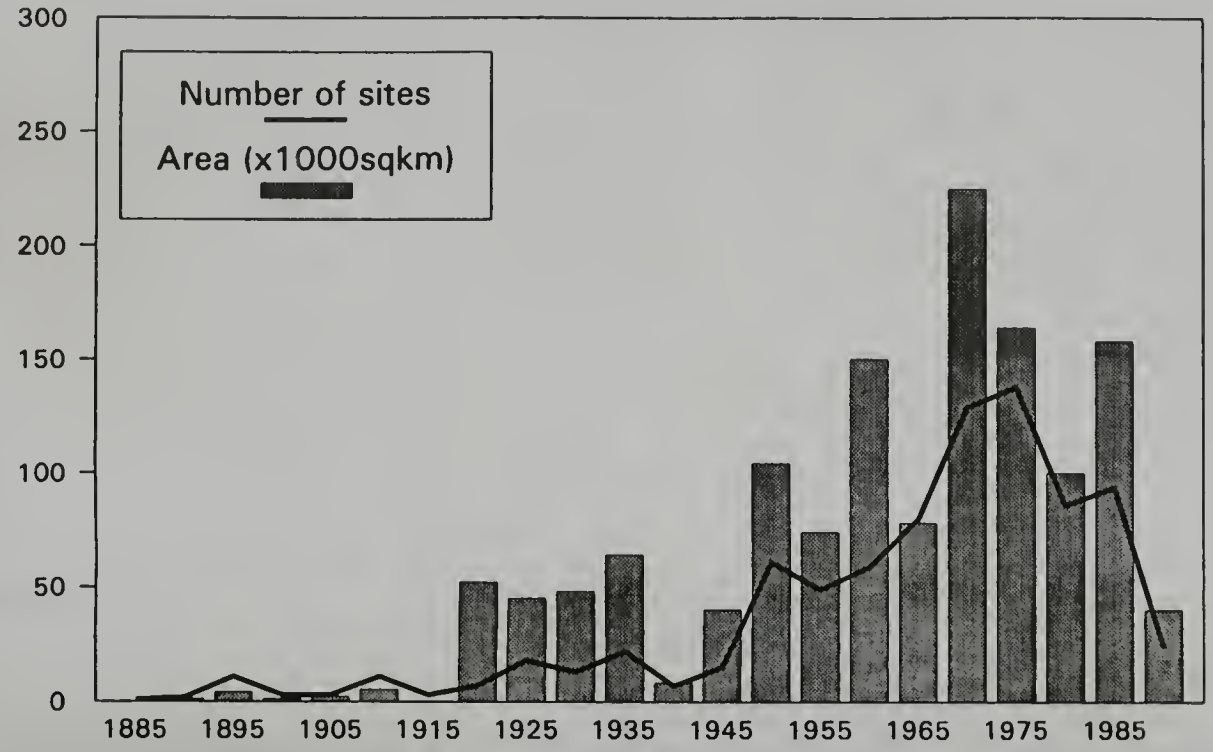
As development has accelerated in the past few decades, the governments in the region have recognized the importance of legally protected areas as part of the overall pattern of land use, though of course the effectiveness of such legal regimes varies widely. Many of these areas have been established in the past 30 years (see Fig. 1), and over that period administration and management of protected area systems has also changed in many countries. WCMC (1992) summarises how each of the national protected area systems is set up in Sub-Saharan Africa, and Lusigi (1992) discusses many of the challenges and issues facing protected areas management in Africa.

2.2 However, it would be a mistake to consider that once an area is legally established, then all threats have been removed. In fact, virtually all protected areas in the Africa have an uneasy relationship with the people living around them. The reasons for this are apparent: the local people pay most of the costs of conservation by not being able to harvest resources as they might wish, while the bulk of the benefits go to the nation at large or even to the international community. Governments need to seek additional means of redressing this imbalance, by ensuring that the costs of conservation are shared more widely, and that more of the benefits are delivered to the local communities.

2.3 Protected areas within the wildlife sector are often augmented by a range of designated areas established and managed by other sectors (such as forestry or fisheries) with management objectives which support a nature conservation function. The World Conservation Monitoring Centre (WCMC) has carried out research on areas within the forest sector, and is working on a series of reports which will show the extensive nature of their contribution in some countries. Review of the conservation value of some of these areas on the ground may be a valuable next step (the development community is currently funding such a study in Sri Lanka).

2.4 In addition to being protected under national legislation, some areas are given further protection under international legislation, notably the *Convention on Wetlands of International Importance* (Ramsar, 1971) and the *Convention*

Fig. 1 Increase in area and number of protected sites in Sub-Saharan Africa 1885-1990



Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972). The list of areas given such protection expands each year as the States Party add areas to the list. Areas currently given such protection are identified and described in later sections.

2.5 While not a convention, the Biosphere Reserve programme of Unesco also has considerable relevance to the region. As part of UNESCO's Man and the Biosphere Programme (MAB), a biosphere reserve is established to conserve representative natural areas throughout the world, and to use these areas to further understanding of the interaction between man and nature. Biosphere reserves ideally take an existing protected area as the core, then incorporating land around the core with varying degrees of human intervention are permitted. Biosphere reserves in Africa are also listed in later sections.

3. Other critical habitats

3.1 While many countries in Africa have an impressive record on establishing protected areas, there are many gaps in coverage, with many ESAs of high priority for conservation yet to receive any effective management. The regional systems review carried out by IUCN (IUCN/UNEP, 1986) identifies a number of important sites, as does the action plan for protected areas in Africa (IUCN, 1987) and in the African Biodiversity Review prepared by IUCN (Stuart and Adams, 1990). Many of these unprotected ESAs may in fact deserve higher attention than the existing protected areas, because they are more liable to alteration to inappropriate uses, and a number are identified in the body of this report.

3.2 Even if they are not yet protected, habitats can also be considered ecologically sensitive areas if they meet the criteria identified in Box 3. The identification of such ESAs outside of existing protected areas ideally requires considerable research and information, but the pace of development is such that it will inevitably prove necessary to take some relatively arbitrary decisions on the limited information available. In making such decisions, use should be made of all available information, including both national and international reviews.

3.3 Threatened species are of particular concern to both governments and the general public. Many such species are protected under national legislation, and in addition many African countries are members of international conventions which provide protection to threatened species. It is widely accepted that the best way to conserve species is through protecting their habitats while simultaneously controlling exploitation. Critical habitats of threatened species are particularly important ESAs.

3.4 Potential ESAs can also be identified from digitized data on the distribution of key species using a Geographic Information System (GIS). By overlaying such

distribution data onto habitat maps, sites of particular species richness can be identified. These should then be priority areas for ground surveys. The application of information technology in this way enables proactive conservation planning to maintain the ecological integrity of such areas before they are disturbed by unsustainable management practices.

3.5 Information on the status and distribution of both habitats and species is central to the study of biodiversity conservation within a country, and a key part of both protected area systems reviews and the development of the national biodiversity strategies necessary for implementation of the *Convention on Biological Diversity*. Information is often widely distributed, and effort is required to bring the information together, and to develop research and monitoring programs to support biodiversity conservation. A range of international organizations, including UNEP and WCMC are in a position to support such activities.

4. **Areas to be rehabilitated**

4.1 Many ESAs have already been over-exploited, with resulting degradation. These areas need to be rehabilitated so that they can once again make important contributions to sustainable development. Since tropical forests often grow on soils which are poor in cations or suffer from other deficiencies, attempts at agriculture are often followed rather quickly by abandoned fields and degraded vegetation. As a result, large areas of Africa are covered by devastated landscapes which are productive only for grazing at a very low stocking density. With proper economic incentives, such areas can be made productive again, either for agriculture, forestry, or conservation of biological diversity.

4.2 It may be more expensive in the short run to reconstitute damaged ecosystems than to conserve new lands (and is certainly more expensive to reconstitute damaged ecosystems than it is to exploit new ones), but it will often be as economically efficient in the long run to rebuild degraded local ecosystems rather than to exploit (and degrade, requiring rebuilding) other more remote land, which may itself be sensitive to degradation.

4.3 Given the right circumstances it is also possible to develop ecologically sensitive areas from lands which previously had no particular value, through careful development of new habitats. This may have economic as well as ecological benefits.

CONCEPTUAL FRAMEWORK FOR DESIGNATION AND CLASSIFICATION OF ENVIRONMENTALLY SENSITIVE AREAS

1. Introduction

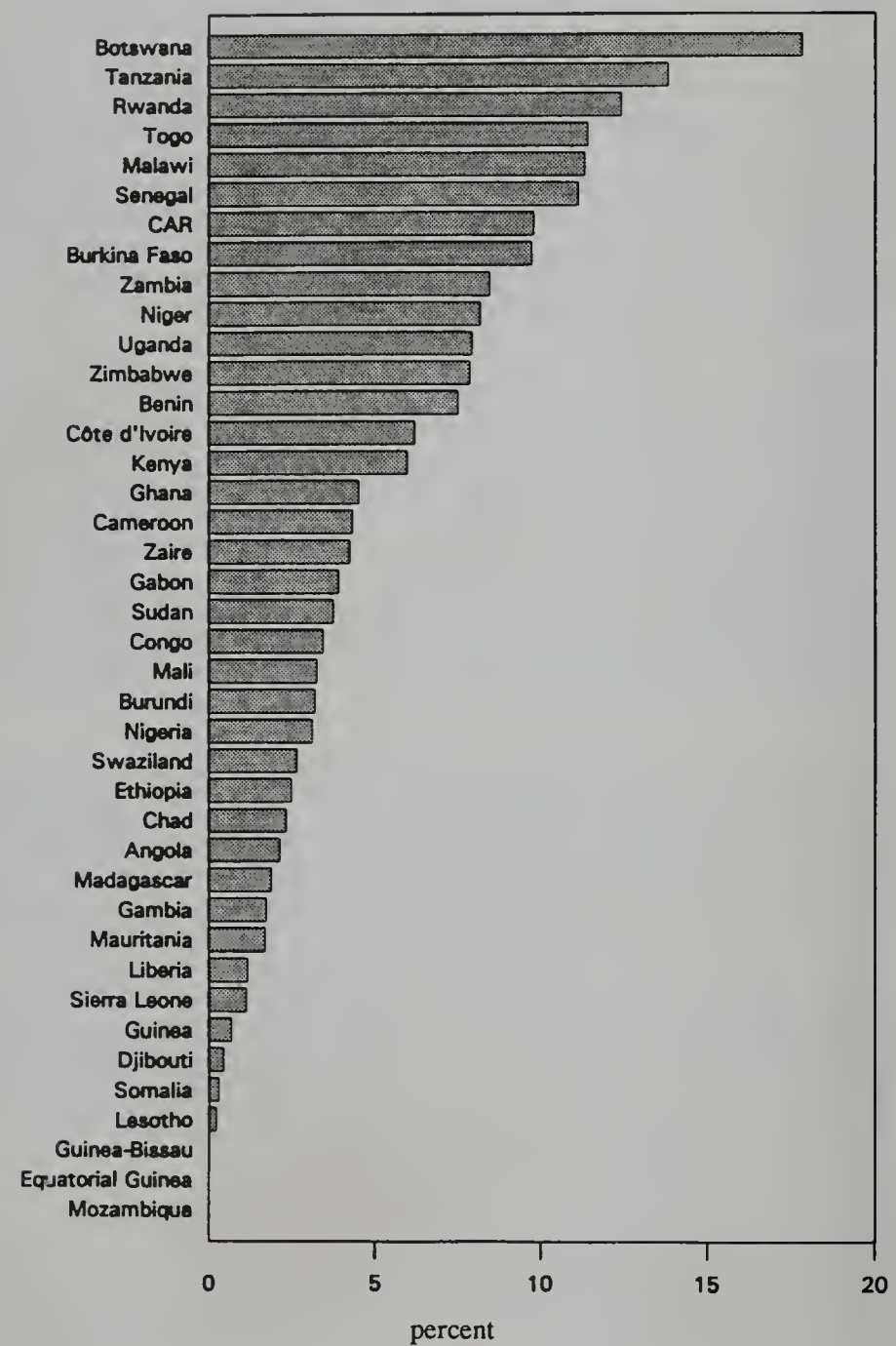
1.1 Conservation of biological resources has become an important item on every country's development agenda. Conservation in the modern sense is part of development. As defined by the *World Conservation Strategy*, it means: "The management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations. Thus conservation is positive, embracing preservation, maintenance, sustainable utilization, restoration, and enhancement of the natural environment" (IUCN, 1980).

1.2 Conservation of biological resources is not a new idea. Farmers have always had the sense to avoid eating the seeds for growing next year's crop, to select the seeds which have the most favourable characteristics, and to plant a wide variety of crops. Herders don't slaughter their breeding stock, and they select the individuals for breeding which are the easiest to manage, have the most meat, or display other desirable traits. For most of human history, the natural world has been protected from the most disruptive human influences by cultural/ecological factors such as taboos preventing over-exploitation, tribal warfare which kept wide areas as wilderness "buffer zones" between groups, land ownership by ancestors or lineages rather than individuals, relatively sparse human populations, and so on.

1.3 But during the last few generations, economic growth based on the conversion of fossil fuels has spurred such rapid expansion of human numbers that new approaches to conservation are required. One such approach has been the establishment within the past 100 years of explicit government policies aimed at ensuring that wild living resources are conserved, usually through the designation of particular ecologically sensitive areas as national parks or other sorts of protected areas. Today, all but a small handful of countries have national parks and national legislation promoting conservation (see Fig. 2). Most governments have established wildlife management agencies, joined international conservation conventions, and built environmental considerations into the national education system. Non-governmental organizations are active throughout the region in promoting public awareness of conservation issues, including those dealing with biological diversity.

1.4 The conservation movement has been led by naturalists. While their contributions have been fundamental, they are unable to address fully the basic problems of conservation because the limiting factors are not biological, but rather political, economic, and social. The decisions affecting the natural

Fig.2 Percentage of each country within protected area system (source: WCMC)



environment are influenced by pressures and incentives that go far beyond the relatively straight-forward technical considerations of what might in theory be best for the ecologically sensitive areas, and consider in addition questions of social equity, political possibility, and technical feasibility.

1.5 Advice on delivering conservation action needs to be sought from development practitioners, engineers, politicians, rural sociologists, agronomists, and economists. In the last analysis, local resource users are the ones who make local-level decisions, and their decisions are affected above all by enlightened self-interest. Those seeking to conserve ESAs need to be able to identify legitimate self-interests of rural people, and design ways of ensuring that the interests of ESAs and community self-interest coincide. Development aid agencies, including the Bank, therefore have an important role to play.

1.6 It has become apparent that a sectoral approach to managing ESAs is unlikely to be successful, even in the short run. While government institutions responsible for wildlife and protected areas need strengthening, even the most successful conservation programs will fail unless they are supported by appropriate developments in other sectors. Progress in sustainable approaches to forestry, agriculture, rural development, international trade, energy, population, national security, and other areas are so essential to the success of efforts to conserve ESAs that they deserve as much attention as the traditional conservation-related sectors.

1.7 The need for a broad based multi-sectoral approach to conservation is clearly identified in both the *Global Biodiversity Strategy* (IUCN/UNEP/WRI, 1992) and the *Convention on Biological Diversity*. Under the convention, countries will be required to prepare national biodiversity strategies and action plans, and to report on their implementation. These plans will need to focus on biodiversity outside the confines of protected areas, and address the fundamental requirements of reconciling the pressures of human development with conservation of ESAs in the wider landscape.

2. Criteria for designating and managing Environmentally Sensitive Areas

2.1 In planning a system to protect ESAs for supporting national development goals, criteria for selection and management are essential. Criteria will enable a relatively systematic comparison of different sites; help communicate to decision-makers why certain areas or policy initiatives are important; help focus research on the most important questions; promote the drawing of boundaries for the ESA by specifying the features which need special management; and facilitate public information programs.

2.2 In seeking to identify which sorts of protective regimes are most appropriate for each major ESA (including, but not limited to, designation as a protected area),

local social, political, and economic factors need to be considered along with the ecological ones. The following set of criteria are presented in rough descending order of importance, though modifications will be required for adapting to each particular situation. Each criterion is presented as an ideal against which each site can be considered. No site can be expected to meet the ideal, but the criteria can provide a basis for comparing sites against each other. In some cases, it may be appropriate for planning purposes to assign numerical scores to the various criteria, with relatively higher scores being assigned to the first four criteria.

a) Criteria which determine the importance of the site to human society

Economic benefit. The site provides obvious long-term economic benefits, such as watershed protection or tourism (even though their initial establishment might involve short-term economic disruptions).

Diversity. The site has a great variety of species and ecosystems, and is sufficiently large to contain viable populations of most species; it contains a variety of geomorphological features, soils, water regimes, and microhabitats.

Critical habitat, international. The site is essential to the survival of one or more threatened species which occurs in no other country, contains the only example of certain types of ecosystems, or contains landscapes of outstanding universal value.

Critical habitat, national. The site is essential to the survival of one or more species which are threatened nationally or internationally, or contains the nation's only example of certain types of ecosystems. The ecological functioning of the area is vital to the healthy maintenance of a natural system beyond its boundaries (such as habitat for migratory species, an important catchment area for lowland irrigation systems, protection of the coast against typhoons, etc.).

Cultural diversity. The site supports populations of indigenous people who have developed mechanisms for living in a sustainable balance with the natural ecosystems, and whose continued presence in the ESA would help ensure that the diversity of the area is maintained.

Urgency. Action is required quickly at the site in order to avert an immediate threat (though it should be realized that this is often a "damage control" action; it is usually best to protect far in advance of threat).

b) Criteria to determine additional elements which enhance the value of the site

Demonstration. The site demonstrates the benefits, values, or methods of protection, and can show how to resolve conflicts between natural resource values and human activities.

Representativeness. The site is representative of a habitat type, ecological process, biological community, physiographic feature, or other natural characteristic.

Tourism. The site lends itself to forms of tourism compatible with the aims of conservation; this criterion is often related to those of economic benefit and social acceptance.

Landscape. The site has features of outstanding natural beauty; these are usually also unique, easily destroyed, and attractive to tourists and any alteration would significantly reduce the area's amenity value.

Recreation. The site provides local communities with opportunities to use, enjoy, and learn about their natural environment.

Inventory and Monitoring. The site can serve as a non-manipulated area against which to measure changes occurring elsewhere; it can form the basis for assessing any ecological change. It can also serve as the site for detailed inventory of biodiversity to provide a baseline for long-term monitoring. Research has been carried out over a long period in the site, and major field studies have been carried out to provide a strong foundation on which new research can build. The site represents ecological characteristics of regional value so research can yield arguments that can have impacts far beyond the protected area.

Awareness. Education and training within the site can contribute knowledge and appreciation of regional values. The site can serve to exemplify techniques or scientific methods, making it particularly important for education purposes.

c) Criteria to help determine the management feasibility of a site

Social acceptance. The site is already protected by local people; or official protection by the government (particularly against outside exploitation) would be welcomed.

Opportunism. Existing conditions or actions at the site lend themselves to further action (such as the extension of an existing protected area or establishment of a buffer zone around an existing park).

Availability. The site can be acquired easily, through inter-departmental

transfer, easements, or other legal forms of control.

Convenience. The site is accessible to researchers or students for scientific and educational uses.

3. An expanded approach to protecting ecologically sensitive areas

3.1 The best-known method of managing ESAs is through national parks, but many other types of reserves can also make contributions to both conservation and development, providing a range of management "tools" (Box 2). Ten years ago, the leading professionals in the field of national parks management, meeting in Bali, Indonesia, asserted that while national parks must be as carefully protected as ever, they must be supplemented by a range of other categories of protected areas in order to fully meet the social and economic development needs of modern society.

3.2 In the Bali Declaration (in McNeely and Miller, 1984), these authorities pointed out that protected areas are an indispensable element of conservation because they maintain those essential ecological processes that depend on natural ecosystems; they preserve the diversity of species and the generic variation within them, thereby preventing irreversible damage to our natural heritage; they maintain the productive capacities of ecosystems and safeguard habitats critical for the sustainable use of species; they provide opportunities for scientific research, education, training, recreation, and tourism; and they provide opportunities for the sustainable use of their natural resources for the benefit of local communities.

3.3 Since 1970, the world's networks of protected areas have expanded in extent by more than 80 per cent, around two-thirds of which are in the Third World (IUCN, 1990). The IUCN review of the protected areas of Africa suggested that the total expanse of protected areas in Africa needs to be increased at least three times, if the protected areas are to be effective in delivering nature's benefits to people. But given the pressures on the land today, these additional protected areas will need to be of a new type, far more flexible in their management than the traditional national parks. They may in fact merit a new term such as "Sustainably Managed Areas", or "Managed Resource Protected Areas".

3.4 New approaches to linking protected areas to surrounding lands are required if the appropriate benefits are to flow to society. While the specifics will vary from case to case, the major generalization is that local support for protected areas must be increased through such measures as education, revenue sharing, participation in decisions, complementary development schemes adjacent to the protected area, and, where compatible with the protected area's objectives, access to resources. In short, economic incentives should be used to encourage people to behave according to their own enlightened interest, and sound

Box 2: Categories and management objectives of protected areas

While all protected areas control human occupancy or use of resources to some extent, there is wide variation in the degree of such control. Different protected areas are established for different purposes, and therefore have different management objectives. The following categories, which were first defined by IUCN in 1978, are currently under review. As a result of this review, it is likely that categories VI-VIII will be removed, and replaced with a new category VI - "Sustainably Managed Area" or "Managed Resource Protected Area".

I Scientific reserve/strict nature reserve. To protect nature and maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, environmental monitoring and education, and for the maintenance of genetic resources in a dynamic and evolutionary state.

II National park. To protect relatively large natural and scenic areas of national or international significance for scientific, educational, and recreational use, under management by the highest competent authority of a nation.

III Natural monument/natural landmark. To protect and preserve nationally significant natural features because of their special interest or unique characteristics.

IV Managed nature reserve/wildlife sanctuary. To ensure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment when these require specific human manipulation for their perpetuation.

V Protected landscapes. To maintain nationally significant natural landscapes characteristic of the harmonious interaction of man and land while providing opportunities for public enjoyment through recreation and tourism within the normal life-style and economic activity of these areas.

VI Resource reserve. To protect the natural resources of the area for future use and prevent or contain development activities that could affect the resource pending the establishment of objectives based on appropriate knowledge and planning.

VII Natural biotic area/anthropological reserve. To allow the way of life of societies living in harmony with the environment to continue undisturbed by modern technology.

VIII Multiple-use management area/managed resource area. To provide for the sustained production of water, timber, wildlife, pasture, and outdoor recreation, with the conservation of nature primarily oriented to the support of the economic activities (although specific zones can also be designed within these areas to achieve specific conservation objectives).

Adapted from: IUCN (1990)

government policies should be designed to ensure that conservation is indeed in their self-interest. Such approaches were extensively discussed at the IV World Congress on National Parks and Protected Areas, held in Caracas, Venezuela,

in 1992, and the Caracas Action Plan (IUCN, 1992) calls for new and innovative programs of integrated planning and cooperative management.

3.5 Another theme of the World Parks Congress held in Caracas, 1992, was the contribution made by other sectors. Strictly protected areas are unlikely to ever cover more than about five percent of Africa. Since permanent agriculture seldom covers more than a quarter of a nation's land area, ample land exists for forestry, shifting cultivation, grazing, and other uses which may, with proper management, contribute to conservation of biological diversity.

3.6 By themselves protected areas will never be able to conserve all, or even most, of the species, genetic resources, and ecological processes they were established to protect; these areas are just too small to support viable populations of wildlife if the areas are isolated from the surrounding lands. Far greater expanses are required for conservation than modern societies can afford to remove from direct production. The best answer to this dilemma is to select and manage protected areas to support the overall fabric of social and economic development, not as islands of anti-development, but rather as critical elements of regionally envisioned harmonious landscapes. Through a planned mix of national parks and other categories of ESAs, amidst productive forests, agriculture, and grazing, conservation can serve human communities and safeguard the well-being of future generations of people living in balance with their local ecosystems.

3.7 Improvements in conservation over the coming decades will be of three main types:

- the establishment and improved management of categories of protected areas where some kinds of human use are tolerated or even encouraged
- the establishment of new types of protected areas in degraded landscapes which have been restored to productive use for conservation
- management regimes in non-protected areas which bring sustainable benefits from harvesting biological resources to local communities

and will be founded on a rapidly improving information base to support management decisions.

DEVELOPING GUIDELINES ON THE RELATIONSHIP BETWEEN VARIOUS TYPES OF BANK PROJECTS AND ECOLOGICALLY SENSITIVE AREAS

While many development projects have led to the abuse of ESAs, in fact a positive relationship between development projects and ESAs would be of benefit to both the project and the ESA. A series of guidelines can be developed for each major type of development project which would illustrate how the project can contribute to the viability of the ESA. The following examples indicate the sorts of guidelines which might be appropriate.

1. Water resources development projects

1.1 Natural vegetation cover on water catchments regulates and stabilizes water run-off. Deep penetration by tree roots or other vegetation makes the soil more permeable to rainwater so that run-off is slower and more uniform than on cleared land. As a consequence, streams in forested regions continue to flow in dry weather and floods are minimized in rainy weather. Water resources development projects -- dams, irrigation systems, urban water supply, and others -- depend on watershed protection to such an extent that many valuable reserves in these ESAs have been established by drawing support from the development projects involved; irrigation and energy agencies can therefore make powerful potential allies for protected areas which protect watersheds.

1.2 In many cases, the total costs of establishing and managing reserves which protect catchment areas can be met and justified as part of the hydrological investment. Guidelines should be developed to specify how the potential positive relationship between watershed protection and water resources development projects can be converted into reality.

1.3 One of the objectives of water resources development projects should be improved integration in the management of such resources. Guiding principles of integrated river basin management (Dugan, 1990) include:

a) The hydrological balance of the basin should be quantified, including measures of both water quantity and quality, and incorporating surface, underground and coastal waters.

b) The values of all the major ecosystems in the basin should be identified, as well as the full range of biophysical processes upon which they depend.

c) The products and services taken from each part of the system should be inventoried and the minimum requirements for the sustenance of these

features determined.

d) The short and long term impact on the environment of planned changes to the system should be determined, and appropriate compensatory measures should be implemented as required.

1.4 The establishment and management of protected areas in coastal and marine ESAs is still in its infancy, with most such areas being merely an extension seaward of existing terrestrial protected areas. Many critical habitats in the coastal zone need protection so that they can provide services to mankind on a continuous basis; these services include support for fish breeding, shoreline protection, and sustainable harvesting of construction materials.

1.5 Virtually all wetland habitats are important for fisheries, but of particular relevance are inland floodplains which are often affected by development projects. Dams, irrigation systems, and other measures affect both inland and coastal wetlands important for fisheries, and alternative means of managing these systems need to be developed, along with guidelines to assessment of potential impacts on both environmental and socio-economic grounds.

2. **Tourism development projects**

2.1 Natural areas -- mountains, rivers, wetlands, forests, savannas, coral reefs, deserts, beaches -- are major attractions for tourists. Tourism can bring numerous socio-economic benefits to a country, in terms of creating local employment, stimulating local economies, generating foreign exchange, stimulating improvements to local transportation infrastructure, and creating recreational facilities. Positive effects on the environment often derive from these socio-economic benefits. Such positive effects may include:

- encouraging productive use for conservation objectives of lands which are marginal for agriculture, thereby enabling large tracts of land to remain covered in natural vegetation

- promoting conservation action by convincing government officials and the general public of the importance of natural areas for generating income from tourism

- increasing awareness amongst local communities of the benefits from conservation, including the economic opportunities it can generate

- stimulating investments in infrastructure and effective management of natural areas

2.2 These benefits can provide incentives for effective management of the natural areas which are tourist destinations, which in turn enhances the quality of the natural resources that attract tourists. Properly planned and managed tourism in natural areas is both non-polluting and renewable, and numerous examples exist where tourism has provided powerful incentives for conserving biological resources.

2.3 However, biological resources can also be damaged by inappropriate tourism developments. McNeely and Thorsell (1987) have outlined the positive and negative impacts that tourism can have on such resources and recommend that the guiding principle for tourism development in natural areas should be to manage the natural and human resources so as to maximize visitor enjoyment while minimizing negative impacts of tourism development.

2.4 Four general principles are relevant for linking investments in tourism with conservation of ESAs:

- Planning for tourism development must be integrated with other planning initiatives, particularly in national parks and other natural areas which are potential tourist destinations.

- Tourism authorities working with protected area managers should determine the level of visitor use an area can accommodate with high levels of satisfaction for visitors and few negative impacts on the environment (the carrying capacity), and ensure that this level is not exceeded.

- For each major tourist destination based on the attractions of biological diversity, a management plan should be developed to specify objectives for both tourism and resource management and to determine how sufficient income from tourism can be provided to the natural area to provide an incentive for improved management.

- National policy should require environmental impact assessments (EIA) for all tourism development projects or programs, and specify the ways and means that the tourism development can provide economic benefits to both the local people and the natural areas which are the primary tourist destinations.

2.5 In short, tourism and conservation of ESAs can be natural partners, and each can benefit from the other if both are properly managed. Sufficient resources must be devoted to managing the natural areas, but it is often difficult to convince the governments who are responsible for budgets to allocate sufficient funds for this purpose. It is in the interest of both tourism and conservation that governments be so convinced.

3. Agricultural development projects

3.1 In addition to the water resource management benefits of ESAs, other positive linkages can also be formed. For example, good soil protection by natural vegetation cover and leaf litter can preserve the productive capacity of the reserve itself, prevent dangerous landslides, safeguard coastlines and riverbanks, and prevent the destruction of coral reefs and freshwater and coastal fisheries by siltation.

3.2 Linkages between conservation and agriculture are also important in industrialized countries. Under regulations adopted by the European Community, EC Governments may define certain areas of the farmed countryside as "Ecologically Sensitive Areas." Such areas are important in environmental terms, and their continued environmental protection depends upon the survival of the traditional forms of farming which give rise to their environmental qualities. Within ESAs, farmers are paid grants to encourage them to continue to farm in a traditional way; ESA payments, therefore, can involve limitations on the amount of fertilizer which can be used, restrictions on changes of agricultural land use and controls over the dates at which meadows are cut for hay; they may also include positive payments to encourage practical conservation, such as woodland management or the restoration of archaeological features.

3.3 A group of US-based NGOs called the "Committee on Agricultural Sustainability for Developing Countries" (CASDC) has suggested a series of criteria for developing sustainable farming systems. Such systems are required if pressures on marginal agricultural lands are to be reduced, thereby enabling such lands (which are often ESAs) to be devoted to conserving natural ecosystems and the benefits they provide. Sustainable farming systems:

a) Maintain and improve soil productivity, quality, and tilth.

b) Augment the potential for achieving the highest possible efficiency in the use and conservation of basic farm resources (soil, water, sunlight, energy, and farmers' time).

c) Incorporate as much biological interaction as possible, including such processes as mulching, the use of nitrogen-fixing plants, the use of agroforestry techniques, and the use of inter-cropping and crop rotations to control pests and weeds.

d) Minimize the use of external inputs which damage the environment and endanger human health (some chemical fertilizers; non-selective pesticides and herbicides; and some forms of energy), maximizing instead the use of available, affordable, renewable, and environmentally benign inputs.

e) Avoid the contamination of groundwater by using only those fertilizers, pesticides and herbicides that do not penetrate below the plants' growing zone and then only in controlled doses.

f) Meet the needs of farm families for energy to work their land, cook, and heat from readily available and affordable energy sources.

g) Meet the needs of farm families for cash income, including from off-farm sources.

h) Are adaptive, so that even as society evolves and communities change, they will strengthen communal cooperation, protect rural survival systems, through community support and sharing allow farm families to keep going in difficult times (famine, drought, and natural or political disasters), and make possible effective local management of community-controlled common property resources (ponds, woodlots, grazing lands, irrigation systems) in ways that permit equitable sharing of benefits.

3.4 Many of the conventional agricultural, water resources development, and forestry projects of the Bank can contribute to the conservation of ESAs by focusing attention on linkages between the ESA and the surrounding lands. To reduce inappropriate pressures on ESAs, the basic criteria of sustainability must be developed and applied to all kinds of farming systems, from the intensive mono-cropping systems to animal husbandry to agroforestry to the vast numbers of mixed systems used by small farmers throughout the region. Therefore, Bank projects in agriculture need to support work on the continuing evolution of the concepts and practices of sustainability, provide encouragement and incentives for the adoption of sustainable agricultural systems (many of which are discussed in McNeely, 1988), and ensure that farmers receive their fair share of the benefits from conserving ESAs.

4. Linkages with other sectors

4.1 Other types of projects for which such considerations can be developed include livestock development, cottage industries, aqua-culture, land classification and titling, reforestation, rangeland management, and mangrove management. While some guidelines will be common to all types of project, others win be specific to certain sectors (such as aqua-culture, forestry, or livestock development). For each type of project, guidelines should be developed for application in the design and implementation of the project. Such guidelines should not focus simply on mitigation, but be far more positive in linking development with conservation by showing the mutual benefits that can follow from enhanced consideration of how conservation can support development.

MINIMUM QUALITY STANDARDS FOR ECOLOGICALLY SENSITIVE AREAS

1. General considerations

1.1 Protected ESAs will succeed in realizing their conservation objectives only to the extent that the areas themselves are effectively managed, and to the extent that the management of the land surrounding them is compatible with the objectives of the protected areas. IUCN has conducted considerable work in this field (see for example Kelleher and Kenchington, 1990; MacKinnon *et al.*, 1985; Oldfield, 1988; Poore, 1992; Poore and Sayer, 1987), which can provide the basis for developing such quality standards. General considerations which need to be incorporated in development projects include:

a) The acceptance of protection depends on putting a sufficient economic value on natural resources and biological diversity and, often, on demonstrating that such areas bring a positive benefit to the local communities around them. Examples may be provided by the role of ESAs as sources of water and products, their maintenance of regional climatic conditions, and their support for tourism.

b) Each ESA, or regional set of ESAs, should have a management plan which establishes the objectives of management, the obstacles to achieving the objectives, the steps required to overcome the obstacles, the resources required, and the costs and benefits of achieving the objectives.

c) Management of an ESA and that of the adjacent land must be planned together, since few protected areas are self-contained entities. The establishment of "buffer zones" (better referred to as "zones of influence") in which human activities including uses of natural resources in adjacent land are compatible with the conservation of natural ecosystems within protected areas, are often vital to the integrity of the latter.

d) The management context and likely ecological resilience of the area in the face of climatic trends and human pressures need critical review, taking into account the likely trend in human numbers in the area in question.

e) Certain "keystone" and critical species will be used as diagnostic indicators of the adequacy of the protected area system, it being assumed that if habitats capable of assuring the survival of viable populations of these are protected, the lesser known species will also be safeguarded.

f) A conscious relationship needs to be established between *in situ* and *ex situ* approaches to conservation and these methods need to be integrated into over-all regional development; the potential contribution of the general managed landscape to conserving biological diversity should not be under-estimated.

g) The national infrastructure needs to be so designed as to ensure that the protected area system designed to manage ESAs is properly evaluated as a national asset and that adequate resources are deployed in its management.

h) The project must gather baseline data on key ecological, economic and social parameters, so that its long-term effects can be monitored.

i) A major effort is needed to raise public consciousness, enlist the aid of professionals in the field (e.g. in universities, museums and professional networks), and educate local communities about the value of the ESA to the region.

2. Economic factors

2.1 Decisions about the identification and management of ESAs, including consideration of alternative land uses, must be based on analysis of costs and benefits, and their distribution. Realizing that change is a constant factor in land use, these economic factors require continual review. It is apparent, then, that economics must be an important foundation of all programs for enhancing the contributions of ESAs to society.

2.2 As a basis for applying economic incentives and calculating benefits and costs of various management options for ESAs, governments need to estimate the economic contribution that ESAs make to the national economy. This requires:

- ensuring that national accounting systems make explicit the trade-offs and value judgements regarding impacts on biological resources that may not be measured in monetary terms
- conducting research on methodologies for assessing the cross-sectoral impacts -- positive and negative -- of resource utilization
- collecting information on the physical properties of resources in specific environments and for specific uses
- developing methodologies for assigning values to non-marketed biological resources, appropriate to the needs of the country

- estimating the economic productivity of various ecosystems, with various types of inputs

2.3 The sustainable levels of production of economic benefits from ESAs -- including goods such as fish, timber, wildlife, and medicinal plants, and services such as supply of clean water, tourism, and recreation -- should be estimated, and demands upon benefits planned within those limits. This should be reflected in the prices of forest products and other biological resources.

2.4 The review and formulation of all national policies which have a direct or indirect bearing upon ESAs and the biological resources they contain must therefore:

- estimate the relevant benefits which ESAs can produce
- treat ESAs as reservoirs of capital resources and invest accordingly in preventing the depletion of their productivity
- ensure that the objectives of sustainable utilization are met
- address the basic needs of the local people who depend on the ESAs for their continued prosperity

3. National policies for managing ESAs

3.1 The incentives which are required to bring the benefits of ESAs to the community require commensurate policies at the national level. A national or regional conservation strategy can be an effective means of reviewing such policies, and determining what shifts are required to achieve national objectives for conserving the productivity of biological resources. Major policy components of the required integrated action might include the following considerations:

a) Sufficient data needs to be compiled from a wide range of sources to enable ESAs to be identified objectively, and to help define the most appropriate management regimes for these areas.

b) The many economic and financial benefits of integrated rural development linked with conservation of ESAs and the biological resources they contain need to be quantified and brought to the attention of policy makers.

c) Both conflicts and potential for cooperation between the various activities of agriculture, fisheries, forestry, conservation and rehabilitation need to be identified in integrated plans and programs.

d) Institutional reform and improvement is often a prerequisite to good design and implementation of integrated sectoral development plans and programs.

e) Legislation consonant with the socio-economic patterns of the target group and the natural resource needs to be formulated, both to institute disincentives and to ensure that incentives carry the power of law.

f) Policies and legislation in other sectors need to be reviewed for possible application to conservation of biological resources and community involvement in such work.

g) Effective incentives need to be devised to accelerate integrated development in and around ESAs, aimed at narrowing any gap between what the individual sees as an investment benefit and what the government considers to be in the national interest.

h) The rural population needs to be involved in the design and follow-up of plans and projects regarding ESAs, not simply their implementation.

3.2 Systems of incentives for improving the contribution of ESAs to rural development can be designed in a large number of ways, and numerous options exist for coordinating these incentives with other national policy objectives. In designing systems of incentives, governments should compare several options, with estimated costs and benefits, for each of the various national objectives being addressed. Systems of incentives need to be supported by suitable machinery for implementing the system, including regulation, enforcement, monitoring, and feedback.

3.3 All government sectors which depend on the productivity of ESAs should design policies to encourage the sustainable use of these resource systems, possibly as part of the process of preparing a national conservation strategy. In addition, other sectors which have major impacts on ESAs, such as transport, highways, and the military, should ensure that their policies do not unnecessarily deplete biological diversity.

3.4 Coordination and control of natural resource use in and around ESAs, in particular to introduce systems of incentives which involve several sectors, may require the creation of new agencies with wide-ranging authority over certain aspects of the operations of implementing ministries within a particular region.

3.5 Based on the best available information, governments should establish national objectives for the management of ESAs. Drawing on the latest advances in conservation biology, governments need to state, as a matter of public record, what proportion of the current land and water area is intended to be legally

protected for conserving biological resources. Such policy objectives can often be incorporated as part of a national protected area system plan or a national conservation strategy; on the basis of such national objectives, governments can measure the costs and benefits of implementing conservation programs effectively.

4. **Data needs**

4.1 In order to identify ESAs and to develop informed policies on their management, governments should build the capacity to assess the status, trends, and utility of their biological resources. This capacity should include:

a) National compilations of the flora and fauna (at least higher plants and vertebrates) contained within the nation, in addition to the more usual assessment of stocks of timber, fish, and minerals.

b) Where these compilations do not yet exist, development projects might require that rapid appraisal methods be employed -- perhaps through the use of indicator species which can provide the optimal return on investment of field time -- to ensure that biological resources are being given an appropriate level of priority.

c) Institutionalized biological surveys, perhaps carried out by university departments of biology, to determine what species occur where and in what numbers, and how these parameters change over time.

d) A national program for monitoring the status and trends of biological resources, linked to international systems such as UNEP's Global Environmental Monitoring System and the World Conservation Monitoring Centre.

e) Regular publication of the available information on status and trends of biological resources, and the various forces which are affecting these trends.

4.2 These efforts will help governments to recognize the consequences of their development activities on the biological resources of the nation, and help identify external effects of development projects on biological resources. However, in-depth assessments are time-consuming, and action should not be delayed until "all" the information is available; instead, some rapid initial assessments need to be done. Development assistance agencies may be willing to assist in such efforts.

5. Policies on mitigating measures

5.1 ESAs, by definition, make their most important contributions to sustaining society by remaining relatively unaltered by human action; the goods and services they provide depend on natural ecological processes, so any forms of development should be aimed at enhancing rather than reducing their natural productivity.

5.2 In cases where objective and competent analysis dictates that public works are required in or near an ESA, environmental impact assessments should be conducted to ensure that the intrusion is made with the minimum detrimental impact on the natural systems in the ESA, and that appropriate mitigating measures are incorporated in the project. An independent decision-making process which has the confidence of the public may be required to ensure that all factors have been given sufficient consideration.

5.3 Since public works in or near an ESA can significantly increase the value of the ESA (for example, through maintaining low sedimentation rates in reservoirs), sufficient investments should be made in improving the management of the ESA so that it can make the most productive contribution. This may require measures to share the costs of improved management on a sustained basis.

5.4 In some cases, where a development project must intrude on an ESA, equivalent areas may be added to other parts of the ESA, or the value of the ESA lost to the project can be invested in other parts of the national ESA system. In this regard, full consideration should be given toward enhancing investments in ESAs which have been degraded through inappropriate uses.

5.5 Any mitigating measures which are proposed should be incorporated in the management plan for the ESA, and contribute to regional land-use objectives.

CONCLUSIONS

The governments of many of the countries of Africa have recognized the importance of Ecologically Sensitive Areas to their development programs, even if they have not used this exact term. However, few nations have been able to invest sufficiently in a systematic approach to designating and managing their ESAs, nor in conducting the economic analysis which would demonstrate the value of such areas to national development.

ESAs are important for social, economic, political, and ethical reasons, and they can make important contributions to sectors ranging from forestry to tourism to rural development. However, many ESAs are being abused rather than nurtured, and a number of general policy changes are required to enable ESAs to be identified, and for the most appropriate management regimes to be implemented.

Each country will have its own particular opportunities and constraints and no set of guidelines or criteria will automatically provide the right answers. Each country will need to design its own approaches to ESAs, and the Bank should stand prepared to provide whatever assistance might be requested.

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OPERATIONAL POLICY NOTE NO. 11.02

WILDLANDS: THEIR PROTECTION AND MANAGEMENT IN ECONOMIC DEVELOPMENT

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1. INTRODUCTION

1. The maintenance of specific natural land and water areas in a state virtually unmodified by human activity, hereafter termed wildland management, is an important subset of the broad environmental concerns addressed in OMS 2.36, "Environmental Aspects of Bank Work". The conversion of wildlands to more intensive land and water uses (through land clearing, inundation, plantations, or other means)[1] continues to meet important development objectives, and is an element of certain World Bank-supported projects. At the same time, wildlands are rapidly diminishing in many Bank member countries. The remaining wildlands can often contribute significantly to economic development, particularly in the longer term, when maintained in their natural state. The Bank's policy therefore is to seek a balance between preserving the environmental values of the world's more important remaining wildlands, and converting some of them to more intensive, shorter term human uses.

2. The Bank already has considerable experience of wildland management in Bank-supported projects. This OPN codifies existing practices and provides operational guidance concerning conservation of wildlands.[2] For a more detailed discussion of wildland management, see the Bank's Technical Paper: *Wildlands: Their Protection and Management in Economic Development*[3] which amplifies each section of this OPN. The Office of Environmental and Scientific Affairs in the Projects Policy Department (PPDES) is available to advise and assist staff on issues of wildland management.

2. JUSTIFICATION

3. There are two principal justifications for wildland management. First, wildlands serve to maintain biological diversity (i.e., the full range of the world's biota).

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1 Conversion here applies to permanent fundamental alteration of the natural ecosystem. Temporary modification by such means as highly selective, long rotation logging usually creates fewer relevant effects.

2 Other conservation activities (designed to protect the environment, but not necessarily to preserve biological diversity) are discussed elsewhere, e.g., in the 1978 Forestry Sector Policy Paper.

3 Available from the Office of Environmental and Scientific Affairs.

Second, wildlands provide environmental services important to society. In addition, certain wildlands are essential for maintaining the livelihood of tribal peoples, discussed in OMS 2.34.

2.1 Biological Diversity

4. Wildland management is necessary to prevent the untimely and often irreversible loss of a large proportion of the world's remaining biota, including the more visible plant and animal species. Because their wildland habitats are today rapidly disappearing, a large and growing number of biotic forms face extinction. Appropriate, low-cost wildland management measures can greatly reduce current extinction rates to much lower (perhaps almost "natural") levels, without slowing the pace of economic progress. By preserving the integrity of the biotic community and its plant and animal species, wildlands are important for the replenishment of surrounding degraded or abandoned areas.

5. Preserving biological diversity is important to development because of the economic potential of species that are currently undiscovered, undervalued, or under-utilized. Many previously unknown or obscure, and often threatened, species have turned out to have major economic benefits. But less than 20 per cent of the world's plant and animal (largely invertebrate) species have ever been inventoried, and even fewer screened for possible human uses. They therefore present valuable development opportunities if they are not irreversibly destroyed. In addition, there are important scientific, aesthetic, ethical, and practical reasons to avoid or minimize the extinction of the remaining biotic stock. While some species can be conserved *ex situ* (such as in zoos or seed banks), wildland management is the only technically and economically feasible means of preserving most of the world's existing biological diversity.

2.2 Environmental Services

6. In addition to maintaining biological diversity, many wildlands also perform important "environmental services", such as improving water availability for irrigated agriculture, industry, or human consumption; reducing sedimentation of reservoirs, harbors, and irrigation works; minimizing floods, landslides, and coastal erosion (and possibly droughts in some regions); improving water quality; and providing essential habitat for economically important fishery species. Despite their economic value and importance in meeting human needs, such environmental services are not always accorded adequate attention because they are usually public goods that tend to be poorly understood, undervalued, or even overlooked. When environmental services are lost due to wildland elimination, remedial measures are almost always far more expensive than prior maintenance. While many environmental services can also be maintained by establishing more intensive water and/or land use systems (e.g., bio-oxidation sewage treatment, tree plantations), wildland management is frequently more cost-effective.

2.3 Wildlands of Special Concern

7. Wildlands of special concern are areas that are recognized to be exceptionally important in conserving biological diversity or perpetuating environmental services. They can be classified into two types. First are wildlands officially designated as protected areas by governments, sometimes in collaboration with the United Nations or the international scientific community. These are National Parks, Biosphere Reserves, World Heritage Natural Sites, Wetlands of International Importance, areas designated for protected status in national conservation strategies or master plans, and similar "wildland management areas" (WMAs), i.e., areas where wildlands are protected and managed to retain a relatively unmodified state (Annex 1).

8. Second are wildlands as yet unprotected by legislation, but recognized by the national and/or international scientific and conservation communities, often in collaboration with the United Nations, as exceptionally endangered ecosystems, known sites of rare or endangered species, or important wildlife breeding, feeding, or staging areas. These include certain types of wildlands that are threatened throughout much of the world, yet are biologically unique, ecologically fragile, or of special importance for local people and environmental services. Wildlands of special concern often occur in tropical forests, Mediterranean-type brushlands, mangrove swamps, coastal marshes, estuaries, sea grass beds, coral reefs, small oceanic islands, and certain tropical freshwater lakes and riverine areas. Within the spectrum of tropical forests, lowland moist or wet forests are the most species-rich and often the most vulnerable. Wildlands of special concern also occur in certain geographical regions (Annex 2) that have been reduced to comparatively small patches and continue to undergo rapid attrition. As a result, these regions harbor some of the most threatened species in the world.

3. THE BANK'S INVOLVEMENT TO DATE

3.1 Existing Record

9. During the last 15 years, the World Bank Group[4] has assisted with financing of upwards of 40 projects with significant wildland management components. Most of them have involved establishment or strengthening of WMAs. Bank-supported

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[4] Includes the International Development Association (IDA) and the International Finance Corporation (IFC)

WMAs include national parks, nature reserves, wildlife sanctuaries, and those forest reserves managed primarily for their watershed or biological values, rather than for wood harvest. Other wildland management components of Bank projects have involved management of wildlife and the humans that utilize it, including anti-poaching measures, management of water flows from reservoirs to maintain wildlife habitat, and relocation of certain species. In still other cases, the location of projects has been changed to avoid important wildland areas.

10. Wildland management components have two principal objectives: first, to prevent, minimize, or partially compensate for wildland elimination, thereby conserving biological diversity; second, to preserve or improve the environmental services provided by wildlands, thereby enhancing the project's economic or social benefits. Most Bank-supported projects emphasize one or the other objective, however some Bank projects have wildland components seeking both objectives. [5]

11. Costs of wildland management components in Bank projects have typically been low. They have normally accounted for less than three per cent of total project costs, and in half of the cases for less than one per cent. In many instances, it is difficult to separate out the cost of the wildland component because of its integration with other components.

12. In one case, wildland management was the sole objective, so accounts for 100 per cent of project costs. At the other extreme, a large number of Bank projects have achieved significant wildland management objectives at zero additional cost. For example, manipulation of a hydroelectric project's water release schedule costs little or nothing, even though it provides major downstream benefits for wildlife, as well as for people and cattle.

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[5] For example, the establishment of the Dumoga-Bone National Park in the Indonesia Irrigation XV project helps ensure a more reliable water supply while reducing sedimentation of valuable irrigation works; at the same time, it helps ensure that a significant portion of the project area remains in its natural state, despite surrounding developments.

13. Wildland management components require additional Bank staff time and can increase project complexity, but they have rarely caused significant delays at any stage of the project cycle. Moreover, the failure to incorporate adequate wildland components can result in much greater delays and complexity later on. Furthermore, the failure to incorporate adequate wildland components can substantially reduce project benefits and might result in project failure. As wildland management components within Bank-supported projects become more routine, the additional staff effort required to manage them successfully is expected to decrease further.

14. The Bank's track record in implementing wildland management components is encouraging. According to project completion reports or environmental post-audits, implementation of only three out of 43 wildland components has been markedly slower than for most other project components. In at least four cases, the wildland component has been imlemented with less difficulty than other project components.

3.2 Lessons Learned

15. A number of important lessons have emerged from the Bank's experience with wildland management to date. First, wildland management components should be routinely and systematically incorporated into certain types of Bank projects (outlined in Section 4.1). Up to now, this has not always been done, and some projects which would have benefitted from wildland components have not included them.

16. Second, wildland components should be incorporated as early as possible within the project cycle (Annex 3) to minimize costs and facilitate implementation. While inclusion of wildland components in later stages of the project cycle may at times be necessary because of unforeseen circumstances, it is more effective and less costly to incorporate them as early as possible in the project cycle.

17. Third, meeting wildland management goals requires effective management "on the ground", not simply on paper. Colonists and resource extractive companies have rapidly moved into such "paper parks" (parks existing only on a legal document or map, rather than on the ground) unless they were inaccessible for other reasons. The wildland management objectives have to be translated into specific measures with a budget for their implementation. These measures include hiring and training of personnel, provision of necessary infrastructure and equipment, development of a scientifically sound management plan for each particular wildland, and a policy environment - legal, economic and institutional - which supports the wildland preservation objective. The mere declaration of intent to protect wildlands or wildlife, or even the designation of WMAs on a map, does not ensure effective management unless specific supporting measures are implemented.

18. Fourth, the multiple objectives of wildland management are most successfully attained if the WMA is carefully designed. For example, a WMA cannot preserve biological and genetic diversity, evolutionary processes, and environmental services

if it is too small. While some Bank-supported WMAs clearly appear sufficiently large to accomplish most or all of their objectives, others are so small that their ability to conserve biological diversity or provide environmental services or other benefits is questionable. Besides size, the specific location and shape of a WMA can be important factors in determining its success. Appropriate WMA design features are best determined for each case by a conservation specialist.

19. Finally, the success of a WMA, as of other project components, is contingent upon government commitment. This, in turn, often depends upon the degree of financial support provided by the Bank. Most of the Bank-supported wildland components have provided some direct support to establishing or strengthening WMAs. However, in some cases, the costs of the WMA establishment were assumed entirely by the Government, and the Bank took no specific measures to ensure the continued availability of such financing. By taking measures to ensure counterpart financing, or by providing the financing itself, the Bank can help ensure the availability of the relatively modest sums necessary for WMA establishment and continuation.

20. Financial support is usually not sufficient, however. It is often also necessary to maintain dialogue with governments, affected local people, and environmental advocates about the importance of conservation and the benefits of WMAs (tourism, watershed protection, etc.) and to include local people in the planning and benefits. Government commitment to the WMA is fostered by such dialogue, by supervision, by monitoring of national legal provisions, and by loan conditionality. In addition, two complementary and parallel activities contribute to WMA success: (1) rural development investments that provide farmers and villagers in the vicinity of the WMA an alternative to further encroachment, and (2) coherent national and sectoral planning and policies that promote wildland conservation.

4. POLICY GUIDANCE

21. The Bank's general policy regarding wildlands is to seek to avoid their elimination and rather to assist in their preservation. Specifically, (1) the Bank normally declines to finance projects involving conversion of wildlands of special concern (as defined in Section 2.3), even if this conversion occurred prior to the Bank being invited to consider financing. (2) When wildlands other than those of special concern may become involved, the Bank prefers to site projects on lands already converted (e.g., logged over, abandoned, degraded, or already cultivated areas) sometime in the past, rather than in anticipation of a Bank project. Deviations from this policy must be explicitly justified. (3) Where development of wildlands is justified, then less valuable wildlands should be converted rather than more valuable ones. (4) When significant conversion (e.g., 100 sq. kms., or a significant proportion of the remaining wildland area of a specicfic ecosystem, if smaller) of wildlands is justified, the loss should be compensated by inclusion of wildland management

components (see Section 4.2 below) in the project concerned, rather than in some future project. This component should directly support preservation of an ecologically similar area.[6] This policy pertains to any project in which the Bank is involved, irrespective of whether the Bank is financing the project component that affects wildlands.

22. The success of projects that do not eliminate any wildland often depends on the environmental services provided by wildlands. In such cases, the Bank's policy is to include a project component to conserve the relevant wildland in a WMA, rather than leaving its preservation to chance. In areas without remaining wildlands, alternative conservation measures may be needed to provide similar project benefits. In other cases, where the wildlands do not directly benefit or serve the objectives of the project, the project may be improved by supporting management of wildlands to provide socio-economic benefits in the general project area (see paragraph 6). Projects with wildland management as the sole objective should also be encouraged.

4.1 Types of Projects Needing Wildland Management Components

23. Based upon these criteria, projects with the following aspects should normally contain wildland components:

a. **Agriculture and livestock projects** involving: wildland clearing, wetland elimination,[7] wildland inundation for irrigation storage reservoirs; watershed protection for irrigation; displacement of wildlife by fences or domestic livestock; **fishery projects** involving: elimination of important fish nursery, breeding, or feeding sites; overfishing or introduction of ecologically risky

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[6] The policy in the 1978 Forestry Sector Policy Paper states ".... in countries where there are no adequate natural resource conservation programs, the Bank will not support projects that might result in disintegration of a habitat not elsewhere represented in the country and not under suitable protection (as in national parks and wildlife reserves)."

[7] Wetlands (such as ponds, marshes, swamps, flood plain forests, estuaries, mangroves) can be eliminated inadvertently through water diversions upstream or deliberately through drainage, diking, or filling.

exotic species within aquatic wildlands; **forestry projects** involving: access roads, clear-felling or other intensive logging of wildlands, wildland elimination.[8]

b. **Transportation projects** involving: construction of highways, rural roads, railways, or canals which penetrate wildlands, thus easing access and facilitating spontaneous settlement; channelization of rivers for fluvial navigation; dredging and filling of coastal wetlands for ports projects.

c. **Hydro projects** involving: large-scale water development, including reservoir, power, and water diversion schemes; inundation or other major transformation of aquatic or terrestrial wildlands; watershed protection for enhanced power output; construction of power transmission corridors.[9]

d. **Industry projects** involving: chemical and thermal pollution which may damage wildlands[10]; wildland loss from large-scale mining; wildland conversion for industrial fuels or feedstocks.

4.2 Types of Wildland Management Components

24. The most effective type of wildland management component is support for the conservation of ecologically similar wildlands in one or more WMAs.[11] In cases where a WMA already exists in the same type of ecosystem that is to be converted by a Bank-supported project, it may be preferable, for administrative or biological conservation[12] reasons, to enlarge the existing WMA, rather than to establish a new one. The government's wildland agencies, local university wildlife departments, and various international organizations can often advise in such judgements.

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[8] Plantations of fast-growing tree species are often an important complement to more direct wildland management activities by reducing the economic pressures for cutting the remaining forest wildland. They should be sited preferentially on already deforested land. Reforestation and land rehabilitation are covered in the 1978 Forestry Sector Policy Paper.

[9] & [10] Industrial pollution control is discussed in the Bank's Environmental Guidelines available from PPDES.

[11] See Section 5 for technical guidance on establishing a WMA.

[12] Biological conservation is usually more effective in one large WMA than in several small ones comprising the same total size and encompassing the same types of natural habitats.

25. A wildland management component could also involve the creation of wildlife habitat, in addition to or rather than preservation of already existing habitat. For example, marginal land on the fringes of irrigation projects could be converted to wildlife reserves by taking advantage of the water supply created by the projects. Natural depressions or seasonal swamps could be exploited by diverting water from the canal systems (probably a very small part of the total supply). Such reserves attract significant numbers of migratory and residential waterfowl with minimal additional project costs and land.[13]

26. A useful option is to improve the quality of management of existing WMAs. Many WMAs in Bank member countries receive insufficient on-the-ground management, due to lack of adequately paid staff, training, staff housing, other infrastructure, equipment, spare parts, fuel, or a well-developed management plan through which efficient resource allocation decisions can be made. Small components can often help correct these deficiencies. In countries where effective management is clearly lacking, it is generally preferable to improve the management of existing WMAs than to create new units "on paper", thereby further over-extending the limited capabilities of the responsible agencies. Whenever a new WMA is established as a project component, provisions are needed to ensure effective management. Since many wildland agencies (e.g., departments of national parks or wildlife) are not as operationally effective as necessary, institutional strengthening (particularly support for training) should be an important element of Bank-supported wildland management components.

27. The establishment or strengthening of WMAs is particularly effective when the Government includes these wildland areas in a national conservation or land use plan. A growing number of Bank member governments have undertaken some type of systematic land use planning for wildland management. Such planning can take various forms, ranging from "master plans" for a system of national parks and other WMAs, to "National Conservation Strategies" which address wildland management as only one component of a broad range of natural resource planning concerns, and in which policy intervention such as economic incentives are used to influence resource utilization. Bank assistance with such planning efforts greatly strengthens wildland management at the national level. When member governments agree to develop appropriate land use plans, it is important for the Bank to refrain from supporting projects which involve eliminating wildlands and run counter to these plans.

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[13] The Wildfowl Trust, Slimbridge, England, has set up such reserves on 5-8 sq. km.

28. In those relatively few Borrower countries in which wildland elimination pressures are still minor,[14] the requirement of a compensatory wildland component can be interpreted more flexibly to involve measures other then the establishment or strengthening of one or more WMAs. Such alternative options include careful project siting to avoid converting the more environmentally sensitive wildlands, support for research on and management of particularly sensitive species, support for land use planning efforts, or institutional strengthening of the government's wildland management agency, and training in ecology, biological conservation, and wildland management.

5. DESIGN OF WILDLAND MANAGEMENT AREAS

5.1 Design Considerations

29. WMA design features include size, shape and siting. Because an optimal design may vary greatly in different ecosystems, it is best determined in each case by a conservation specialist.

30. The size of a compensatory WMA should be sufficient to maintain the biological diversity or other important values present in the area to be converted. A WMA which is large enough to encompass a viable population of the largest local predator (e.g., eagle, tiger), or the seasonal territories and migration routes of the largest local herbivore, will most likely preserve all other pertinent ecological values. These objectives would most likely be achieved in a WMA larger than 1,000 sq. kms. Many values are conserved in moist forest WMAs of 500 sq. kms, although possibly not all in perpetuity. Interim WMAs of less than 100 sq. kms can be useful short-term expedients for subsequent expansion into surrounding degraded areas. In general, the larger the WMA, the greater the number of ecological interdependencies and gene pools that will be preserved. Both are necessary to a healthy and self-perpetuating ecosystem. It is recognized that conflicting pressures for more intensive land use often make the establishment of large WMAs difficult. In any case, compensatory WMAs should be no smaller than the wildland area converted by the project.

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[14] Wildland elimination pressure may still be minor because of low human population densities and growth rates, little economic demand for agricultural land, timber, or other resources, or because a substantial proportion of each remaining wildland ecosystem in a country has been set aside in WMAs which receive good on-the-ground protection and have strong policy support from the Government.

31. The optimal shape of a WMA will depend upon its objectives. A more circular shape may preserve more biological diversity than other shapes of the same area. Shape is also determined by the location of centres of endemism and other wildlife resources. Boundaries are more effective when they coincide with natural surficial features, such as a river or watershed.

32. To ensure that the compensatory WMA is ecologically similar to the area to be converted, it is obviously necessary to site the WMA in the same ecosystem as the area to be converted. Moreover, siting the WMA some distance away from the converted area (separated by a managed buffer zone for example) helps reduce pressures for encroachment upon the WMA from people living in the converted area.

5.2 Management Categories

33. A variety of different use related categories can be used in establishing WMAs. The choice of category depends upon the particular objectives being accorded priority for management. The categories listed in Annex 1 indicate the variety of WMAs appropriate under different circumstances.

5.3 Personnel and Training Needs

34. The need for well-trained personnel in the proper management of WMAs cannot be overemphasized. Without adequate numbers of such trained people, WMAs cannot effectively serve their intended national or societal functions. Bank-supported wildland project components should therefore provide for staffing levels and training activities that ensure competent management of WMAs. The appropriate number and types of WMA personnel depend upon the category of WMA, its size, and its intensity of management. The minimum adequate permanent staff size for a "modest to average" WMA is usually about eight.

5.4 Equipment, Infrastructure, and Budgetary Needs

35. Designation of WMAs on a map in no way ensures that they will be managed to provide their greatest possible benefits to society. Effective on-the-ground management requires a variety of physical inputs. In Bank-supported WMAs, efforts should be made to ensure that these inputs are provided as a project component in adequate supply and on a timely basis. Annex 4 contains a basic checklist of the physical inputs that are typically needed for effective WMA management. Some types of WMAs will require a variety of additional inputs, according to specific management objectives.

36. The budgetary requirements for establishing and operating WMAs will vary according to size and the amounts of needed infrastructure, equipment, and personnel. The comparatively large (3,200 sq. kms.) Dumoga-Bone National Park, financed by the Indonesia Irrigation XV Project, cost roughly US$ 1 million for establishment and

initial operating costs; most smaller WMAs can be expected to cost considerably less.

37. In some instances, establishment or enlargement of WMAs may require additional funds for purchasing land from private or tribal owners. It may at times also be necessary to resettle and compensate people living within the boundaries of a newly-established WMA.[15] Usually, however, WMAs are established on wholly government-owned properties on which people have not settled.

38. The largest recurrent cost of WMAs is usually staff **salaries**. It is important to maintain salaries at levels that encourage high productivity and a degree of permanence, and discourage corruption.[16] **Spare parts** for machinery, while usually a relatively small budget item, are also a vital recurrent expenditure. Without a reliable supply of spare parts for often remote WMA areas, necessary equipment will often lie idle or may become cannibalized to provide spare parts. In some cases, salaries, spare parts, fuel, and other recurrent costs can be fully or partly met by fees collected from tourists, persons engaged in some form of harvesting, or scientific researchers.[17] Otherwise, small annual outlays from the national or other government budget will be needed.

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[15] See OMS 2.33 for guidelines regarding involuntary resettlement and OMS 2.34 for guidelines regarding tribal people in Bank-financed projects. In many cases, indigenous hunter-gatherer societies are as much a part of the "natural" environment as the wildlife, and can safely remain in the park as caretakers as long as traditional ways of life are continued.

[16] High productivity also depends upon these important components: 1) environmental education for an understanding of the importance of the WMA; 2) pride in the WMA and the role of those who protect and support it; and 3) self-interest through some direct accrual of benefits of the WMA (aesthetic, recreational, moral, etc., as well as economic).

[17] The proportion of recurrent costs that can be recovered in this manner varies greatly in different WMAs, from 0 to 100 per cent.

5.5 Management Plans

39. Wildland management areas typically need well-developed management plans to ensure efficient allocation of the scarce financial and skilled human resources devoted to their management. A management plan is a written document which guides and controls the use of the resources of a WMA and directs the design of subsequent programs of management and development. A thorough management plan will:

(a) Describe the physical, biological, social, and cultural features of the WMA within a national, regional, and local context;

(b) Identify those items of particular concern from which the objectives for managing specific areas of the WMA are derived;

(c) Describe appropriate uses of the entire WMA through zoning; and

(d) List in chronological order the activities to be carried out to realize the proposed management programmes.

40. Preparation and implementation of management plans are carried out by the government wildland agency. Project staff should ensure that Bank-supported WMAs either have adequate management plans or will develop them early in the project. Some parts of a management plan can be completed in a few days, while others may take years to refine. While a longer-term management plan is being developed as soon as possible after loan signing, an "interim management plan" or "operational plan" may be used. PPDES can be of assistance in these matters.

5.6 Legal Considerations

41. The success of a WMA may depend upon how its design fits into an overall national legal framework concerning natural resources management in general and wildland management in particular. To maintain their legitimacy in the eyes of policy-makers and local populations, WMAs must have a firm legal foundation. National legislation, sometimes accompanied by a specific Presidential designation, is often needed to establish a WMA. Depending upon the particular situation, such legislation needs to establish precise WMA boundaries; specific management zones within the WMA, including buffer zones; a central management authority (at the national or sub-national level) with unambiguous responsibilities; and a mechanism to channel local participation in WMA management decisions. Bank staff should ensure that Bank-supported WMAs are established and managed within a compatible legal and policy context.

June 2, 1986

ANNEX I

Categories of Wildland Management[18]

1 **Scientific or Strict Nature Reserves** represent the most restrictive WMA category, intended to maintain representative samples of natural ecosystems in an undisturbed state for scientific research, environmental monitoring, education, and preservation of biological diversity. Tourism, recreation, and most other human uses are usually not permitted.

2 **National Parks** are usually relatively large areas where native plant and animal species (and often outstanding geological or other scenic features) are of special interest. Controlled tourism and scientific research are permitted; more intensive human uses usually are not.

3 **Natural Monuments** are often smaller WMAs intended to protect highly localized species, ecosystems, or geological formations. Tourism and scientific research are permitted to the extent that they are compatible with preservation of the unique natural features.

4 **Managed Nature Reserves or Wildlife Sanctuaries** protect rare plant or animal species, or large concentrations of resident or migratory wildlife. Manipulation of vegetation and other intensive management may be done to improve the habitat for species of special concern. Tourism, research, and occasionally limited livestock grazing or fuelwood collection are permitted, when these activities are compatible with wildlife management objectives.

5 **Tribal Peoples Reserves** are relatively unmodified natural areas in which indigenous tribal peoples or vulnerable ethnic minorities (see OMS 2.34) continue to practice traditional, low-intensity forms of land use such as hunting and gathering or nomadic pastoralism. Settlement or potentially disruptive resource utilization by outsiders is not permitted.

6 **Protected Landscapes** are areas which have often been significantly modified by people, but which still contain important wildland resources. Traditional land uses, including fishing, grazing, and some agriculture, are often permitted to accommodate the needs and interests of local populations. Land use control is often at the local government level.

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[18] Recognizing that different countries use different names for various types of WMAs, the standardized system of WMA nomenclature developed by the International Union for Conservation of Nature and Natural Resources (IUCN) is used here to facilitate comparisons and reduce confusion.

7 **Resource Reserves** are "interim" WMAs. They are typically fairly extensive areas which are not yet heavily settled, but which may be under relatively recent pressure for colonization, timber or mineral extraction, or other intensive uses. This WMA category is designed to restrict such uses until a land use plan or other management guide is issued to channel further development in an environmentally suitable manner.

8 **Multiple Use Management Areas** are intended to allow sustainable production of such economic goods as water for downstream uses; timber (obtained through low-intensity logging); fuelwood; wild fruits, herbs, gums, or other plant products; wildlife; fish; grazing; and outdoor recreation. Included in this category are most "forest reserves" and "protection forests," including those established largely for watershed catchment protection. Within these WMAs, management is primarily oriented to the sustaining of these economic activities, although special zones may also be designated within these areas to achieve more specific conservation objectives, such as preservation of biological diversity. These WMAs are generally large and capable of sustaining these types of economic activities without degradation or elimination of the wildland resource. Generally, these wildland areas do not possess nationally unique or exceptional natural features.

ANNEX II

Some Tropical Wildlands of Special Concern[19]

Eastern Africa

1 Madagascar: significant proportions of the northern and eastern moist forests.
2 Ethiopia: much of the remaining highland forest.
3 Tanzania: Usambara, Pare, and Uluguru Mountains.
4 Rwanda: mountain forests along the Zaïre and Uganda borders.
5 Kenya: Kakamega, Nandi, and Arabuko-Sokoke forests.

Western Africa

6 Cameroon: particularly Cameroon Mountain and the moist forested area extending into Gabon, and to the vicinity of the Cross River in southeastern Nigeria, including the Oban Hills.
7 Ivory Coast: southwestern forests (including the Taï forest), and adjacent parts of Liberia and Sierra Leone.

East Asia and Pacific

8 The Malay Peninsular (including parts of Thailand): Lowland forests, especially along the northwestern and eastern coasts.
9 Indonesia: much of the remaining lowland forests of Kalimantan, Sumatra, Sulawesi (especially the two southern peninsulas), and many smaller islands (e.g., Siberut).
10 Philippines: much lowland forest on all larger islands.

South Asia

11 Sri Lanka: the coastal hills of the southwest and the Sinharaja forest of the "wet zone."
12 India: most of the forests remaining on the Western Ghats.
13 Burma: the untouched teak forests in the northern regions.

Latin America and Caribbean

14 Ecuador: lowland coastal forest
15 Mexico: Lacandon forest in Chiapas.
16 Honduras-Nicaragua border: Mosquitia forest.
17 Panama: Darien province.
18 Colombia: the Choco region adjacent to Darien province.
19 Brazil: coastal forests of the "Cocoa Region" in the southeastern extension of Bahia between the coast and 41°30'W longitude, and between 13°' and 18°15'S latitude, and an outlier near Linhares, Espiritu Santo.
20 Brazil: parts of the eastern and southern Amazon region.

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[19] This list is by no means to be interpreted as comprehensive.

Tropical Aquatic Areas

1 Amazon River and associated wetlands (including varzea forests) (Brazil, Peru, Colombia, Ecuador, and Bolivia.)
2 Orinoco River and Delta (Venezuela and Colombia).
3 Purari River (Papua New Guinea).
4 Musi River (Sumatra, Indonesia).
5 Lake Malawi (Malawi), and other Rift Valley Lakes.
6 Lake Toba (Sumatra, Indonesia).
7 Sudd Swamp (Sudan).
8 Pantanal Swamp (Mato Grosso, Brazil).
9 Lake Atitlan (Guatemala).

ANNEX III

The Project Cycle

Responsibility for implementing wildland management projects or components rests primarily with regional operations staff, with advice and operational support provided by PPDES, as detailed for all environmental work in OMS 2.36. At *identification*, projects being considered are reviewed by regional staff in conjunction with PPDES to identify, as early as possible, the need to avoid converting a wildland tract or to preserve such a tract as part of the project. To determine whether a proposed project will develop or be in close proximity to ennvironmentally important wildlands, Bank staff can consult those government agencies with jurisdiction over wildland management authority. PPDES maintains contacts with such agencies and will assist upon request. Additional sources of information on ecologically important wildlands are computerized data bases maintained by some non-governmental organizations (NGOs) and several published directories, available from PPDES. In this manner, it will often be possible to learn quickly whether a proposed project site contains existing or proposed WMAs; known endangered species; major wildlife or fish breeding, feeding, or staging areas; important watershed catchments; or living resources of major importance to local people. If none of these mechanisms reveal the existence of ecologically important wildlands in the project area, a brief pre-project field survey is necessary since many important wildlands are not yet identified. This field survey should be undertaken by relevant specialists from the government's environmental ministry, wildlife agency, national university, or similar institution. This brief survey indicates the nature and extent of impacts on critical wildlands that would result from the implementation of the project and puts the information in a national context. The results should be recorded on the form provided in Annex 5.

During *preparation*, project staff (or their consultants) may assist the Borrower or project sponsor in carrying out the necessary environmental studies, including those pertaining to wildlands. PPDES can recommend consultants or other experts who can identify important wildland areas, carry out necessary field surveys, or help design appropriate wildland management project components. At the completion of any necessary studies, the Project Brief (see OMS 2.13) should highlight whether the project involves the conversion or disintegration of a relatively unmodified ecosystem and include alternative suggestions for achieving the goals of the government. If conversion is justified, the Brief should outline why, together with the wildland management components needed.

As part of *appraisal*, project staff assess the planned wildland management and other environmental measures, as specified by OMS 2.20. The Staff Appraisal Report specifically describes any planned wildland management measures, including budgets and agency responsibilities. While PPDES is available for consultation and assistance at any stage of the project cycle, it is also responsible for reviewing projects at the Yellow Cover stage (see OMS 2.00). In addition to the Staff Appraisal Report, the

President's Report (see OMS 3.02) also notes any significant environmental -- including wildland management -- issues and mitigatory measures. Once wildland measures are identified as necessary, timely action should be ensured by conditionality such as loan effectiveness of disbursement. Since wildland management must be done in perpetuity to be effective, the loan agreement should specify long-term measures which the Borrower has agreed to implement.

Supervision missions should routinely review implementation of the wildland component with the Borrower. Such aspects are handled as for environmental issues in general (see OMS 2.36). Implementation of important wildland components should, as a general principle, be well underway before a project's major land clearing or construction works are allowed to proceed.

ANNEX IV

Physical Inputs Required in Most Wildland Management Areas

a. Headquarters building and guard posts at entry points.

b. Staff housing

c. Visitor information center, including educational and interpretive exhibits where appropriate.

d. Research facilities, including laboratory and housing for scientists.

e. Roads and trails (amount will vary according to intensity of management desired).

f. Fencing and signs, adequate to ensure proper demarcation and to control access.

g. Communications, internal and external to the WMA: radio, walkie-talkies, mail, and telephone (where appropriate).

h. Electricity, gas, or other energy systems.

i. Sewage and waste systems.

j. Four-wheel drive, motor bikes, or other vehicles.

k. Boats, outboard motors, and docking facilities, where needed.

l. Appropriate tools, maintenance equipment, and *spare parts*.

m. Fuel.

n. Management-oriented publications: maps, species lists, pamphlets for visitors, etc.

ANNEX V

Wildland Survey and Management Form[20]
(Sample only)

Name of Project:
Expected Appraisal (or other) Date:

Date of this Survey: Surveyor: Affiliation:

Methodology(ies) (circle one):
Site inspection/Library research/Both/Other(specify)

1 Specific subcategory(ies) of ecosystem that proposed project will affect: (e.g., tropical semi-evergreen moist forest, salt-marsh, wet savanna)

2 Important environmental and biological features of ecosystem(s): (e.g., water catchment area for large agricultural valley and habitat for the endangered mountain gorilla)

3 Projected general impact type on ecosystem(s) of proposed project: (e.g., deforestation, flooding, draining)

4 Proportion (%) of the region's remaining ecosystem(s) (as in #1 above) to be converted (and/or impacted, if different): (e.g., this project will flood about 10% of this country's remaining lowland riparian swamp forest.)

5 Estimated annual rates of attrition of affected ecosystem(s) in this country and historical trend of this rate: e.g., The current annual rate of attrition of (semi-montane forest) is 3% a year. This rate was 0.5% in 1975 and 1% in 1980.)

Maps and more complete reports used or available can be appended or cited.

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[20] This type of information is expected as part of identification, and can be used for the project brief. This form can be completed by the government's environmental ministry or wildlife agency, or by the project pre-feasibility team's wildlands specialist.

SECTION II

SOUTHERN AFRICA

Botswana, Lesotho, Malawi, Mozambique, Swaziland, Zambia, Zimbabwe

ANNOTATED LIST OF SITES

Within each country, sites are divided into four subsections, according to the degree of protection they appear to enjoy.

INTERNATIONALLY DESIGNATED PROTECTED AREAS These are the World Heritage sites, Biosphere Reserves and Ramsar sites within each country.

NATIONALLY PROTECTED AREAS Excluding those in the above section, these include all nationally designated protected areas having objectives which qualify them for IUCN Management Categories I-VII (see below).

OTHER MANAGED AREAS In this section are other designated sites which have a nature conservation function (including forest reserves and other IUCN Management Category VIII sites), as well as some well managed private reserves.

UNPROTECTED SITES This section includes sites where there is no officially recognised protection status. Three types of site are included: proposed protected areas, where implementation is either being studied or is under way; recommended sites, where protection has been recommended by an individual or group but where implementation is yet to be initiated; and other sensitive sites which have been recognised as valuable wildlands.

In some countries, the political situation may have caused management to lapse, and in these and other cases information on the current status of the site can be hard to obtain. The annotated list is based on the information available.

The protected areas information shown on the maps for each chapter have been classified by management authority; i.e the forestry sector, wildlife sector or additional sector (e.g. Presidential reserve). Information concerning the location of all numbered sites was not available. Hence some sites numbered on the lists do not appear on the maps.

This list has been prepared as a desk study, and is based on available information. It should be taken as a guide rather than a definitive study.

Information Sources

The World Conservation Monitoring Centre gathers, analyzes and disseminates information on the status, security and management of the Earth's biological diversity as a service to the international community. The information presented in this publication has been drawn from WCMC's databases and geographical files which have been developed in collaboration with numerous national and international sources. These data, which have been gathered over a number of years, are held within tabular databases, paper files and geographic information systems (GIS) at the Centre. WCMC relies on its own and its sponsors' worldwide network of contacts, as well as published and unpublished literature, to provide accurate information and an efficient service to its users.

The protected areas listings in the country chapters have been downloaded from the WCMC Protected Areas Database which contains over 32,000 records. The WCMC maintains these data in collaboration with the IUCN Commission on National Parks and Protected Areas, the UNESCO Man and the Biosphere Programme, the World Heritage Convention and others. This desk study has concentrated heavily on these data and on the extensive conservation library held at WCMC.

Much of the information WCMC holds has a spatial element and since 1989 WCMC has been operating a GIS. A substantial amount of data on threatened habitats, protected and unprotected sites and other related subjects have now been assembled. The digital spatial data run in parallel with the supporting structured data, and the locational or boundary information shown on the maps within the country chapters are updated as new data are acquired. The spatial data are maintained within the Centre's GIS in ARC/INFO format and are available to all parties concerned with environmental conservation, via the WCMC *Biodiversity Map Library* (BML). The BML has been designed and implemented to enhance the Centre's information service providing a method for maintaining the environmental data in a structured and easily accessible manner. The information shown on the maps in this book are stored in the BML.

The following text was originally drafted in December 1991 by James Culverwell and Hilary Tye, and updated in 1993 by James Culverwell and Harriet Gillett. Maps were prepared by Mary Edwards. Final copy was prepared by Harriet Gillett with assistance from Mark Lewis. Secretarial support was provided by Veronica Greenwood, with assistance from Deborah Rothera. Clare Billington and Jerry Harrison were responsible for overall coordination.

BOTSWANA

INTERNATIONALLY DESIGNATED PROTECTED AREAS

None

NATIONALLY PROTECTED AREAS

Bathaen Dam Bird Sanctuary IUCN Category IV
470ha

Central Kalahari (Kgalagadi) Game Reserve IUCN Category II
This area of 5,180,000ha (which is contiguous to the 260,000ha **Khutse Game Reserve**) was established in 1961 primarily to protect the hunting areas of 2000-3000 nomadic hunter-gatherer San people, and includes rangelands supporting vast herds of largely migratory ungulates. The entire reserve is on Kalahari sands up to 90m deep, and there is no permanent surface water. Vegetation is sparse, with scrub, grassland and some mopane woodland. The fauna includes lion, leopard, African wild dog, brown hyena, cheetah, zebra, red hartebeest, springbuck and ostrich. Intensive poaching is a considerable problem, which the authorities are unable to adequately control. The erection of veterinary fences to contain foot and mouth disease has caused a serious decline in ungulate populations, particularly wildebeest, and wildlife numbers have been affected by drought and conflicts with the livestock industry over grazing and borehole usage. Further threats to the integrity of the reserve are mineral prospecting and the proposed trans-Kalahari railway (IUCN/UNEP, 1987).

Chobe National Park IUCN Category II
Established as a national park in 1968, the area of 1,057,000ha has a varied topography, including the Savuti Marsh, a dry treeless area in the sandy Mababe Depression which floods during the rainy season, and eight seasonal pans on the Nogatsaa floodplain. Vegetation includes dry savanna grassland, mopane woodland and some riverine forest. The park is renowned for large herds of elephant, buffalo and zebra, but giraffe, tsessebe, lion, spotted and brown hyena, amongst numerous other species, occur as well. White rhinoceros have been reintroduced. It is the only locality in Botswana where puku *Kobus vardoni* occur. Marked habitat change is occurring along the Chobe River due to heavy concentrations of elephants during the dry season, which includes some herds from Zimbabwe breaking through the veterinary fencing. A westward extension to include further habitat of the threatened red lechwe *Kobus leche leche* and wattled crane *Bugeranus carunculatus* has been suggested (IUCN/UNEP, 1987; Spinage 1990; Stuart *et al.*, 1990).

Gemsbok National Park IUCN Category II
This park, established in 1971, covers 2,600,000ha of Kalahari desert in the extreme south-west of Botswana. Vegetation types include thorn thickets and savanna, and some frontage along the banks of the intermittent Nossob River. Larger mammals include springbuck, eland, gemsbuck, lion, leopard, cheetah, and both brown and spotted hyena. The park is undeveloped, and is managed by authorities from the

adjacent Kalahari-Gemsbok National Park in South Africa; visitors are permitted, but poaching occurs (IUCN/UNEP, 1987).

Gaborone Game Reserve IUCN Category IV

This small reserve of 300ha is near Gaborone. It was established primarily for wildlife education and recreational purposes, but contains a wide variety of habitats including woodland, marsh, savanna and seasonally flooded grassland. Wet habitats are partly maintained by discharges from a sewage works. The fauna is varied, and includes many species of ungulate and waterfowl; a reintroduction programme has been proposed to increase species diversity. Grazing has affected vegetation quality in the past, but the area is now fenced and grazing by domestic stock is prohibited. Local people are allowed to cut firewood within the reserve (IUCN/UNEP, 1987).

Mabuasehube Game Reserve IUCN Category IV

This reserve, covering 166,500ha, is contiguous with the **Gemsbok National Park** and includes three large seasonal salt pans which attract a wide variety of game. It was originally gazetted in order to protect lion. Both spotted and brown hyena occur, as do typical Kalahari species such as eland, red hartebeest, springbuck, gemsbuck and ostrich. Visitors are allowed (IUCN/UNEP, 1987).

Khutse Game Reserve IUCN Category IV

This 260,000ha reserve is a vast, undulating sandy plain with 50-60 scattered mineralised clay pans and several sand-filled fossil valleys. Its northern boundary is contiguous with the **Central Kalahari (Kgalagadi) Game Reserve**. There is no permanent surface water, although some pans may be flooded after heavy rains; other pans are semi-permanent grassy depressions. Most of the area is dry savanna, less degraded than in many parts of the Kalahari. Resident wildlife is sparse, but concentrations of animals may occur on migration. Threatened mammals include leopard, cheetah, brown hyena and African wild dog. There is a sparse nomadic human population of San hunter-gatherers. Fencing has disrupted game migration routes, and illegal hunting occurs. It is also the nearest wildlife area to Gaborone and receives many visitors (IUCN/UNEP, 1987).

Makgadikgadi Pans Game Reserve IUCN Category IV

This 413,000ha reserve includes sections of Ntwetwe and Sowa pans, which form the Makgadikgadi Salt Pan complex, the last remnant of a vast 6,000,000ha lake. Wide grassy plains with groves of vegetable ivory palm *Hyphaene benguellensis* extend northwards from Ntwetwe Pan. The pans only contain water after heavy rains, when they attract large flocks of waterfowl. The reserve is a dry season refuge for many animals, particularly zebra and springbuck, and several species of ungulate migrate through the reserve. Threatened mammals include cheetah and brown hyena. Some poaching occurs. There has been a proposal to link the reserve to the nearby **Nxai Pan National Park** (Hughes and Hughes, 1992; IUCN/UNEP, 1987).

Mannyelanong Game Reserve IUCN Category IV
An area of 300ha at an elevation of 1367m near the village of Otse, this reserve was established in 1985 to protect a breeding colony of the cliff-nesting, endangered southern African endemic Cape vulture *Gyps coprotheres*. The hill still supports mammals such as mountain reedbuck, klipspringer, greater kudu, caracal and rock hyrax (WCMC, 1991).

Maun Educational Park IUCN Category V
This is a fenced area of 300ha adjacent to **Maun Wildlife Sanctuary** on the left bank of the Thamalakane River opposite Maun town, containing wildebeest, zebra, giraffe and white rhino.

Maun Wildlife Sanctuary IUCN Category IV
19°55'S, 23°26'E Records indicate that this 8500ha sanctuary, adjacent to the **Maun Educational Park** and originally gazetted in 1969 to limit the use of firearms and to conserve wildlife around the village of Maun, has been severely degraded by dense settlement and overgrazing around this booming tourist town. A few hippopotami, crocodile, green monkeys, steenbuck and bushbuck still survive. (Wildlife Management Training Centre, 1982).

Mogabane Dam Bird Sanctuary IUCN Category IV
940ha

Moremi Game Reserve IUCN Category IV
This 390,000ha reserve is part of the inland delta of the Okavango River, situated in the otherwise arid Kalahari desert. The Okavango swamp is virtually the only permanent surface water in Botswana apart from the Okavango, Linyanti and Chobe rivers, and includes permanent lagoons, channels, papyrus swamp, reedbeds and islands, some of the latter supporting savanna woodland covering a third of the reserve. The diverse habitats support a wealth of wildlife, with threatened species including elephant, leopard, cheetah, African wild dog, slaty egret and Nile crocodile. A veterinary fence has now prevented the incursion of cattle into the reserve, thereby preventing over-grazing. However, dredging to improve water supply to Maun will extend 25km into the fenced reserve, and there are plans to drain the Boro river, which may cause habitat alteration (Armstrong, 1991). The chemical eradication of tsetse fly poses a major threat, but increasingly sophisticated poaching, illegal fishing and burning occur as well (IUCN/UNEP, 1987).

Nnwane Sanctuary
Nxai Pan National Park IUCN Category II
This park, covering 150,000ha, includes two salt pans, Nxai Pan (a fossil lake bed 10km wide) and the smaller Kgama-kgama Pan. There has been a proposal to link the park to the nearby **Makgadikgadi Pans Game Reserve**. Vegetation is predominantly woodland savanna, but Nxai Pan is covered with short salt-tolerant grass and scattered clumps of trees. There are large zebra herds and many migratory ungulates, which concentrate at waterfilled depressions in the pan during the rains, moving outside the

park during the dry season. Endangered mammals include cheetah, leopard and brown hyena. Access routes for migratory ungulates may be restricted if the Maun-Francistown road is fenced or if neighbouring ranches erect fencing (IUCN/UNEP, 1987).

OTHER MANAGED SITES

Chobe Forest Reserve IUCN Category VIII
18°12'S, 24°26'E This reserve covers 188,000ha and is contiguous to **Chobe National Park**. It is situated primarily on the swampy floodplain of the Linyanti River, with expanses of reedmarsh, papyrus swamp, islands and meandering waterways similar to the Okavango system. During exceptional floods the Kuando River spills over into the Linyanti, linking the Chobe and Okavango systems. It includes one of the few remaining natural timber forests in Botswana with Rhodesian teak *Baikiaea plurijuga* and mukwa *Pterocarpus angolensis* trees. The varied fauna includes elephant, lion, African wild dog and Nile crocodile. It has been recommended for inclusion in **Chobe National Park** together with the **Linyanti Wildlife Management Area** (IUCN/UNEP, 1987).

Kasane Forest Reserve IUCN Category VIII
17°48'S, 25°12'E Recommendations have been made to include this 16,250ha area into **Chobe National Park**. Trees harvested commercially in the reserve are Rhodesian teak and mukwa, which are exported to Zimbabwe and South Africa. Wildlife populations still occur, including sable and roan antelope, buffalo, lion and elephant (WCMC, 1991).

Kasane Forest Reserve Extension IUCN Category VIII
18°00'S, 25°12'E Established in 1981 and covering 47,500ha of mixed broadleaved semi-deciduous woodland, this area was established to protect commercially harvestable areas of Rhodesian teak and mukwa. *Terminalia* spp., *Sterculia africana* and other tree species occur, growing on red Kalahari sands. The timber is exported to Zimbabwe and South Africa (WCMC, 1991).

Kazuma Forest Reserve IUCN Category VIII
18°47'S, 25°04'E Covering 23,750ha of mixed broadleaved woodland on red Kalahari sands, this forest reserve was established in 1981 to protect commercially harvestable stands of Rhodesian teak and mukwa, which are exported to Zimbabwe and South Africa (WCMC, 1991).

Maikaelelo Forest Reserve IUCN Category VIII
18°28'S, 25°04'E Covering 62,500ha, established in 1981

Sibuyu Forest Reserve IUCN Category VIII
18°48'S, 25°41'E Covering 117,500ha, this reserve was established in 1981 to protect commercially valuable Rhodesian teak and mukwa trees. Large mammals, including elephant, still occur (WCMC, 1991).

Shashe/Limpopo Junction Elephant Reserve
22°07'S, 29°00'E This area of 45,000ha includes the privately-owned **Mashatu Game Reserve** in the triangle formed between the confluence of the Shashe and Limpopo rivers. Game is abundant, including elephant, African wild dog and lion. The proposed reserve includes the **Lepakola Hills**, and 10,000ha of mopane tree savanna and granite hills (IUCN, 1987; WCMC, 1991).

UNPROTECTED SITES

Aha Hills Recommended
19°47'S, 21°06'E An area of 100,000ha is recommended for protection (IUCN, 1987).

Drotsky's Caves Recommended
20°01'S, 21°26'E Situated in the Gcwihaba Hills in western Ngamiland, these extensive limestone caverns are currently unprotected (IUCN, 1987).

Grootlaagte Wildlife Management Area Proposed
21°10'S, 21°25'E Situated north of the town of Ghanzi, this proposed Wildlife Management Area covers an area of 390,800ha. Numbers of San hunter-gatherers live in the area (Kalahari Conservation Society, 1988).

Kedia Wildlife Management Areas Proposed
21°31'S, 24°42'E This area is situated to the east of Deception Pan, south of Kedia in Boteti Sub-District. Plans include relocating existing boreholes to the perimeter of the Wildlife Management Area. The ongoing Kedia Game Harvesting Project has been using the proposed Wildlife Management Area as its resource area. Protection of the area is under consideration, and has been approved by the District (Kalahari Conservation Society, 1988; WCMC, 1991).

Kgalagadi Wildlife Management Area Proposed
24°00'S, 21°00'E Situated in Kgalagadi District, this Wildlife Management Area consists of two sections covering a total area of 2,500,000ha. It acts as a buffer between the **Gemsbok National Park**, **Mabuasehube Game Reserve**, and adjoining communal and commercial grazing areas. Migratory game such as gemsbuck, eland, red hartebeest and various predators occur. Sixteen percent of the area's human population are San hunter-gatherers, and the Wildlife Management Area is currently used for subsistence hunting. It includes *Acacia* parkland to the north of **Gemsbok National Park** and around **Masetlheng Pan**, the latter having been specifically recommended for protection (Kalahari Conservation Society, 1988; WCMC, 1991).

Kubu Island
20°50'S, 25°49'E This is a rocky hill 'island' at the southern end of Soa Pan, itself part of the Makgadikgadi Pan complex. Ancient stonewalling exists, and baobab trees are a notable feature of the hill. The area is in danger of degradation from uncontrolled visitation (J. Culverwell pers. comm., 1991).

Kwebe Hills Recommended
20°33'S, 23°09'E An area of 10,000ha has been recommended for protection (IUCN, 1987).

Kweneng Wildlife Management Area Proposed
23°34'S, 23°30'E The bulk of this Wildlife Management Area is to the west of **Khutse Game Reserve**. Its prime function is to provide a link for migratory game moving between the **Central Kalahari Game Reserve** and the Kgalagadi District (Kalahari Conservation Society, 1988).

Lake Ngami Recommended
20°26'S, 22°40'E, at 932m. This is a seasonal lake that may cover 20,000ha when full, fed by the seasonal Nghabe River. An area of 6500ha is recommended for protection under the Ramsar Convention, which would help protect the lake and surrounding grasslands. The lake, now drier than in historical times, is still one of the most important southern African sites for breeding white pelican (10,000 in 1971) and greater (100,000 in 1971) and lesser flamingo when full, as well as a wintering site for inter-tropical and Palaearctic migrants. The area has been degraded by overgrazing and trampling by cattle (Burgis and Symoens, 1987; IUCN, 1987; WCMC, 1991).

Lepakola Hills - see **Shashe/Limpopo**

Linyanti Wildlife Management Area Proposed
18°06'S, 24°08'E (part of **Okavango Delta Wildlife Management Area**) Comprising open grasslands and savanna between the Okavango Delta and the Linyanti River, this area supports abundant game. Red lechwe and wattled crane occur. Its establishment is under consideration, and approved by District (Kalahari Conservation Society, 1988; WCMC, 1991).

Mabeleapodi Hill
20°56'S, 22°31'E (WCMC, 1991)

Makgadikgadi Pans Wildlife Management Area Proposed
20°41'S, 25°24'E This is intended as a buffer zone between **Makgadikgadi Pans Game Reserve** and cattle areas to the south. It includes almost all of Ntwetwe Pan, but may exclude Sowa Pan. The vegetation varies from open saline semi-desert and *Hyphaene benguellensis* palm savanna, to mopane and *Acacia* scrub and thicket. Game species include abundant zebra, gemsbuck and springbuck, and brown hyena, cheetah and lion also occur. It is proposed that the area be utilised for controlled long-term hunting and culling, as well as for tourism, limited cattle farming and dryland farming (Burgis and Symoens, 1987; Kalahari Conservation Society, 1988; WCMC, 1991).

Matlho-a-Phuduhudu Wildlife Management Area Proposed
23°00'S, 22°19'E Situated in Ghanzi District to the south of Ghanzi town, this proposed Wildlife Management Area covers an area of 881,600ha. Numbers of San hunter-gatherers live in the area (Kalahari Conservation Society, 1988).

Masetlheng Pan - see **Kgalagadi Wildlife Management Area**

Mogware Hills Recommended
22°41'S, 26°39'E These hills support knobthorn *Acacia nigrescens* and *Combretum* sp. tree savanna, 10,000ha of which is recommended for protection (WCMC, 1991).

Mookane/Limpopo river - see **Notwane/Limpopo Area**

Nata Statelands Wildlife Management Area Proposed
19°24'S, 25°35'E It is recommended that all or a part of this area be proposed as a Wildlife Management Area (Kalahari Conservation Society, 1988; WCMC, 1991).

Ngamiland Statelands Wildlife Management Area Proposed
19°34'S, 24°25'E Covering 1,670,500ha, this area originated as a migration corridor between **Makgadikgadi Pans Game Reserve** and **Nxai Pan National Park** (Kalahari Conservation Society, 1988).

Nnwane Dam Bird Sanctuary

Notwane/Limpopo Area
23°43'S, 26°54'E The area around Buffelsdrift, plus 1000ha of tree savanna of the southern hardveld, and including leadwood bushveld of the Mookane area, has been recommended for protection (WCMC, 1991).

Nunga Wildlife Management Area Proposed
18°51'S, 25°05'E This is adjacent to **Chobe National Park** in northern Botswana. It is an area with a high elephant population, and is presumed to be the area through which elephant migrate between **Chobe National Park** and Hwange in Zimbabwe. If Botswana starts culling its elephant populations, this will be one of the main areas concentrated upon (Kalahari Conservation Society, 1988).

Okavango Delta Wildlife Management Area Proposed
18°45'S, 23°00'E The 1,388,000ha of the **Okavango Delta Wildlife Management Area** cover much of the Okavango Delta within the veterinary Buffalo Fence. The system is fed by floodwaters from Angola, entering Botswana via the Okavango River. Vegetation includes semi-desert, grasslands, scrub, thicket and woodlands, swamps, papyrus and reedbeds. Sixty-eight species of fish have been recorded from the system, and hippopotami, sitatunga and Nile crocodile are fairly common. The networks of islands and higher ground support a wide variety of larger mammals such as roan and sable antelope, red lechwe, buffalo and elephant, as well as lion, leopard, African wild dog and spotted hyena. Rare species include the slaty egret, wattled crane and Pel's fishing owl. **Moremi Game Reserve** (390,000ha) is situated in the east of the delta (Kalahari Conservation Society, 1988; Stuart *et al.*, 1990; WCMC, 1991).

Okavango River
18°45'S, 22°10'E Between Muhembo and Jao, 10,000ha of river frontage are considered as worthy of protection. The Okavango River is deep and perennial, with banks lined by papyrus and *Phragmites* sp. and areas of riparian forest. Populations of hippopotami, sitatunga, common reedbuck and crocodile occur, and rare birdlife include Pel's fishing owl, African skimmer, slaty egret and white-backed night heron. The area along the river is heavily settled, the residents depending upon it for watering stock and fishing. Large area of papyrus are burned annually, but the effects of this are not known (J. Culverwell pers. comm., 1991; IUCN 1987).

Okwa Wildlife Management Area Proposed
22°18'S, 22°25'E Situated in Ghanzi District to the south-east of Ghanzi town, this proposed Wildlife Management Area covers an area of 1,361,800ha. Numbers of San hunter-gatherers live in the area (Kalahari Conservation Society, 1988).

Pataletsabe(a) Hill
A conserved area of 6000ha has been recommended to protect a breeding colony of the Cape vulture, a southern African endemic (IUCN, 1987).

Shoshong Hills
23°00'S, 26°34'E These hills support knobthorn and *Combretum* sp. tree savanna, 10,000ha of which are recommended for protection (WCMC, 1991).

Soa Pan/Nata River
20°16'S, 26°08'E The northern end of Sowa Pan (one of the two Makgadikgadi Pans) is seasonally important for pelicans, flamingos and other waterbirds. There is a soda-ash mine operating in the vicinity (J. Culverwell pers. comm., 1991; WCMC, 1991).

Southern District Wildlife Management Area Proposed
24°28'S, 23°14'E Covering an area of 2,510,000ha, this area lies in south-eastern Botswana. Species that occur include springbuck, red hartebeest, steenbuck, grey duiker and ostrich (Kalahari Conservation Society, 1988).

Tamafupa/Jari Pan complex Recommended
A conservation area of 120,000ha has been recommended (IUCN, 1987).

Tsodilo Hills Recommended
18°43'S, 21°46'E These are a unique and isolated group of hills of cultural significance to the local San people, with many superb rock paintings. Some endemic reptile species occur. A protected area of 9000ha has been recommended, which would include some Ngamiland tree savanna as well. There is fair tourism potential; currently the area is being degraded by uncontrolled visitation, vandalism and heavy grazing of domestic stock (J. Culverwell pers. comm., 1991; IUCN, 1987).

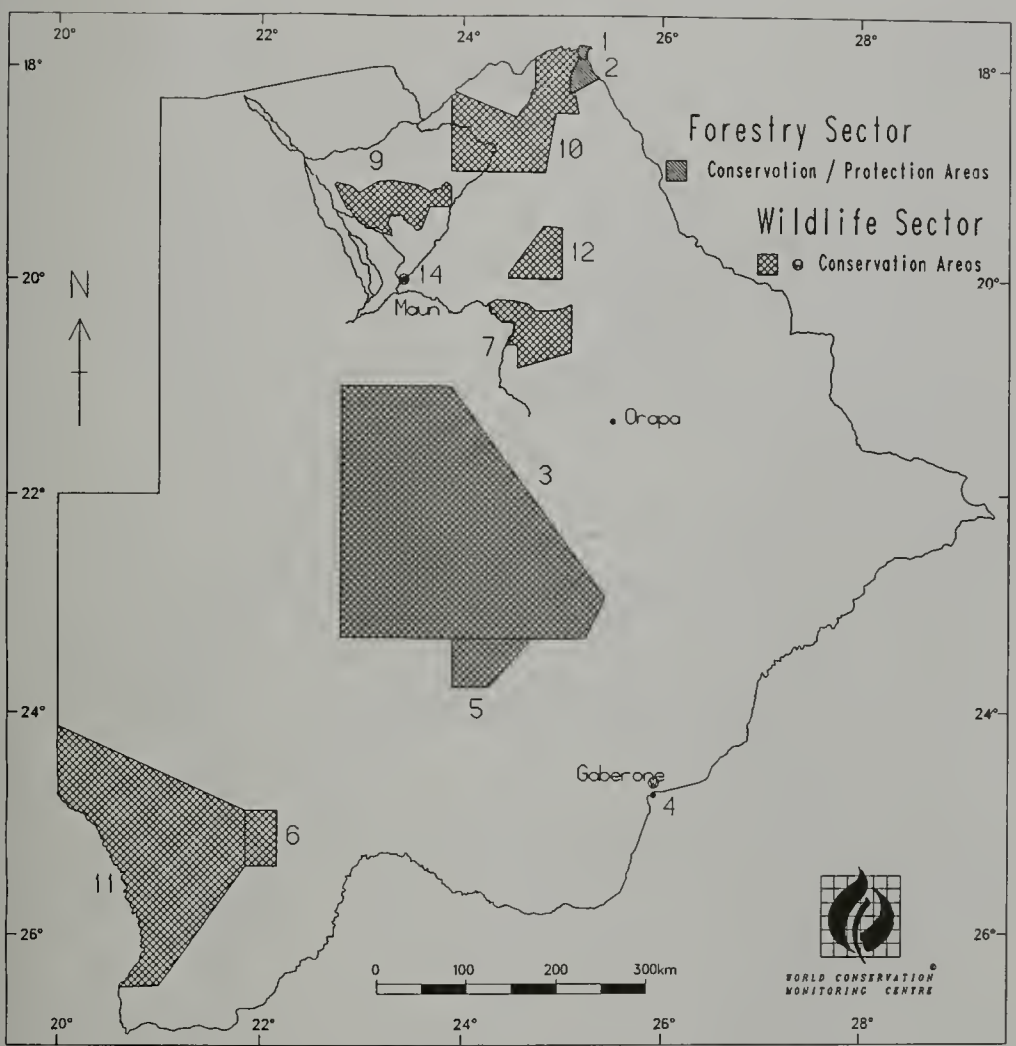
Tswapong Recommended
22°46'S, 27°27'E Vegetated by knobthorn and *Combretum* tree savanna, this hill supports a colony of the Cape vulture, an endangered southern African endemic. 20,000ha are recommended for protection (Stuart *et al.*, 1990; WCMC, 1991).

BOTSWANA - PROTECTED SITES

National/international designations

Name of area and map reference (see Fig. 1.1)		Management area (ha)	Year notified
Forest Reserves			
	Chobe	188,000	
1	Kasane	16,250	1968
2	Kasane Extension	47,500	1981
	Kazuma	23,750	
	Maikaelelo	62,500	
	Sibuyu	117,500	
Game Reserves			
3	Central Kalahari	5,180,000	1961
4	Gaborone	300	1980
5	Khutse	260,000	1971
6	Mabuasehube	166,500	1971
7	Makgadikgadi Pans	413,000	1970
8	Mannyelanong	300	1985
9	Moremi	390,000	1965
National Parks			
10	Chobe	1,057,000	1968
11	Gemsbok	2,600,000	1971
12	Nxai Pan	150,000	1971
Reserve			
	Shashe/Limpopo Junction Elephant	45,000	
Sanctuaries			
13	Bathaen	470	
14	Maun	8,500	
15	Mogabane	940	

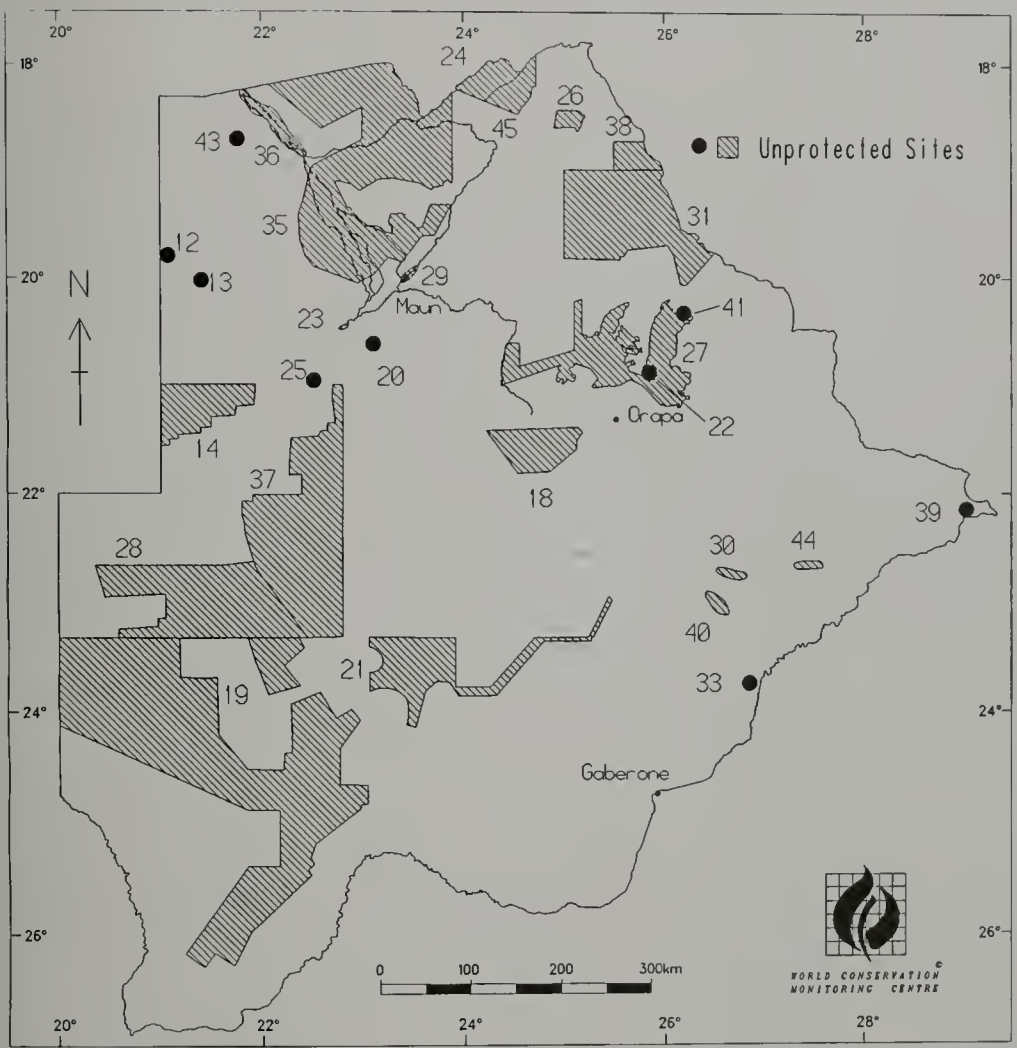
Fig 1.1 Botswana: protected ecologically sensitive sites



BOTSWANA - UNPROTECTED SITES

Name of area and map reference (see Fig. 1.2)		Management area (ha)
1	Aha Hills	100,000
2	Drotsky's Caves	
3	Grootlaagte Wildlife Management Area	390,800
4	Kedia Wildlife Management Areas	
5	Kgalagadi Wildlife Management Area	2,500,000
6	Kwebe Hills	10,000
7	Kweneng Wildlife Management Area	
8	Kubu Island	
9	Lake Ngami	
	Lepakola Hills	
10	Linyanti Wildlife Management Area	
11	Mabeleapodi Hill	
12	Makgadikgadi Pans Wildlife Management Area	
13	Matlho-a-Phuduhudu Wildlife Management Area	881,600
14	Mogware Hills	10,000
15	Nata Statelands Wildlife Management Area	
16	Ngamiland Statelands Wildlife Management Area	1,670,500
	Nnwane Dam Bird Sanctuary	
17	Notwane/Limpopo Area	
18	Nunga Wildlife Management Area	
19	Okavango Delta Wildlife Management Area	1,388,000
20	Okavango River	10,000
21	Okwa Wildlife Management Area	1,361,800
	Pataletsabe(a) Hill	
22	Shoshong Hills	
23	Soa Pan/Nata River	
24	Southern District Wildlife Management Area	2,510,000
	Tamafupa/Jari Pan complex	120,000
25	Tsodilo Hills	
26	Tswapong	

Fig 1.2 Botswana: unprotected ecologically sensitive sites



LESOTHO

INTERNATIONALLY DESIGNATED PROTECTED AREAS

None

NATIONALLY PROTECTED AREAS

Sehlabathebe National Park IUCN Category IV

This park covers 6805ha, and it is proposed to extend it, to form the larger **Lesotho National Park** (38,400ha). It is a mountainous area, with striking sandstone outcrops weathered into caves, pillars, arches and potholes, crossed by the Tsoelikana River. Much of the park, situated at an elevation of around 2400m, is covered with snow and ice in winter. The vegetation is primarily species-rich sub-alpine grasslands, with patches of wet meadow and marshland. There are dwarf shrub heaths on steep and rocky ground, but few *Protea* remain. Mammals include a small resident population of black wildebeest and various other ungulates, with some seasonal visitors. The park supports the threatened southern bald ibis *Geronticus calvus*. Attempts at cultivation have resulted in severe local erosion in some places, whilst in others, cattle grazing and incised tracks have left their mark. Tall shrub communities have been virtually eliminated by past overgrazing and removal, and burning has damaged the dwarf shrub heaths (IUCN/UNEP, 1987).

OTHER MANAGED AREAS

None

UNPROTECTED SITES

Lesotho National Park - see **Sethlabathebe National Park** Proposed
38,400ha

Makhaleng Valley (IUCN, 1987)

Oxbow-Drakensberg Watershed
This area is part of the Lesotho Highlands Water Scheme, a joint venture with South Africa.

Qeme Plateau (IUCN, 1987)

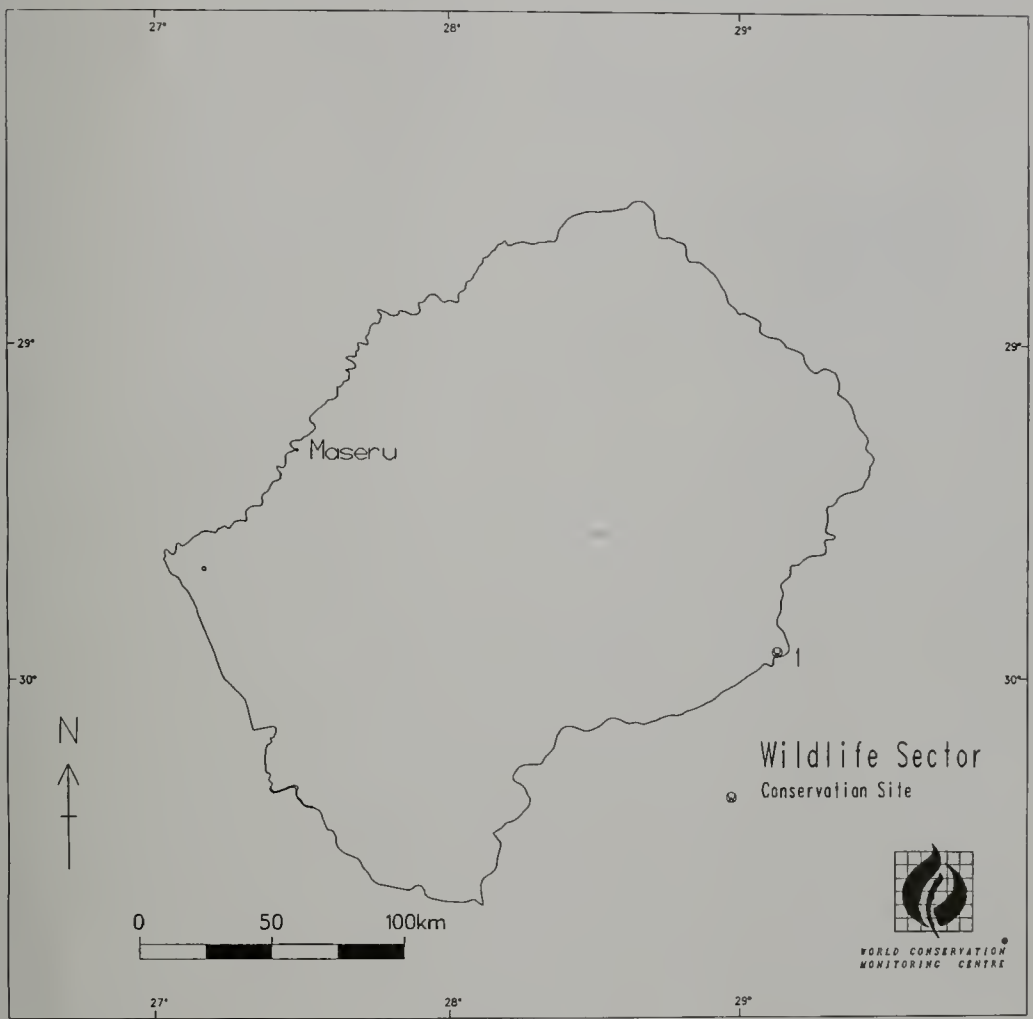
Quthing Valley (IUCN, 1987)

LESOTHO - PROTECTED SITES

National/international designations

Name of area and map reference (see Fig. 2.1)	Management area (ha)	Year notified
National Park		
1 Sehlabathebe	6,805	

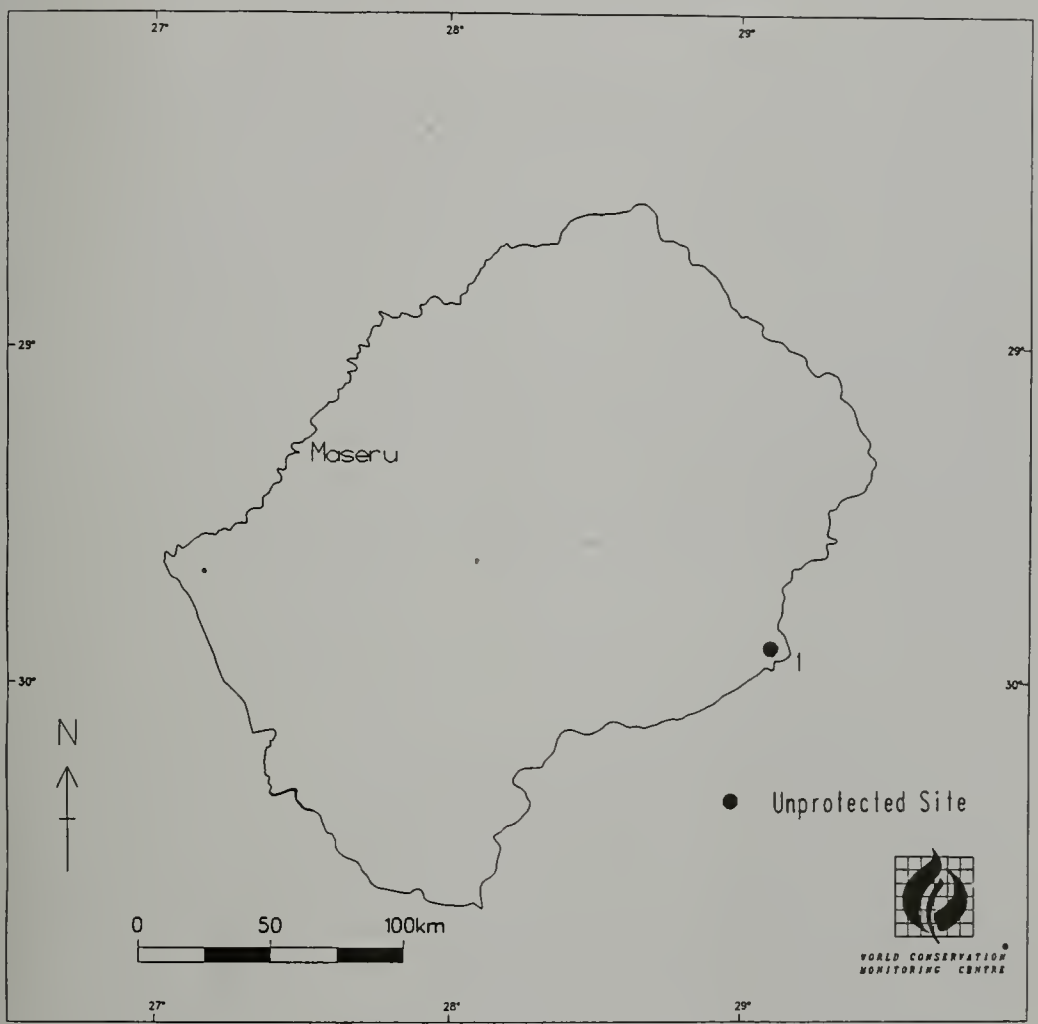
Fig 2.1 Lesotho: protected ecologically sensitive sites



LESOTHO - UNPROTECTED SITES

Name of area and map reference (see Fig. 2.2)	Management area (ha)
1 Lesotho National Park Makhaleng Plateau Qeme Plateau Quthing Valley Oxbow-Drakensberg Watershed	38,400

Fig 2.2 Lesotho: unprotected ecologically sensitive sites



MALAWI

INTERNATIONALLY DESIGNATED PROTECTED AREAS

Lake Malawi National Park IUCN Category II and X

This 8700ha park, established as a World Heritage site in 1982, includes the Cape Maclear Peninsula, two other headlands and 12 islands, plus an aquatic zone of 700ha extending 100m offshore. It is an area of rocky wooded hills rising steeply from the lake, with shrubby vegetation where forest has been cleared. This 1-2 million years-old lake forms part of the Western Rift Valley, and contains the largest number of fish species of any lake in the world, probably over 500 in ten families (of which about half occur within the park) and endemism is high, over 90%. Particularly characteristic are cichlids, of which over 400 species occur. The terrestrial section of the park supports a wide range of mammals, and the islands are important nesting areas for several thousand white-breasted cormorant. Five shoreline villages are isolated within enclaves in the park and traditional fishing methods are permitted in limited areas, although in most of the park fish are completely protected. Reforestation of the peninsula is critical for the protection of water quality, but forest clearance has increased. The lake is polluted by powerboats at Cape Maclear. The water area within the park is only 0.04% of total lake area and the lake would benefit from overall integrated managed (IUCN/UNEP, 1987).

NATIONALLY PROTECTED AREAS

Kasungu National Park IUCN Category II

This park covers an area of 231,600ha with a buffer zone of 16,000ha, and is on a relatively flat plateau broken by several prominent inselbergs. It comprises much of the upper catchment of the seasonal Dwangwa River, in the bed of which deep pools survive during the dry season. Vegetation includes a mosaic of open country and medium height miombo woodland, with more varied woodland along the larger watercourses. The area supports a variety of ungulates, and threatened species include about 800 elephant, leopard, African hunting dog, cheetah and black rhinoceros. The 300 bird species include wattled crane *Bugeranus carunculatus*, which is of special concern. Adjoining the eastern boundary is an expanding tobacco-growing project and, even though a buffer zone has been added in this region, conflicts between agriculturalists and wildlife persist. An 8km electric fence has been erected in order to control the movements of large herbivores from the park into this farmland, but this needs extending along the entire southern and eastern boundaries. There has been some poaching of elephant for ivory (IUCN/UNEP, 1987).

Lengwe National Park IUCN Category II

This park covers 88,700ha of gently undulating plains with seasonally flooded depressions along drainage lines. Late in the dry season, water is available only at four artificial waterholes. Vegetation is dominated by mopane and miombo woodlands, but dry deciduous thickets (of which now only a small area remains) are most important for wildlife, particularly nyala antelope *Tragelaphus angasi*. The park is one of two areas in Malawi in which nyala occur, at the northern limit of their

distribution. A striking assortment of lowland tropical birds occurs. The park is almost surrounded by agricultural schemes, and there is no buffer zone. Poaching is a problem in certain areas, and fires occur. Overgrazing by nyala is destroying the habitat of thicket birds (IUCN/UNEP, 1987).

Liwonde National Park IUCN Category II

This park covers an area of 53,800ha, with an extension of 7450ha providing a corridor for elephants moving between this area and **Mangochi Forest Reserve**. It is bounded to the west by the Shire River and Lake Malombe. The most widespread vegetation is mopane woodland, whilst the lakeshore and Shire River support riverine vegetation and gallery forest. The fauna is diverse, and populations of larger mammals have been increasing since the area was fully protected. There are plans to include the opposite bank of the Liwonde, to include the entire river. The Liwonde barrage, downstream of the park, floods substantial areas for varying periods; its ecological impact is not yet fully known (IUCN/UNEP, 1987).

Majete Game Reserve IUCN Category IV

This reserve of 69,100ha lies in a sloping area of the Rift Valley floor, at the junction of the middle and lower Shire valleys; the spectacular Kalpichila (Livingstone) Falls lie in the south-east corner of the reserve. The western half of the area is hilly, with large rock outcrops and steep, densely wooded valleys; the eastern regions are gently sloping, with short, open woodland. Surface water is very scarce during the dry season, being then confined to a few small seepages and to the Shire and Mkurumadzi rivers on the eastern boundary. There is a small population of elephant (about 100: the population is probably stable) in the reserve, and a number of antelope species. Poaching of species such as elephant is slight, although there is a high level of trespass and other illegal activities (IUCN/UNEP, 1987).

Mwabvi Game Reserve IUCN Category IV

This 13,500ha reserve lies on the edge of the Rift Valley; it comprises broken, hilly terrain with gullies and steep-sided rock outcrops. Seasonal watercourses occur, but several waterholes persist during the dry season. Vegetation types include dry deciduous thickets, mopane woodland and knobthorn *Acacia nigrescens* savanna, with tall grasses. The reserve is one of only two remaining areas in Malawi for nyala, and supports a number of other mammals including suni *Nesotragus moschatus*, which are rare in Malawi. However, 60% of the original reserve area has been degazetted because of human settlement. Poaching occurs, and law enforcement is difficult because of lack of funds (IUCN/UNEP, 1987).

Nkohota-Kota Game Reserve IUCN Category IV

This reserve covers 180,200ha along an escarpment near Lake Malawi, between elevations of 550m and 1638m. The upper part of the reserve is a dissected plateau with deep valleys, whilst the lower areas are rugged. Perennial water is plentiful, and vegetation types are predominantly miombo woodland, with major valleys containing tall grass savanna; some montane forest occurs on the slopes of **Chipata Mountain**. The reserve supports a variety of mammals, including about 300 elephant (in 1983,

and probably declining) but the black rhinoceros is probably extinct in the area. Poaching, particularly of fish, occurs and development of the reserve has been delayed by a lack of funds (IUCN/UNEP, 1987).

Nyika National Park IUCN Category II

This park covers an area of 313,400ha, adjacent to **Nyika National Park** in Zambia. It is situated on a high-altitude ovoid plateau, which forms part of the western edge of the East African Rift Valley. The area is one of the most important water catchments in Malawi, containing the sources of four large rivers. The plateau supports a short open grassland, whilst relic evergreen forest covers 2-4% of the area, mainly at valley heads, on slopes, and in hollows. The Nyika is one of several highland areas in Central Africa remarkable for their high level of local plant speciation; at least 15 endemic species occur. It also supports a wide variety of mammals, but fewer than 50 elephants have been seen and numbers are decreasing. Several fish, reptile, amphibian and butterfly species are endemic to this area. The greatest threat to the reserve is fire, including management fires which may get out of control, and protecting the surviving forest is a particular problem. Poaching occurs, particularly in the dry season. Four major streams have been stocked with rainbow trout (IUCN/UNEP, 1987).

Vwaza Marsh Game Reserve IUCN Category IV

This reserve of 98,600ha lies at the foot of **Nyika Plateau**, from which the marsh derives most of its water. Vwaza marsh occupies about 10% of the reserve, and surrounding it are extensive *Brachystegia* woodlands, deciduous thicket and savanna. A varied fauna occurs, including elephant (300 in 1983 but decreasing in numbers) and a number of antelope species. A few small settlements remain in the reserve, and considerable pressure is occurring on the eastern boundary, which may be realigned as a result. There is a great deal of illegal activity, including poaching of elephant and other wildlife, fishing and timber extraction (IUCN/UNEP, 1987).

OTHER MANAGED AREAS

Masenjere Forest Reserve IUCN Category VIII
Established 1930, 101ha

Matandwe Forest Reserve IUCN Category VIII
Established 1931, 26,205ha

Matipa Forest Reserve IUCN Category VIII
Established 1948, 1062ha

Mirale 1 Forest Reserve IUCN Category VIII
Established 1949; 103ha

Mndilansadzu Forest Reserve IUCN Category VIII
Established 1958

Msitolengwe Forest Reserve IUCN Category VIII
Established 1974; 85ha

Mtangatanga Forest Reserve IUCN Category VIII
Established 1935; 8443ha

Mua-Livulezi Forest Reserve IUCN Category VIII
Established 1924; 12,147ha

Mua-Tsanya Forest Reserve IUCN Category VIII
Established 1932; 1062ha

Mughese Forest Reserve IUCN Category VIII
Established 1948; 673ha

Mvai Forest Reserve IUCN Category VIII
Established 1924; 4268ha

Nalikule Forest Reserve IUCN Category VIII
Established 1948; 104ha

Ndirande Forest Reserve IUCN Category VIII
Established 1922; 1709ha

Ngara Forest Reserve IUCN Category VIII
2253ha

Nyika Juniper Forest Reserve IUCN Category VIII

Perekezi Forest Reserve IUCN Category VIII
Established 1935; 14,762ha

Phirilongwe Forest Reserve IUCN Category VIII
Established 1924; 16,129ha

Ruvuo Forest Reserve IUCN Category VIII
Established 1935; 2460ha

Sambani Forest Reserve IUCN Category VIII
Established 1948; 129ha

Senga Forest Reserve IUCN Category VIII
Established 1958; 1420ha

South Viphya Forest Reserve IUCN Category VIII
Established 1948

Thuchila Forest Reserve IUCN Category VIII
Established 1925; 2434ha

Thyolo Forest Reserve IUCN Category VIII
Established 1924; 1321ha

Thyolo Mwani Forest Reserve IUCN Category VIII
Established 1930; 932ha

Tsamba Forest Reserve IUCN Category VIII
Established 1928; 3237ha

Uzumara Forest Reserve IUCN Category VIII
Established 1948; 596ha

Vinthukutu Forest Reserve IUCN Category VIII
Established 1948; 2227ha

Wilindi Forest Reserve IUCN Category VIII
Established 1948; 907ha

Zomba Forest Reserve IUCN Category VIII
Established 1913; 5957ha

UNPROTECTED SITES

Bua River
This, the largest river entering **Lake Malawi** from the Malawian side, is partly protected within **Nkohota-Kota Game Reserve**. It supports huge breeding runs of the migrating fish *Opsaridium microlepis*, which is endemic to Lake Malawi and is one of the major commercial species in the northern and central areas of the lake. Protection of the river is considered necessary for the survival of fishing enterprises (Hughes and Hughes, 1992).

Chikala Hill Forest Reserve
15°08'S, 35°30'E This reserve in southern Malawi supports important evergreen montane forest dominated by *Newtonia buchananii*, covering an area of 285ha between 1300m and 1600m. The threatened Thyolo alethe *Alethe choloensis* occurs (Dowsett-Lemaire, 1989; Dowsett-Lemaire and Dowsett, 1988; IUCN, 1987; Johnston-Stewart, 1982; Stuart *et al.*, 1990).

Chimalero Forest Reserve
12°27'S, 33°34'E This area of miombo woodland is an important conservation site (Stuart *et al.*, 1990).

Chipata Mountain
13°04'S, 33°56'E This important forest site is partly protected within **Nkohota-Kota Game Reserve** (Stuart *et al.*, 1990).

Chiradzulu Mountain Forest Reserve
15°41'S, 35°09'E This reserve lies 20km north-west of Blantyre in southern Malawi, and is a central part of the **Shire Highlands**. It rises to a height of 1775m, supporting 150ha of submontane evergreen forest and 150ha of mid-altitude forest. Rare birds occur, and there are threats from logging (Collar and Stuart, 1988).

Chirobwe Mountain
13°49'S, 33°22'E This important forest site covers 614ha of submontane forest between 1800m and 2000m (Dowsett-Lemaire, 1989; Stuart *et al.*, 1990).

Chongoni Forest Reserve
Submontane forest covers 12,639ha between 1600m and 1950m on Chongoni Mountain (Dowsett-Lemaire, 1989; Stuart *et al.*, 1990).

Dedza-Salima Escarpment Forest Reserve
14°20'S, 34°21'E 230ha of submontane and montane forest occur between 1800m and 2150m on Dedza Mountain (Dowsett-Lemaire, 1989; Stuart *et al.*, 1990).

Dwambazi Forest Reserve
12°40'S, 33°50'E This is an important area of miombo woodland (Stuart *et al.*, 1990)

Dzalanyama Forest Reserve
14°19'S, 33°28'E Located in the Dzalanyama Mountains, this area of miombo woodland covers 98,934ha between 1500m and 1600m. Sable antelope *Hippotragus nigeri* occur (Dowsett-Lemaire, 1989; Stuart *et al.*, 1990).

Elephant and Ndinde Marshes
16°11'-17°05'S, 34°59'-35°19'E Permanent swampland with channels and lagoons occur along the lower Shire River, close to the border with Moçambique. Their combined area during the dry season is about 650km², and some of the larger lagoons may cover 40km². Virtually treeless, they are dominated by herbaceous vegetation and fringed by *Hyphaene* palms, baobabs and other trees. Crocodile and hippopotamus occur; the birdlife is prolific, with breeding colonies of thousands of carmine bee-eaters. The area supports an important fishery, and agriculture is probably the biggest threat to the marshes (Burgis and Symoens, 1987; Hughes and Hughes, 1992; Stuart *et al.*, 1990).

Jembya Plateau
This is an important forest site (Stuart *et al.*, 1990).

Kalwe Forest
Lakeshore forest occurs at this site (Stuart *et al.*, 1990).

Kaningina Forest Reserve
This reserve is situated in the Kaningina Hills, supporting an area of miombo woodland (Stuart *et al.*, 1990).

Kirk Range
This is an important forest site, covering 150ha of fragmented submontane and mid-altitude forests (Dowsett-Lemaire, 1989; Stuart *et al.*, 1990).

Kuwilwe Hill
This is an important lakeside forest (Stuart *et al.*, 1990).

Lake Chilwa
15°20'S, 35°30'E Situated to the east of the Zomba plateau at an altitude of 622m, this is a biologically important soda lake separated from Lake Chiuta in the north by a sandbar. Its surface area varies greatly, but averages about 678km^2; it is bounded on three sides by swamps, and by floodplains to the south. It is an important wetland site for waterbirds, hippopotamus, spotted hyena, common reedbuck, baboon and small mammals. Nile crocodile are now rare. The surrounding areas are cultivated, and the lake provides much protein for local peoples in the form of fish (Burgis and Symoens, 1987; Hughes and Hughes, 1992; Stuart *et al.*, 1990).

Lake Malawi
Measuring 600km by 80km and covering an area of 31,000km^2, this is the third largest and second deepest (over 700m) of the African lakes. It has the highest degree of fish endemism of any lake in the world, with 400-500 species in total, mostly cichlids, 98% of which are endemic. Nile crocodile are now rare, but hippopotamus still occur. There are several relict fish species in the Ruo River, which are currently endangered. The lake supports a large fishing industry (Chapman, 1980; Hughes and Hughes, 1992; Stuart *et al.*, 1990,).

Lilonde Mountains Forest Reserve
Endangered montane evergreen forest occurs in these isolated mountains, which support a particularly distinct biota (IUCN, 1987).

Mafinga Mountains
10°00'S, 33°22'E This important forest site on the Zambian border includes ravine forest dominated by *Entandophragma* and *Ficalhoa*, whilst an interesting montane shrubland occurs on the rocky upper slopes. The lower slopes, vegetated by a stunted *Brachystegia taxifolia* forest, are being rapidly denuded by millet cultivation (Chapman, 1980; Stuart *et al.*, 1990).

Malawi Hills Forest Reserve
16°58'S, 35°09'E These isolated mountains support a particularly distinct forest site, covering 400ha of lowland forest between 600m and 900m (Dowsett-Lemaire, 1989; IUCN, 1987; Stuart *et al.*, 1990).

Malosa Complex Forest Reserve
15°20'S, 35°17'E This reserve covers an area of miombo woodland in the **Shire Highlands** (Stuart *et al.*, 1990).

Mangochi Forest Reserve
14°28'S, 35°30'E This reserve protects 230ha of submontane forest and miombo woodland on Mangochi Mountain in southern Malawi. The threatened Thyolo alethe *Alethe choloensis* occurs (Dowsett-Lemaire, 1989; Johnston-Stewart, 1982; Stuart *et al.*, 1990).

Matope Marsh
This is an important wetland (Stuart *et al.*, 1990).

Mchinji Forest Reserve
This reserve supports an area of miombo woodland (Stuart *et al.*, 1990).

Michiru Mountain Conservation Area Proposed
15°44'S, 34°57'E Covering 4600ha on the eastern edge of the Rift Valley between 700m and 1470m to the north-west of Blantyre, this area originally supported a closed deciduous miombo woodland, riparian, and moist sub-montane forests. The north and western sides have been settled, resulting in denudation and erosion. An integrated land-use system has been initiated, halting further degradation (Hough, 1984).

Misuku Hills
9°39'S, 33°26'E This is an important submontane forest site, including species of *Bosquiea*, *Ficus*, *Sapium* and *Trichilia* (Dowsett-Lemaire, 1989; Stuart *et al.*, 1990).

Mlunduni Mountain
This is an important submontane forest site of 5ha, at an elevation of about 1900m (Dowsett-Lemaire, 1989; Stuart *et al.*, 1990)

Mpatsanjoka Dambo (marsh)
This is an important wetland (Stuart *et al.*, 1990).

Mulanje Mountain
16°00'S, 35°35'E This is the highest point in tropical southern Africa, reaching an elevation of 3001m. It comprises grassy plateaus and shelves, forest patches on slopes, in valleys and along streams and in sheltered hollows. Submontane and montane forest cover 4600ha, and are dominated by the cypress ("Mulanje Cedar") *Widdringtonia cupressoides*. Mid-altitude forest dominated by *Newtonia buchananii* covers 1800ha, and lowland forest about 200ha. About 30 species of plant are endemic to the

mountain, whilst three species of endemic butterfly and several endemic reptile and amphibian species occur. The birdlife includes the very rare spotted ground-thrush *Turdus fischeri*. Larger mammals are few, but include an endemic variety of blue duiker *Cephalophus monticola*, red duiker *C. natalensis*, blue monkey, two hyrax species and leopard. Threats include poaching and deforestation by refugees, uncontrolled tourism and fire (Chapman, 1990; Collar and Stuart 1988; IUCN, 1987; Stuart *et al.*, 1990).

Musisi Hill
This is an important forest site (Stuart *et al.*, 1990).

Mzuma Forest Reserve
This is an important lakeshore forest (IUCN, 1987; Stuart *et al.*, 1990).

Namidzimu Forest
14°06'S, 35°18'E 40ha of miombo woodland occur in the Namizimu Hills, east of Lake Malawi. Sable antelope occur (Dowsett-Lemaire, 1989; Stuart *et al.*, 1990).

Nchisi Mountains Forest Reserve
13°28'S, 33°56'E This reserve covers two isolated mountains with particularly distinct biota (Stuart *et al.*, 1990).

Nkhwadzi Forest
This area supports lakeshore forest (IUCN, 1987; Stuart *et al.*, 1990).

North Viphya Forest Reserve
11°06'N, 34°04'E This reserve supports miombo woodland (Stuart *et al.*, 1990).

Ruwenya Hills
9°20'S, 32°55'E Several grass and reed swamps (one of which covers 1000ha), and stunted riparian forests of *Ilex mitis* and *Syzygium cordatum* occur in this remote, sparsely-populated area (Hughes and Hughes, 1992).

Shire Highlands
15°48'S, 35°00'E (centred on Blantyre) This highland includes the mountains of Sochi, Chiradzulu, Zomba and Malosa; they support about 2000ha of submontane and *Khaya nyassica* forests, and an interesting avifauna (Chapman, 1980).

Shire Swamps - see **Elephant and Ndinde Marshes**

Sochi Mountain Forest Reserve
15°47'S, 35°00'E Lying immediately to the south of Blantyre in southern Malawi, this mountain rises abruptly to 1533m and is part of the **Shire Highlands**; 150ha of distinctive mid-altitude evergreen forest survive, in which the endemic tree *Buxus nyasica* is found. Several rare birds occur, including spotted ground thrush and

Delegorgue's pigeon. It has high water conservation value, and considerable potential as an environmental education area (Collar and Stuart, 1988; IUCN, 1987).

South Viphya Forest Reserve
11°49'S, 33°48'E This reserve supports miombo woodland (Stuart *et al.*, 1990).

Sucoma Game Ranch
This area supports an important population of nyala (Stuart *et al.*, 1990).

Sumbu Area Forests
This unique closed canopy woodland of very large *Afzelia quanzensis* and *Pterocarpus angolensis* trees occurs on sandstones (Chapman, 1980).

Thambani Hill
This is an important forest site, including 80ha of lowland forest between 1100m and 1200m (Dowsett-Lemaire, 1989; Stuart *et al.*, 1990).

Thyolo Mountain
16°02'S, 35°05'E Situated in southern Malawi, in the Shire Highlands 30km south of Blantyre, this mountain reaches a height of 1464m. About 16km² of distinctive submontane and lowland forests occur, the former dominated by strangling figs *Ficus* spp., the latter by the tree *Khaya nyassica*. Threatened birds that occur include spotted ground-thrush, Delegorgue's pigeon, green-headed oriole, Thyolo alethe *Alethe choloensis* and Thyolo green barbet *Stactolaema (olivacea) belcheri*, amongst others. It is an important forest, with high water catchment and biological values, threatened by illegal felling and the proliferation of tea estates in the region (Collar and Stuart, 1988; Dowsett-Lemaire and Dowsett, 1988; Frame, 1987; Stuart *et al.*, 1990).

Tuma Forest Reserve
This reserve supports miombo woodland (Stuart *et al.*, 1990).

MALAWI - PROTECTED SITES

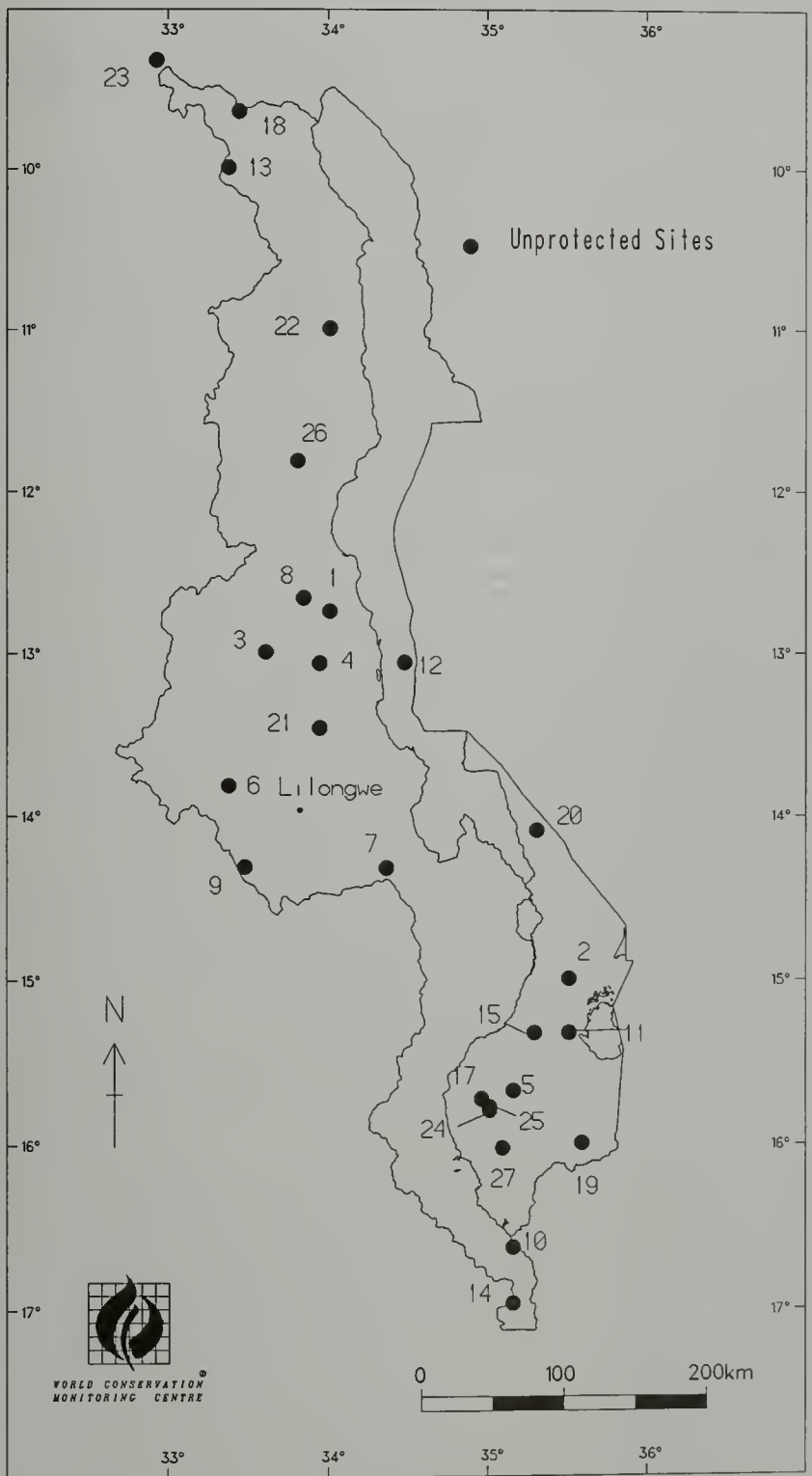
National/international designations

Name of area and map reference (see Fig. 3.1)	Management area (ha)	Year notified
Forest Reserves		
1 Amalika	520	1974
2 Bangwe	4,196	1930
3 Bunganya	3,470	1973
4 Chigumula	622	1925
5 Chilolowe	1,347	
6 Chimaliro	17,120	1926
7 Chiradzulu	1,140	1924
8 Chisasira	932	1935
9 Chongoni	12,639	1924
10 Dedza Mountain	3,263	1926
11 Dedza/Salima		1974
12 Dowa Hills	2,420	1974
13 Dzalanyama	98,934	1922
14 Dzenza	829	1948
15 Dzonzi Mvai	4,020	1924
16 Escarpment	32,600	
17 Kalulu Hills	2,823	1958
18 Kalwe	200	1956
19 Kangwe	18,133	1926
20 Kaning'ina	14,970	1935
21 Kanjedza	181	1922
22 Kawilwe	699	1935
23 Litchenya	55	1948
24 Liwonde	29,473	1924
25 Mafinga Hills	4,260	1976
26 Malabvi	207	1927
27 Maleri Islands		1971
28 Malosa	8,599	1924
29 Mangochi	37,553	1924
30 Mangochi Palm	510	1980
31 Masambanjati	92	1974
32 Masenjere	101	1930
33 Matandwe	26,205	1931
34 Matipa	1,062	1948
35 Mchinji	19,166	1924
36 Michiru	3,263	1970
37 Mirale I	103	1949
38 Mndilansadzu		1958

MALAWI - UNPROTECTED SITES (cont.)

Name of area and map reference (see Fig. 3.2)	**Management area (ha)**
25 Sochi Mountain Forest Reserve	150
26 South Viphya Forest Reserve	
Sucoma Game Ranch	
Sumbu Area Forests	
Thambani Hill	80
27 Thyolo Mountain	1,600
Tuma Forest Reserve	

Fig 3.2 Malawi: unprotected ecologically sensitive sites



MALAWI - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 3.1)	Management area (ha)	Year notified
National Parks		
75 Kasungu	231,600	1970
76 Lake Malawi	8,700	1980
77 Lengwe	88,700	1970
78 Liwonde	53,800	1973
79 Nyika	313,400	1965
World Heritage Site		
Lake Malawi National Park	8,700	1984

MALAWI - UNPROTECTED SITES

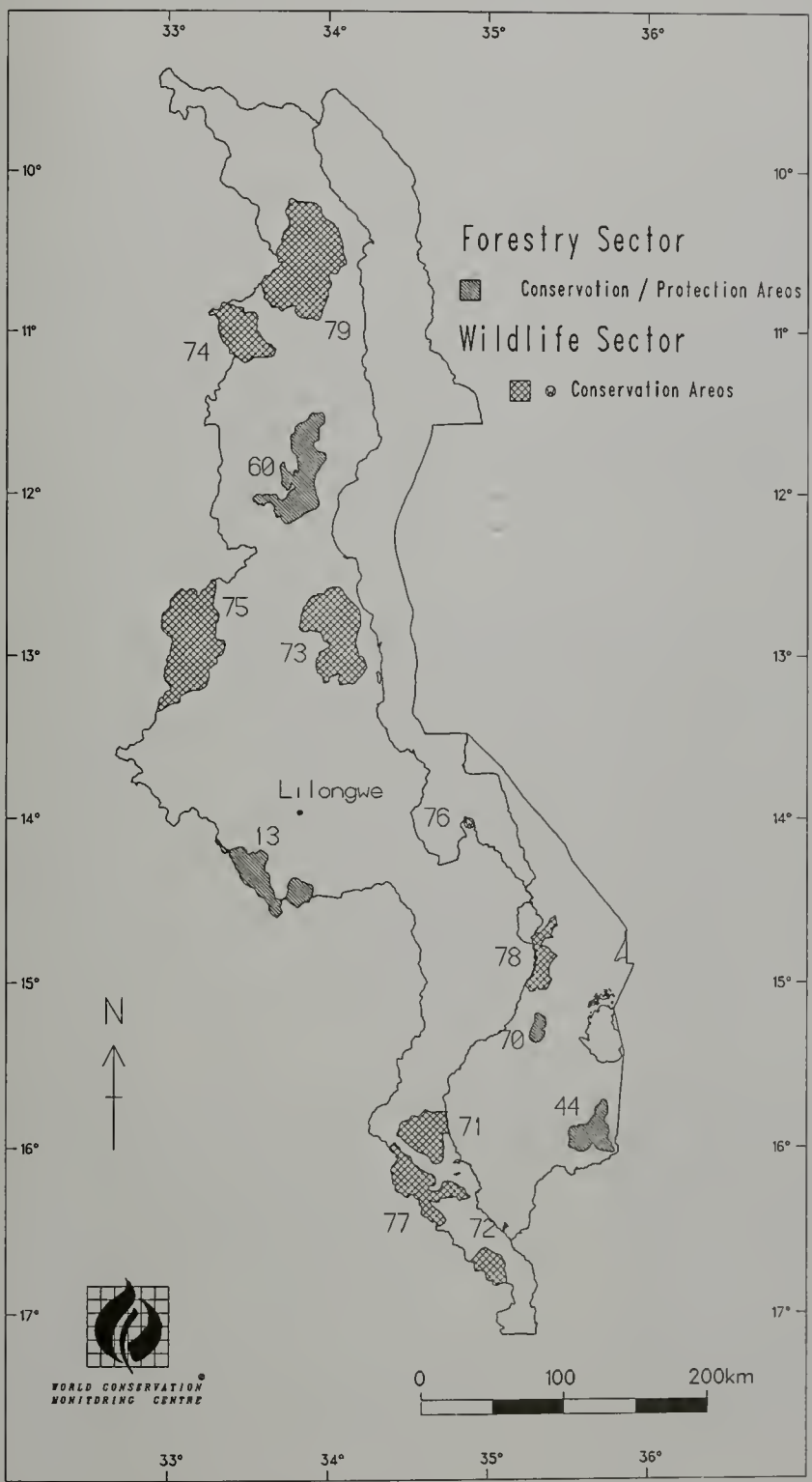
Name of area and map reference (see Fig. 3.2)	Management area (ha)
1 Bua River	
2 Chikala Hill Forest Reserve	285
3 Chimalero Forest Reserve	
4 Chipata Mountain	
5 Chiradzulu Mountain Forest Reserve	300
6 Chirobwe Mountain	614
Chongoni Forest Reserve	177
7 Dedza-Salima Escarpment Forest Reserve	230
8 Dwambazi Forest Reserve	
9 Dzalanyama Forest Reserve	75
10 Elephant and Ndinde Marshes	
Jembya Plateau	
Kalwe Forest	
Kirk Range	150
Kuwilwe Hill	
11 Lake Chilwa	67,800
12 Lake Malawi	
Lilonde Mountains Forest Reserve	
13 Mafinga Mountains	
14 Malawi Hills Forest Reserve	
15 Malosa Complex Forest Reserve	
16 Mangochi Forest Reserve	230
Matope Marsh	
Mchinji Forest Reserve	
17 Michiru Mountain Conservation Area	4,600
18 Misuku Hills	
Mlunduni Mountain	5
Mpatsanjoka Dambo (marsh)	
19 Mulanje Mountain	6,800
Musisi Hill	
Mzuma Forest Reserve	
20 Namidzimu Forest	40
21 Nchisi Mountains Forest Reserve	
Nkhwadzi Forest	
22 North Viphya Forest Reserve	
23 Ruwenya Hills	
24 Shire Highlands	2,000

MALAWI - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 3.1)	Management area (ha)	Year notified
39 Msitolengwe	85	1974
40 Mtangatanga	8,443	1935
41 Mua-Livulezi	12,147	1924
42 Mua-Tsanya	1,062	1932
43 Mughese	673	1948
44 Mulanje	55,209	1927
45 Musisi	6,734	1948
46 Mvai	4,268	1924
47 Nalikule	104	1948
48 Namizimu	86,994	1924
49 Ndirande	1,709	1922
50 Ngara	2,253	
51 Nkhwazi	2,668	1927
52 Ntchisi	9,712	1924
53 Nyika Juniper		
54 Perekezi	14,762	1935
55 Phirilongwe	16,129	1924
56 Ruvuo	2,460	1935
57 Sambani	129	1948
58 Senga	1,420	1958
59 Soche	363	1922
60 South Viphya		1948
61 Thambani	4,947	1927
62 Thuchila	2,434	1925
63 Thuma	16,395	1926
64 Thyolo	1,321	1924
65 Thyolo Mwani	932	1930
66 Tsamba	3,237	1928
67 Uzumara	596	1948
68 Vinthukutu	2,227	1948
69 Wilindi	907	1948
70 Zomba	5,957	1913
Game Reserves		
71 Majete	69,100	1955
72 Mwabvi	13,500	1953
73 Nkhota-Kota	180,200	1954
74 Vwaza Marsh	98,600	1977

Fig 3.1 Malawi: protected ecologically sensitive sites



MOZAMBIQUE

INTERNATIONALLY DESIGNATED PROTECTED AREAS

None

NATIONALLY PROTECTED AREAS

Banhine National Park Under review

Open plains characterise this 700,000ha park. It is located in Mozambique's most arid zone, receiving under 400mm annual rainfall. Vegetation consists mainly of open grassland, with baobab, mopane and *Terminalia* trees on the higher areas. This region supported the country's largest populations of elephant and cheetah (both threatened), and the only populations of giraffe, roan antelope and ostrich. Sizeable populations of other antelope species occurred, some of which have now disappeared. There are reports of heavy uncontrolled hunting in the area, and it is unclear what the current situation is. There is a permanent settlement within the park and some poaching occurs, although recent droughts have helped reduce wild animal populations. The political situation has not helped matters, and no staff have been in the park since 1975 (IUCN/UNEP, 1987).

Bazaruto Marine National Park Under review

21°40'S, 35°29'E This 15,000ha park includes three islands between Bazaruto island and the Santo Sebastian Peninsula and a 5km marine zone around them, with extensive coral reefs. The area has been identified as a priority site for increased protection (IUCN, 1987). Vegetation cover is sparse. There are reported to be extensive coral formations, dugong and five species of marine turtle (all of which are threatened). Terrestrial habitats support samango (blue) monkey and red duiker. Nile crocodile occur in a lake on one of the islands. The unprotected Bazaruto island to the north is an important feeding area for dugong and nesting area for marine turtles, and has been proposed as a reserve. Turtle and dugong are still hunted. Only one island is uninhabited, but is visited by fishermen from the mainland. There are over 200 sheep and goats on Benguerua island. The archipelago is the site of a progressive natural resources management programme (IUCN/UNEP, 1987; P. Dutton pers. comm., 1992).

Gile Game Reserve Under review

This reserve covers 210,000ha of plains, inselbergs and numerous rivers. The dominant vegetation type is *Brachystegia* (miombo) woodland with associated open grass plains. Some inselbergs support endemic cycads. Mammals include elephant, lion and a variety of ungulates. Poaching increased in the 1970s, and lack of equipment and transport has hampered patrolling. The area was considered to have national park potential, but little development has occurred (IUCN/UNEP, 1987).

Gorongosa National Park Under review

This park of 375,000ha is contiguous to the partially protected **Zambezi Wildlife Utilisation Area**, situated at the southern end of the Great Rift Valley. It comprises

an extensive floodplain with marshes, lakes and inselbergs. Large areas of savanna woodland and dry forest patches on old sand river beds occur, and some areas adjoining the floodplain support a short *Hyphaene* palm savanna. A wide variety of larger mammals occur in the park, including elephant and wildebeest. Reports of excessive and uncontrolled hunting exist, and it is unclear what the current situation is. The security situation and lack of equipment have meant that staff are ineffective, and there is pressure along the boundary from human settlements. The summit of Mount Gorongosa could be included within the park to give full protection to the water catchment, and to include this unique montane area (Collar and Stuart, 1988; IUCN/UNEP, 1987).

Ilhas da Inhaca e dos Portugueses Faunal Reserve IUCN Category IV
26°00'S, 33°00'E Designated in 1965, this 2000ha protected area is on Inhaca Island, close to Maputo. Intact dune forest and mangroves survive, and significant coral reefs and important marine biological resources occur. There is tourism development on the island, which has been suggested as a biosphere reserve (Stuart *et al.*, 1990; UNEP/IUCN, 1988).

Limpopo Valley Wildlife Utilisation Area Under Review
Established in 1979, this covers an area of 1,200,000ha.

Maputo Game Reserve Under review
This coastal reserve covers 90,000ha of undulating terrain, mainly formed of sand dunes, beaches, freshwater and saline lakes, salinas and floodplain. Vegetation includes coastal dune and swamp forest, mangroves, open grassland and sand ridges with savanna. Mammals include a variety of ungulates and one of the world's southernmost large populations of elephant, but the reintroduced white rhinoceros population is reported to be near extinction. Some 337 bird species have been recorded, and reptiles include Nile crocodile, leatherback turtle and loggerhead turtle, all three of which are threatened. Most animal populations are very small, and poaching and competition from domestic animals occur. Subsistence farmers inhabit the reserve, and have resisted attempts to remove them. Staffing is inadequate. Uncontrolled fires and the drying up of the Futi River and its floodplain are management problems.

Marromeu Reserve Under Review
18°45'S, 19°16'E This reserve is included within the **Zambezi Wildlife Utilisation Area** (1,000,000ha). It includes important wetlands and, in 1988, over 11,000 buffalo and 1500 elephant were recorded in the area. Habitats are still fairly intact, but wildlife populations have declined drastically through uncontrolled poaching, which has recently become commercialised. Cabora Bassa and Kariba dams on the Zambezi are having an impact on the ecology of the area (IUCN/UNEP, 1987).

Niassa Game Reserve Under Review
This covers an area of 1,500,000ha on the Tanzania border, and there has been a proposal to develop it into the **Rovuma National Park**. Numerous rivers traverse the

area, and miombo woodlands of *Brachystegia* and *Baikiaea* spp. predominate, with some open grass plains. The only area of *Combretum-Terminalia* savanna in Mozambique occurs east of Niassa. Mammals include elephant and a variety of antelope species. The area is poorly known, and there are still some settlements which were created in the early 1970s during the war, which are politically difficult to remove. The adjacent **Lugenda Valley** holds important wildlife populations (IUCN/UNEP, 1987; Stuart *et al.*, 1990).

Paradise Island Marine National Park Under review
Established in 1972, this park covers 377,000ha. About 300 loggerhead turtles nest here annually, and dugong occur (Stuart *et al.*, 1990).

Pomene Game Reserve Under review
This reserve covers 10,000ha of coastal and estuarine areas. Vegetation comprises dune forest, acid grassland and mangroves. The marine fauna includes dugong, dolphin species and five threatened species of marine turtle, while terrestrial species include red duiker, samango (blue) monkey and chacma baboon. There has been extended military activity in the area, and staff have never been stationed within the reserve (IUCN/UNEP, 1987).

Zambezi Wildlife Utilisation Area Under review
This wildlife area covers an area of 1,000,000ha contiguous to **Gorongosa National Park** (375,000ha); it also includes the **Marromeu Reserve**. It is situated in the Zambezi River delta, and includes mangrove swamps and seagrass beds. Much of the terrestrial area supports dune scrub, and broadleaved and palm savannas, and scattered forest occur. The area is famous for a large population (about 50,000) of buffalo, elephant and a number of ungulate species. The avifauna is rich both in numbers and species, and includes the threatened wattled crane *Bugeranus carunculatus* and east coast akalat *Sheppardia gunningi*. About 4000 people inhabit the reserve. Until 1974 poaching was successfully controlled, but has increased since 1982. Kariba and Cabora Bassa dams have altered the flooding regime and water table levels (IUCN/UNEP, 1987).

Zinave National Park Under review
This area of 500,000ha occurs at the transition between moist tropical and arid tropical environments. Major vegetation types consist of *Brachystegia* (miombo) and *Colophospermum mopane* woodlands, with some areas of *Acacia-Combretum* tree savanna and grassland. Mozambique's largest populations of elephant and cheetah occurred in this region, as did the country's only populations of giraffe and roan antelope. There are reports of excessive and uncontrolled hunting in the area, and it is unclear what the current situation is. Permanent settlement and many cattle exist within the reserve, and poaching by local people, guerrillas and soldiers occurs. The area has suffered from military activity since 1976. Drought has been a serious concern for several years (IUCN/UNEP, 1987).

OTHER MANAGED AREAS

Baixo Pinda Forest Reserve IUCN Category VIII

Bobole Forest Reserve IUCN Category VIII

Derre Forest Reserve IUCN Category VIII

Inhamitanga Forest Reserve IUCN Category VIII

Licuati Forest Reserve IUCN Category VIII

Maribano Forest Reserve IUCN Category VIII

Maronga Forest Reserve IUCN Category VIII

Matibane Forest Reserve
Established in 1950, this reserve covers 4200ha.

Mecuburi Forest Reserve IUCN Category VIII

Mucheve Forest Reserve IUCN Category VIII

Nepalue Forest Reserve IUCN Category VIII

Nhapacue Forest Reserve IUCN Category VIII

Ribaue Forest Reserve IUCN Category VIII

Zomba Forest Reserve IUCN Category VIII

UNPROTECTED SITES

Bartolomeu Dias Area
21°15'S, 35°06'E This is a spectacular sandspit, where the Govuro River enters Bartolomeu Dias bay. The landward side of the bay is deeply dissected and covered with mangrove forests.

Cabo Delgado
10°45'S, 40°15'E Largely unexplored, this is a unique semi-arid area situated to the immediate south of the Rovuma River; it is characterised by baobabs *Adansonia digitata*, and the tree *Guibourtia schliebenii* (Tinley *et al.*, 1976).

Chimanimani Mountains
19°00'-20°45'S, 32°30'-33°18'E These are an important forest and grassland montane area with numerous endemics, including 46 species of vascular plants and a number of endemic reptiles and amphibians. Elephant, buffalo, sable antelope and blue duiker occur. The area extends into Zimbabwe, and includes the adjacent Serra Maquta (Stuart *et al.*, 1990; Tinley *et al.*, 1976).

Chioco/Luia National Park
16°10'S, 33°00'E Situated south of Cabora Bassa dam, this area is scenically spectacular and supports a small but diverse array of wildlife (Tinley *et al.*, 1976).

Gorongosa Mountain
18°27'S, 34°03'E Lying 115km east of Zimbabwe's Inyanga Highlands, this montane area rises to 1863m on the edge of the Manhica Platform; it is almost covered in sub-alpine evergreen and wet montane forest. Rare birds and an endemic chameleon subspecies occur, and the mountain is of great botanical interest. Forest clearance is chronic, and the area has been recommended for inclusion in **Gorongosa National Park** (Collar and Stuart, 1988; Stuart *et al.*, 1990).

Ilha Marina
25°08'S, 32°57'E This unique 'island' in the Incomati River is an important waterfowl nesting area. It is vegetated by *Pandanus* and *Raphia* palms, and hippopotami occur (Tinley *et al.*, 1976).

Lake Nyasa
11°34'-13°29'S, 34°25'-34°57'E This is one of the richest freshwater lakes in the world (Stuart *et al.*, 1990).

Libombo Mountains
25°40'-26°30'S, 31°57'-32°10'E Occurring along the border with Swaziland and South Africa, this sparsely-settled area holds a small breeding colony (opposite Swaziland) of the endangered Cape vulture *Gyps coprotheres*, a southern African endemic. The only population of mountain reedbuck *Redunca fulvorufula* in Mozambique occurs in these hills, as do Sharpe's grysbuck *Rhaphicerus sharpei*, greater kudu, and a few Lubombo mountain endemics: the Natal hinge-backed tortoise *Kinixys natalensis*, and Tello's worm-snake *Leptotyphlops telloi*. The highly restricted cycad *Encephalartos umbeluziensis* occurs in the Mbuluzi River valley north of Goba (J. Culverwell pers. comm., 1991; Stuart *et al.*, 1990; Tinley *et al*, 1976).

Lugela Montane Area - see **Mount Mabu**

Lugenda Valley - see **Niassa Game Reserve**

Mhanda Inselberg
18°35'S, 33°25'E Situated west of Serra Gorongosa, this dramatic feature supports moist evergreen fringing forest as a result of orographic rainfall created by the inselberg (Tinley *et al.*, 1976).

Morrumbala Montane Area
17°28'S, 35°25'E This supports moist evergreen forests, and includes splendid scenery rising to over 1000m; the area is otherwise little-known (Tinley *et al.*, 1976).

Mount Chiperone
16°30'S, 35°44'E This is an isolated peak situated in superb scenery in western Mozambique, 2180m high. Its moist evergreen forests are possibly similar to those in southern Malawi, but there is a lack of information on the area. Rare birds occur, including the Thyolo alethe *Alethe choloensis* and white-winged apalis *Apalis chariessa* (Collar and Stuart, 1988; Stuart *et al.*, 1990; Tinley *et al.*, 1976).

Mount Mabu
16°19'S, 36°24'E This mountain in the vicinity of Lugela supports moist evergreen forests and has splendid scenery, but is little known (Tinley *et al.*, 1976).

Mount Namuli
15°21'S, 37°02'E Namuli massif lies in north-western Mozambique, reaching a height of 2680m; it is the principal watershed of northern Mozambique. Deep ravines and shelving areas support rain forest, characterised by the tree *Newtonia buchananii*. Several rare birds are known to occur, including Thyolo alethe and dappled mountain robin *Modulatrix orostruthus* (Stuart *et al.*, 1990).

Nacala-Mossuril Marine National Park Proposed
14°27'S, 40°45'E This is an important marine area, with coral, seabirds, seagrass and turtle nesting beaches (Stuart *et al.*, 1990).

Nampula Inselbergs
14°55'S, 38°00'E Scenically splendid inselberg communities with an interesting fauna and flora occur between Nampula and Entre-Rois (Tinley *et al.*, 1976).

Njesi Plateau
This is an important forest area (Stuart *et al.*, 1990).

Porto Amelia Bay
12°55'S, 40°26'E The north side of this bay consists of coral cliffs and coastal thickets of *Guibourtia schliebenii* (Tinley *et al.*, 1976).

Primeira and Segunda Islands National Park Proposed
16°00'-17°00'S, 38°00'-41°00'E This park consists of two strings of small islands, Primeira (5) and Segundos (4). They comprise an important marine reserve area with exceptional fringing coral reefs, seabird colonies, seagrass beds and turtle nesting

beaches (including 200 green turtles). The region between the islands and the mainland is the most important in the western Indian Ocean for dugong (Stuart *et al.*, 1990; UNEP/IUCN, 1988).

Quirimbas Archipelago Marine Park Proposed
12°30'S, 40°30'E Consisting of 27 islands and islets extending from Pemba to the Rovuma River close to the Tanzanian border, this archipelago is a pristine area of coral reefs, mangroves (seven species), seabird colonies, seagrass beds and turtle nesting beaches. A massive tern colony occurs on one of the islands. Quirimba, the largest island, has extensive coconut plantations, and the village of Ibo is located there (Dutton and Ramsay, 1992; Stuart *et al.*, 1990; UNEP/IUCN, 1988).

Rio Save Mangroves
20°58'S, 35°02'E (Save estuary) Significant areas of swamp and tidal forest occur between the Rio Save estuary and Beira (Hughes and Hughes, 1992).

Rovuma National Park Proposed
See **Niassa Game Reserve**.

San Sebastian Peninsula National Park Proposed
22°08'S, 35°33'E This park includes a sandspit 15km by 45km, protecting a bay 8km by 30km; the latter is almost totally occluded by tidal forest, with mangroves covering at least 20,000ha. Coastal *Brachystegia* savanna occurs on the mainland, with abundant cycads. It is an important marine turtle nesting area, and flamingo are reported to nest in the area (Tinley *et al.*, 1976).

Vila Cabral Mountains
12°49'S, 35°10'E Montane habitats with moist evergreen forest occur to the immediate north of Vila Cabral (Tinley *et al.*, 1976).

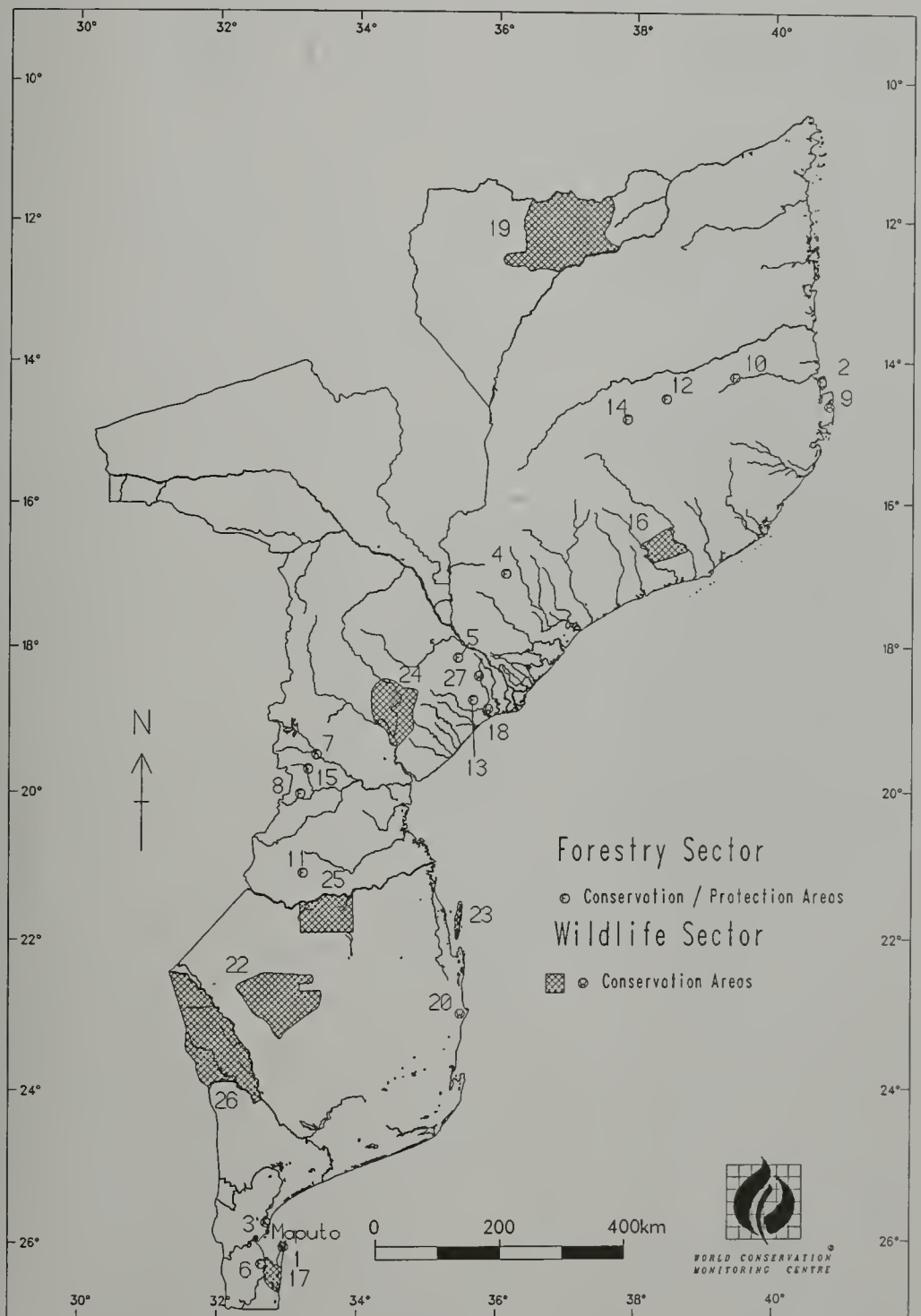
Vumba Highlands
These are an important forest area (Stuart *et al.*, 1990).

MOZAMBIQUE - PROTECTED SITES

National/international designations

Name of area and map reference (see Fig. 4.1)	Management area (ha)	Year notified
Faunal Reserve		
1 Ilhas da Inhaca e dos Portugueses	2,000	1965
Forest Reserves		
2 Baixo Pinda		
3 Bobole		
4 Derre		
5 Inhamitanga		
6 Licuati		
7 Maribano		
8 Maronga		
9 Matibane	4,200	1950
10 Mecuburi		
11 Mucheve		
12 Nepalue		
13 Nhapacue		
14 Ribaue		
15 Zomba		
Game Reserves		
16 Gile	210,000	1960
17 Maputo	90,000	1969
18 Marromeu	1,000,000	1969
19 Niassa	1,500,000	1960
20 Pomene	10,000	1972
Marine National Park		
21 Paradise Island	377,000	1972
National Parks		
22 Banhine	700,000	1972
23 Bazaruto Marine	15,000	1971
24 Gorongosa	375,000	1960
25 Zinave	500,000	1972
Wildlife Utilization Areas		
26 Limpopo Valley	1,200,000	1979
27 Zambezi	1,000,000	1981

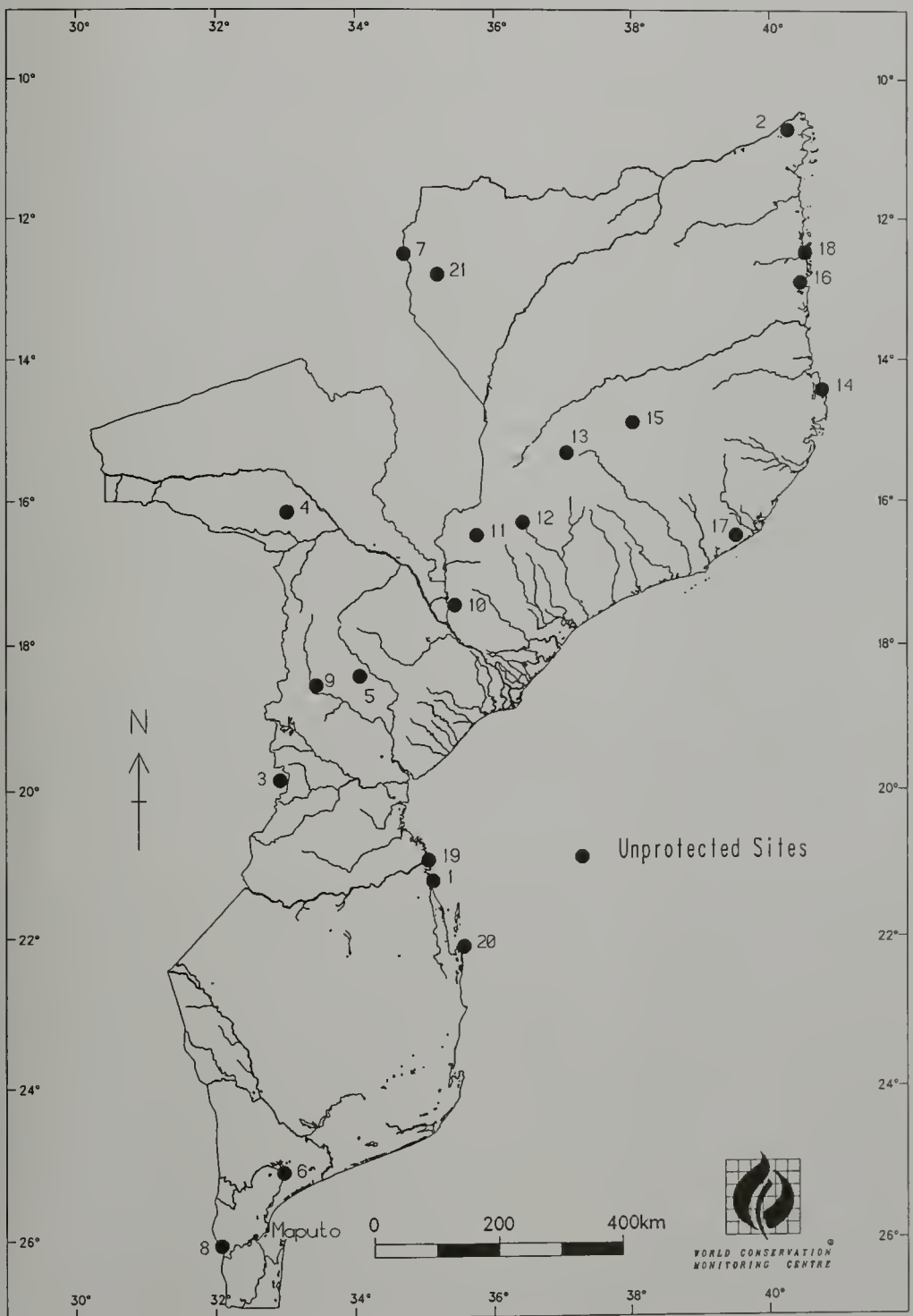
Fig 4.1 Mozambique: protected ecologically sensitive sites



MOZAMBIQUE - UNPROTECTED SITES

Name of area and map reference (see Fig. 4.2)	Management area (ha)
1 Bartolomeu Dias Area	
2 Cabo Delgado	
3 Chimanimani Mountains	
4 Chioco/Luia National Park	
5 Gorongosa Mountain	
6 Ilha Marina	
7 Lake Nyasa	
8 Libombo Mountains	
9 Mhanda Inselberg	
10 Morrumbala Montane Area	
11 Mount Chiperone	
12 Mount Mabu	
13 Mount Namuli	
14 Nacala-Mossuril Marine National Park	
15 Nampula Inselbergs	
Njesi Plateau	
16 Porto Amelia Bay	
17 Primeira and Segundos Islands National Park	
18 Quirimbas Archipelagos Marine Park	
19 Rio Save Mangroves	
Rovuma National Park	1,500,000
20 San Sebastian Peninsula National Park	
21 Vila Cabral Mountains	
Vumba Highlands	

Fig 4.2 Mozambique: unprotected ecologically sensitive sites



SWAZILAND

INTERNATIONALLY DESIGNATED PROTECTED AREAS

None

NATIONALLY PROTECTED AREAS

Malolotja Nature Reserve IUCN Category IV

This 18,175ha reserve is situated in the Swaziland highveld, which is part of the Drakensberg range. It includes the southern part of the Barberton mountain range, with features such as the Nkomati gorge and the Malolotja falls (the highest in Swaziland). Grassland predominates in the higher areas, with *Protea* savanna on some west-facing slopes. Forested ravines and some savanna woodland occur at lower elevations. A granitic area supports the greatest diversity of flora within the reserve, and three major sour grassveld types occur on an altitudinal gradient. The area supports a diverse fauna, and South African Red Data Book species such as aardvark, Meller's mongoose, aardwolf, leopard (reintroduced), serval and oribi occur. Blue swallow and southern bald ibis *Geronticus calvus* are two endangered bird species that breed within the park. Other mammal species include Vaal rhebuck, and mountain and common reedbuck. Several larger mammals have been introduced, including red hartebeest and both blue and black wildebeest, whilst zebra and blesbuck have been reintroduced. Exotic plants are a management problem, and introduced trout occur in two small dams (J. Culverwell pers. comm., 1993; IUCN/UNEP, 1987).

Mkhaya Nature Reserve IUCN Category IV

Established 1981, this 6200ha privately-owned reserve is situated in semi-arid savanna. It is notable in its aggressive reintroduction programme; black and white rhinoceros, roan antelope and elephant have been reintroduced in small numbers. Totally fenced, it pursues an active programme of encouraging high-cost, low-impact tourism. Poaching is a problem.

Mlawula, Ndzinda, Mbuluzi & Simunye Nature Reserves IUCN Category IV

This combined protected area covers about 17,000ha. The western part consists of lowveld with low north-south ridges, while the eastern area includes the Lubombo escarpment. Savanna woodland of various types is predominant, but valleys in the Lubombo mountains contain dry and moist forests. The area is noteworthy for its high floristic diversity, with over 1000 plant species. A cycad *Encephalartos umbeluziensis* and a tree euphorbia *Euphorbia keithii* are endemic to the area. Birdlife is rich, and over 360 species have been recorded. The reserve supports populations of a variety of mammals, including 13 antelope species. Sharpe's grysbuck and oribi are locally rare species, and a few white rhinoceros have been reintroduced. Spotted hyena, two jackal species, serval and a few leopard occur, and Nile crocodile are fairly common. A number of man-made features exist within the reserve, including roads, a veterinary fence, railway line and station. Alien plants have become a major problem in lower areas where vegetation cover has been greatly reduced by large numbers of grazers, particularly impala, which have had to be culled. Poaching is a major problem.

Management of the area is now split between three authorities (J. Culverwell pers. comm., 1993; IUCN/UNEP, 1987).

Mlilwane Nature Reserve IUCN Category IV

This reserve covers 4545ha, straddling the escarpment that divides the middleveld from the highveld. It includes the spectacular Mantenga Falls, and the twin peaked hill of Sheba's Breasts in the north. The sanctuary houses a planted collection of aloes and indigenous trees. The area has been largely rehabilitated from old farmland and tin mining areas, and a number of species, including white rhinoceros and hippopotamus, have been introduced. There are over 240 bird species, including numerous waterfowl attracted to the flooded mining pits. Constant anti-poaching patrols have reduced poaching (IUCN/UNEP, 1987).

OTHER MANAGED AREAS

Hlane Game Sanctuary IUCN Category VIII

This 14,164ha reserve is contiguous to **Mlawula Nature Reserve** (16,500ha). The dominant vegetation type is *Acacia nigrescens* savanna associations and *Euclea* dominated thicket, with limited areas of riverine and alluvial flora. The area supports a total of over 10,000 mammals, predominantly impala, blue wildebeest and zebra, although nyala, greater kudu, warthog, spotted hyena and two jackal species also occur. Small numbers of elephant and giraffe have been reintroduced, and there is a declining population of 30-40 white rhinoceros, presently at great risk from poachers. The eastern half of the area is ungazetted and is a royal hunting reserve; the western half is gazetted, and reserve staff control both areas. The reserve (which is completely fenced) has a policy of non-management of flora and fauna, and cyclical population increases and crashes of the more abundant grazers have led to severe bush encroachment by sicklebush *Dichrostachys cinerea*, and gross reduction of palatable grasses; a recent development has been the mass invasion by the alien annual plant *Parthenium hysterophorus*. A main tarred road cuts the sanctuary in half, severely impacting its wilderness qualities (J. Culverwell pers. comm., 1993; IUCN/UNEP, 1987).

UNPROTECTED SITES

Jilobi Forest

26°33'S, 32°00'E This is a locally unique example of moist evergreen forest, situated on tribal land in the Lubombo Mountains south of Siteki. It displays floral affinities to the coastal forests of south-eastern Africa, including the trees *Heywoodia lucens*, *Oxyanthus* sp., *Gardenia thunbergii*, *Albizia adianthifolia* and *Erythrophleum lasianthum*. Red duiker, Samango monkey, bushpig, bushbuck and possibly leopard survive, and the forest is surrounded by rural settlement. It has cultural values that have helped protect it, but cutting of timber by local persons is increasing (J. Culverwell pers. comm., 1993).

Mababane Nature Reserve Declassified
26°05'S, 31°08'E This small 202ha reserve of montane forest and flora-rich granite outcrops was recently degazetted because of pressures from graziers and urban developers. The restricted endemic plant *Streptocarpus davyi* occurs. Some parts of the area are situated on sympathetically managed private land (J. Culverwell pers. comm., 1993).

Mahamba Gorge
27°04'S, 31°03'E A colony of threatened bald ibis *Geronticus calvus* nest in this privately-owned small gorge on the border with South Africa. The Swaziland National Trust Commission has recently attempted to obtain this land, without success (J. Culverwell pers. comm., 1993; IUCN, 1987; Stuart *et al.*, 1990).

Makhonjwa Hills
25°50'S, 31°14'E This is probably the only area in Swaziland where the endangered cycad *Encephalartos heenanii* may still survive the depredations of collectors. Montane forest occurs in ravines. The area is situated mostly on tribal land (J. Culverwell pers. comm., 1993; IUCN, 1987).

Malahleni Area
26°20'S, 31°45'E This Crown-owned area of knobthorn-savanna is still in good condition, and is inhabited by large herds of wildebeest, zebra and impala from the adjacent **Hlane Game Reserve** to the east, which is severely overgrazed. Up to 60 white rhino use the area (J. Culverwell pers. comm., 1993).

Mbuluzi North Bank
26°09'S, 32°04'E This area comprises spectacular forested valley slopes with stands of rare Lubombo ironwood *Androstachys johnsonii*, pod mahogany *Afzelia quanzensis* and a high diversity of vegetation. Crocodiles, bushbuck, red duiker and klipspringer survive. It is adjacent to and falls under the jurisdiction of the Shewula tribal area, and could be sympathetically managed with the **Mlawula, Ndzindza, Mbuluzi Nature Reserves** complex, which manages the south bank of the river (J. Culverwell pers. comm., 1993; IUCN, 1987; Stuart *et al.*, 1990).

Mhlumeni Area
26°15'S, 32°03'E Situated on Swazi Nation Land in a triangle formed between **Ndzindza** and **Mlawula Nature Reserves**, south-east of Mhlumeni borderpost in the Lubombo Mountains. It incorporates picturesque ravines with cycads and dry forest, and open bushclump savanna on high ground. It is highly desirable to amalgamate this area with the **Mlawula, Ndzindza, Mbuluzi Nature Reserves** complex, to conserve rare oribi and the locally rare Samango monkey (J. Culverwell pers. comm., 1993; IUCN, 1987; Stuart *et al.*, 1990).

Mnyame Gorge
26°27'S, 32°05'E This is a government-owned area, comprising a largely unspoiled area of dry and moist forest, ravines and plateaus in the Lubombo Mountains east of

Siteki. Larger mammals have been almost eliminated but baboon, Samango and vervet monkeys, red duiker, bushbuck, mountain reedbuck, leopard and bushpig still survive. Two cycad species *Encephalartos lebomboensis* and *E. villosus* occur, as do the rare endemic tree euphorbia *Euphorbia keithii* and stands of Lubombo ironwood. Birdlife is rich (J. Culverwell pers. comm., 1993).

Ngwempisi Gorge

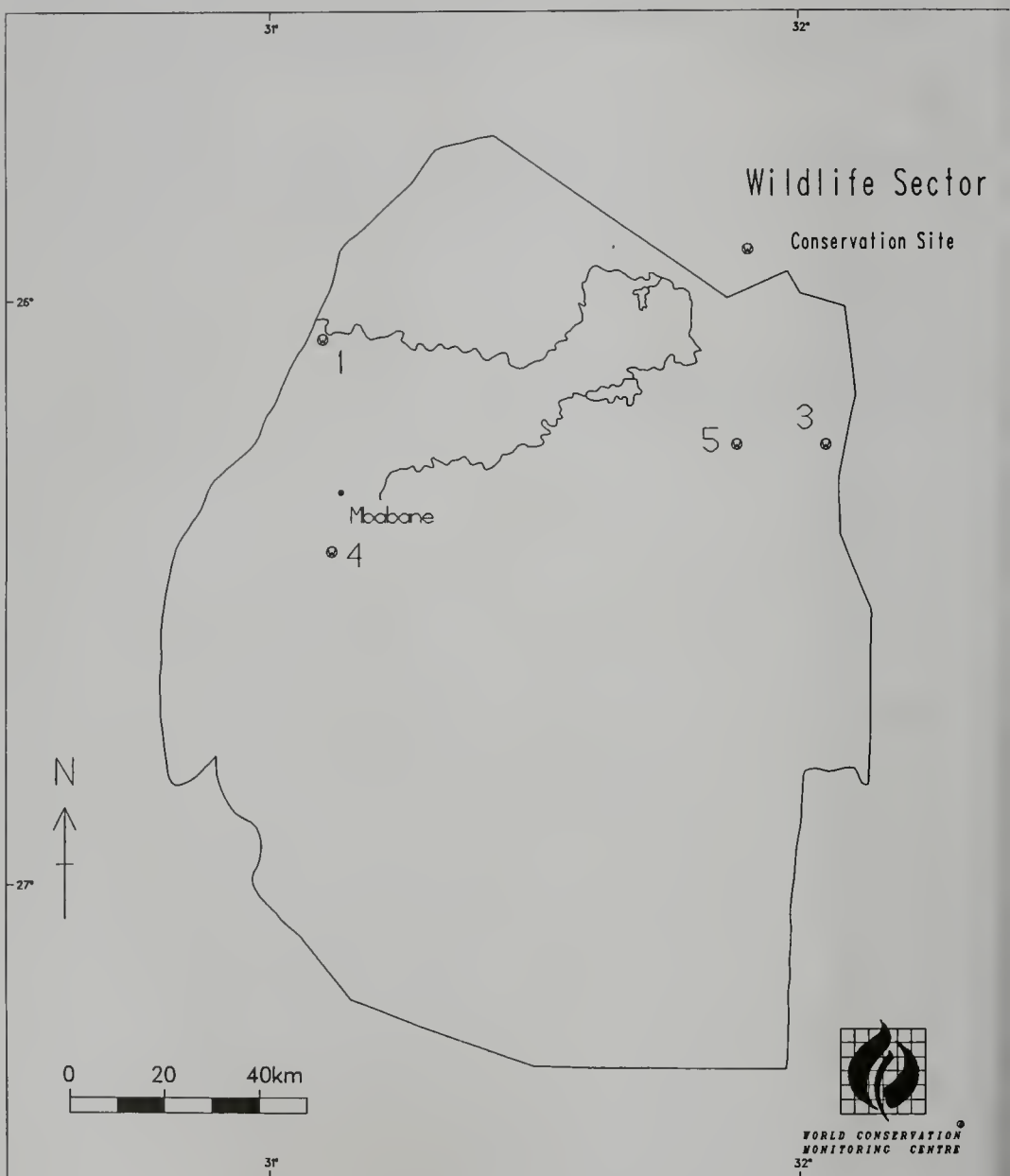
26°42'S, 31°14'E This is a spectacular gorge in granite country to the south-west of Manzini, situated on both tribal and private land. It is largely unexplored, but has been recommended for protected status (J. Culverwell pers. comm., 1993).

SWAZILAND - PROTECTED SITES

National/international designations

Name of area and map reference (see Fig. 5.1)	Management area (ha)	Year notified
Game Sanctuary		
1 Hlane	14,164	1967
Nature Reserves		
2 Malolotja	18,175	1972
3 Mkhaya	6,200	1981
4 Mlilwane	4,545	1972
5 Mlawula, Ndzinda, Mbuluzi & Simunye Reserves	17,000	1977

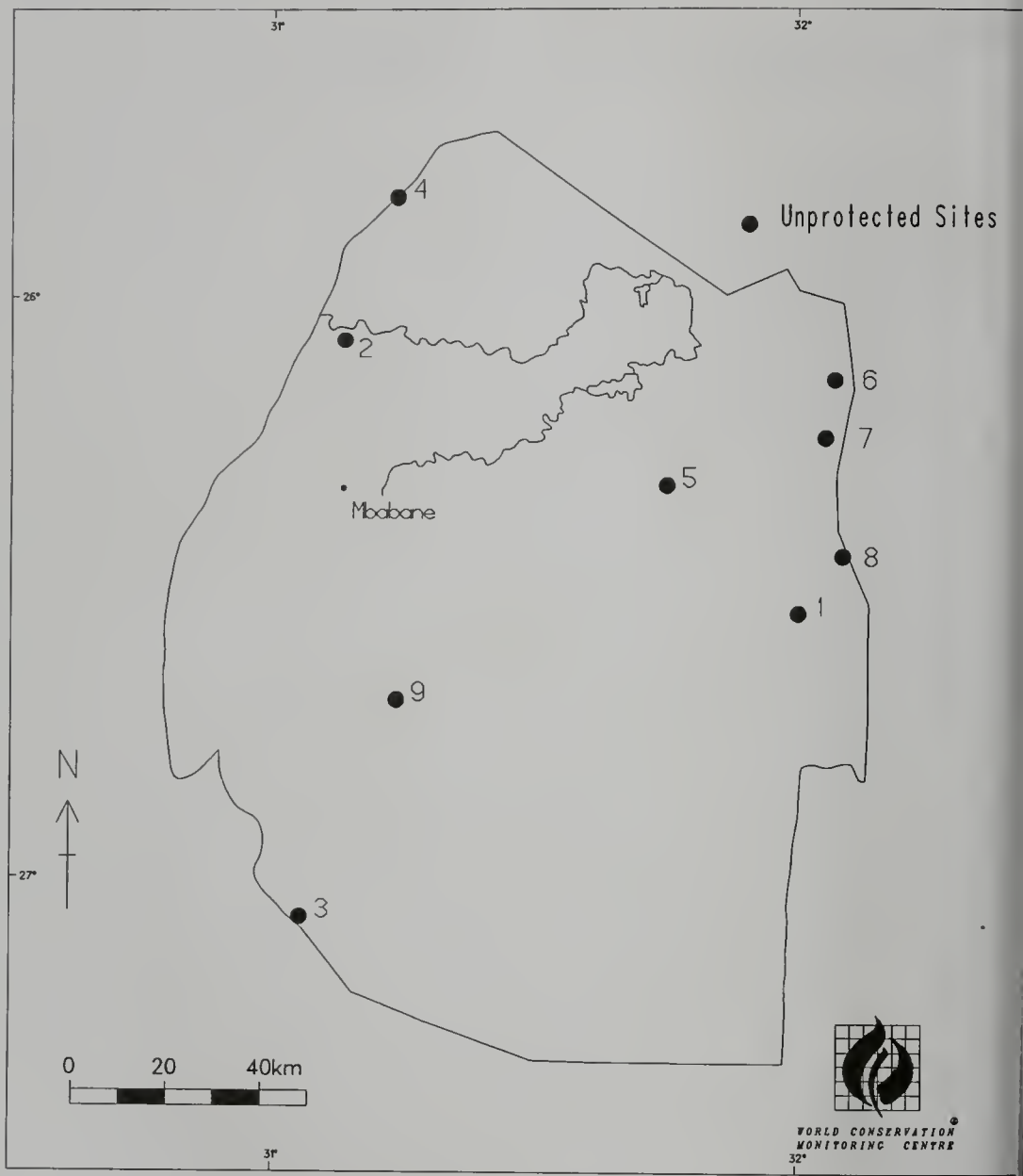
Fig 5.1 Swaziland: protected ecologically sensitive sites



SWAZILAND - UNPROTECTED SITES

Name of area and map reference (see Fig. 5.2)	Management area (ha)
1 Jilobi Forest	
2 Mababane Nature Reserve	202
3 Mahamba Gorge	
4 Makhonjwa Hills	
5 Malahleni Area	
6 Mbuluzi North Bank	
7 Mhlumeni Area	
8 Mnyame Gorge	
9 Ngwempisi Gorge	

Fig 5.2 Swaziland: unprotected ecologically sensitive sites



INTERNATIONALLY DESIGNATED PROTECTED AREAS

Mosi-Oa-Tunya (Victoria Falls) National Park IUCN Categories II and X
This park of 6600ha is contiguous to **Victoria Falls** and **Zambezi national parks** in Zimbabwe, part of a complex of conservation areas in Zimbabwe covering over 1,846,700ha. A World Heritage site of 3779ha is shared between the two countries. The main feature is the Victoria Falls which, at full flood, are the largest curtain of falling water in the world. Mopane forest dominates, but the fragile riverine 'rainforest' within the humid waterfall spray zone is of particular interest. The area supports a variety of ungulates. The falls form a physical barrier between the distinct fish faunas of the upper and middle Zambezi River. Many tourism-related developments exist within the park, mostly dating from before its establishment. A hydroelectric power station exists, and railway lines and roads traverse the area. Cattle grazing has become established, and there is gradual encroachment of small-scale cultivation into the area. Insufficient funds and manpower are available to the park authorities. The rainforest regenerates slowly, and is vulnerable to trampling (IUCN/UNEP, 1987).

NATIONALLY PROTECTED AREAS

Bangweulu Game Management Area IUCN Category VI
11°30'S, 30°15'E This area of swamps, floodplains and miombo woodlands is situated to the south of **Lake Bangweulu**. An increase in status is desirable, and it is proposed to extend the boundaries to include **Lake Bangweulu** (Burgis and Symoens, 1987; Stuart *et al.*, 1990).

Bilili Springs Game Management Area IUCN Category VI
Established in 1971; 308,00ha

Blue Lagoon National Park IUCN Category II
This park of 45,000ha is partly surrounded by **Kafue Flats Game Management Area** (517,500ha). It lies on the north bank of the flats just north-west of Luwato Lagoon, an oxbow lake which dries out only at the end of the dry season. Vegetation includes floodplain grasses and sedges, a narrow intermediate termitaria grassland zone, and open woodland dominated by *Acacia*, *Combretum* and *Terminalia* species. The park supports a varied fauna including threatened species such as African wild dog, Kafue lechwe (large herds of up to 25,000 enter the park seasonally) and cheetah. It is an important feeding ground for waterbirds, including the threatened slaty egret *Egretta vinaceigula* and wattled crane *Bugeranus carunculatus*. Uncontrolled bush fires, cattle grazing and poaching of animals, including fishing, cause problems. The expanding population of Lusaka has increased poaching pressure. The south-eastern corner of the park was permanently flooded between 1977 and 1981 as a result of the Kafue Gorge Dam; flooding is now influenced by the Itezhi-tezhi dam which may reduce the impacts of flood peaks and lows. Since October 1976 the park has been a security area, and closed to visitors (IUCN/UNEP, 1987).

Chambeshi Game Management Area IUCN Category VI
This area is situated within the swamps, floodplains and miombo woodlands south of **Lake Bangweulu** (Stuart *et al.*, 1990).

Chibwika-Ntambu Game Management Area IUCN Category VI
This is an extensive complex of miombo woodland, grassland, floodplains, wetlands and *Cryptosepalum* forest (Stuart *et al.*, 1990).

Chisomo Game Management Area IUCN Category VI
Important concentrations of large mammals occur within this area. There is now a project (the Luangwa Integrated Resource Development Project) aimed at reconciling human and conservation uses of the area (Stuart *et al.*, 1990).

Chizera Game Management Area IUCN Category VI
This is an important area of miombo woodland (Stuart *et al.*, 1990).

Isangano National Park IUCN Category II
This 84,000ha area of flats and floodplain is crossed by the Lubansenshi River. Much of the area is swamp forest and grasslands. The area supports a variety of large mammals, including threatened species such as elephant, Nile crocodile and black lechwe (seasonally). Poaching and uncontrolled bush fires occur, with fishing villages occurring within the reserve. As a result of the area being of a low priority under game reserve status, animal populations are now much reduced (IUCN/UNEP, 1987).

Kafinda Game Management Area IUCN Category VI
This is situated within an area of swamps, floodplains and miombo woodlands south of **Lake Bangweulu** (Stuart *et al.*, 1990).

Kafue Flats Game Management Area IUCN Category VI
This is part of the Kafue River System, a diverse mosaic of miombo woodlands, grassland, flood-plains and swamps; human and conservation land-use conflicts need to be resolved (Stuart *et al.*, 1990).

Kafue National Park IUCN Category II
This park covers 2,240,000ha surrounded by **Kafue Flats Game Management Area.** It is on a gently undulating plateau crossed by the Kafue River and two major tributaries. There is a perennial swamp in the extreme north-west. The south supports primarily miombo or *Brachystegia*-dominated woodland, with terminaria woodland surrounding open grassy floodplains. Patches of teak occur throughout. The park supports a varied fauna, including threatened species such as elephant, black rhinoceros and red lechwe. A dam has been constructed at Itezhi-tezhi on the Kafue River just outside the park, since which time about 31,000ha have been flooded. The labour force for the dam construction subsequently formed a squatter settlement, and this and fishing in Lake Itezhi-tezhi have encouraged illegal entry and poaching. The island in the lake is inhabited by fishermen, and 17 villages have fishing rights. However, a project to encourage rural development and to reduce pressure on the park

was initiated in 1985. Wastes, including nitrates and phosphorus residues, are discharged into the Kafue. The main road from Lusaka to Mongu bisects the park, and uncontrolled bush fires occur (IUCN/UNEP, 1987).

Kalaso Mukoso Game Management Area IUCN Category VI
This is situated within the area of swamps, floodplains and miombo woodlands south of **Lake Bangweulu** (Stuart *et al.*, 1990).

Kansonso-Busanga Game Management Area IUCN Category VI
This area forms part of the Kafue River system, a diverse mosaic of miombo woodlands, grassland, flood plains and swamps; human and conservation land-use conflict need to be resolved (Stuart *et al.*, 1990).

Kaputa Game Management Area IUCN Category VI
Established in 1971, this area covers 360,000ha.

Kasanka National Park IUCN Category II
This 39,000ha park consists of a flat and gently undulating area crossed by two major rivers, including extensive wetlands and the Kapabi swamp. The area is dominated by miombo *Brachystegia-Julbernardia* woodlands. The park supports a variety of large mammals, including elephant and an abundant avifauna. Poaching and uncontrolled burning occur. The construction of the Serenje-Samfya road has had adverse effects on the park (IUCN/UNEP, 1987).

Lavushi Manda National Park IUCN Category II
The Lavushi Manda hills run along the south-eastern side of this park of 150,000ha, contiguous to **Kafinda and Bangweulu Game Management Areas**. The hills are extremely rugged with high cliffs to the south-east, and are dissected by several narrow canyons with perennial water-courses. Most of the area supports miombo *Brachystegia-Julbernardia* woodland, interspersed with dambo plains and dense gallery forest along rivers. Larger mammals are not numerous, but include threatened species such as leopard and elephant. Uncontrolled fires and poaching occur, the latter having increased through developments along the Tazara railway line (IUCN/UNEP 1987).

Liuwa Plain National Park IUCN Category II
This park of 366,000ha is surrounded by **West Zambezi Game Management Area** (3,807,000ha). This extremely flat sand plain is flanked by two rivers, with seasonally inundated areas occurring along them. Most of the area consists of Kalahari short grass sand plains, with watershed grasslands. The park supports many ungulates, including the threatened red lechwe and the largest population of migrating blue wildebeest in Zambia. A variety of waterfowl occurs on the pans, including the threatened slaty egret *Egretta vinaceigula*. Poaching, illegal fishing, uncontrolled bush fires and grazing by domestic animals on the park boundary occur; villages exist within the park (IUCN/UNEP, 1987).

Lochinvar National Park IUCN Category II

This park of 41,000ha is contiguous to **Kafue Flats Game Management Area** (517,500ha), and comprises three areas: part of the Kafue Flats flood plain with grassland, a flat termitaria zone, and woodland on higher areas in the south. Mammals include large herds of up to 35,000 of the threatened Kafue lechwe *Kobus leche kafuensis*, and a variety of other ungulates. The area supports a rich avifauna of over 400 species, including the threatened wattled crane and slaty egret. Poaching has resulted in a decrease in lechwe, wildebeest and oribi populations, and the local extinction of eland. Overgrazing by domestic stock occurs, with large herds straying into the park. Illegal fishing, including commercial fishing, occurs and fishermen live within the park. The construction of two dams has modified ecological conditions which could affect the population of Kafue lechwe, dependent upon the Kafue's annual flood for good pasture. Some dry season grazing areas on the flats are now under water because of hydroelectric development, and this has increased cattle encroachment into the park (IUCN/UNEP, 1987).

Lower Zambezi National Park IUCN Category II

This park covers 414,000ha in a predominantly hilly area, including rugged mountains. The vegetation of the park is dominated by miombo *Brachystegia* woodland, mopane woodland, and mixed *Kigelia-Diospyros* woodland and grassland along the river. The varied fauna includes a number of threatened species such as elephant, black rhinoceros, leopard, African wild dog and Nile crocodile. Heavy poaching and large bush fires occur (IUCN/UNEP, 1987).

Luambe National Park IUCN Category II

This park of 25,400ha is contiguous to **South Luangwa National Park** (905,000ha), and is surrounded by game management areas. It slopes gently to the Luangwa River on the western boundary. Alluvial areas supporting mopane woodland predominate, while miombo woodland grows on sandy soils away from the river. The varied fauna includes threatened species such as numerous elephant and a few black rhinoceros. The park also supports the largest concentration of a subspecies of blue wildebeest (Cookson's wildebeest) *Connochaetes taurinus cooksoni*, endemic to the Luangwa valley. Uncontrolled bush fires occur, and there is local overstocking of elephant, impala, and hippopotamus (IUCN/UNEP, 1987).

Luana Game Management Area IUCN Category VI

Established in 1971, this covers 893,000ha.

Lukusuzi National Park IUCN Category II

This 272,000ha park is surrounded on three sides by game management areas. The eastern part consists of a level plateau, with more hilly country appearing towards the western escarpment overlooking the Luangwa valley. Miombo woodland dominates the plateau and escarpment, and grasslands follow drainage lines. The park supports a number of ungulate species, and elephant. The rocky outcrops are one of the main Zambian habitats for klipspringer. Uncontrolled fires and poaching occur. Activities

associated with prospecting and emerald mining are a serious threat (IUCN/UNEP, 1987).

Lukwakwa Game Management Area IUCN Category VI
This is an extensive complex of miombo woodland, grassland, floodplains, wetlands and *Cryptosepalum* forest (Stuart *et al.*, 1990).

Lumimba Game Management Area IUCN Category VI
This area supports important populations of large mammals. There is now a project (the Luangwa Integrated Resource Development Project) aimed at reconciling human and conservation uses of the area (Stuart *et al.*, 1990).

Lunga-Luswishi Game Management Area IUCN Category VI
This is part of the Kafue River system, a diverse mosaic of miombo woodlands, grassland, flood plains and swamps; human and conservation land-use conflicts need to be resolved (Stuart *et al.*, 1990).

Lusenga Plain National Park IUCN Category II
Established in 1972, this park covers 88,000ha in the south-west of an area formed of a weathered volcanic plug; rock outcrops in concentric rings have formed a saucer-shaped depression. Three large waterfall occur on the Kalungwishi River. Grassland predominates, with remnants of swamp forest, dry evergreen forest and dense miombo woodland. The fauna is depleted, but includes remnant populations of vervet and blue monkeys, leopard, elephant and many ungulates. Uncontrolled fires and poaching occur (IUCN/UNEP, 1987).

Lupande Game Management Area IUCN Category VI
Established in 1971, this 484,000ha area supports important populations of larger mammals. There is now a project (the Luangwa Integrated Resource Development Project) aimed at reconciling human and conservation uses of the area (Stuart *et al.*, 1990).

Luwingu Game Management Area IUCN Category VI
Covering 109,000ha, this area is situated within the swamps, floodplains and miombo woodlands south of **Lake Bangweulu** (Stuart *et al.*, 1990).

Machiya-Fungulwe Game Management Area IUCN Category VI
Covering 153,000ha, this area is part of the Kafue River system, a diverse mosaic of miombo woodlands, grassland, flood plains and swamps. Human and conservation land-use conflicts need to be resolved (Stuart *et al.*, 1990).

Mansa Game Management Area IUCN Category VI
This area is situated within the swamps, floodplains and miombo woodlands south of Lake Bangweulu (Stuart *et al.*, 1990).

Mazabuka Game Management Area IUCN Category VI
25,400ha

Mosi-Oa-Tunya National Park IUCN Category II
Established in 1972, this park covers 6600ha.

Mulobezi Game Management Area IUCN Category VI
This is part of the Kafue River system, a diverse mosaic of miombo woodlands, grassland, flood plains and swamps. Human and conservation land-use conflicts need to be resolved (Stuart *et al.*, 1990).

Mumbwa Game Management Area IUCN Category VI
Part of the Kafue River system, this is a diverse mosaic of miombo woodlands, grassland, flood-plains and swamps; human and conservation land-use conflicts need to be resolved (Stuart *et al.*, 1990).

Munyamadzi Game Management Area IUCN Category VI
This area supports important populations of large mammals. There is now a project (the Luangwa Integrated Resource Development Project) aimed at reconciling human and conservation uses of the area (Stuart *et al.*, 1990).

Musalangu Game Management Area IUCN Category VI
This area supports important populations of large mammals. There is now a project (the Luangwa Integrated Resource Development Project) aimed at reconciling human and conservation uses of the area (Stuart *et al.*, 1990).

Musele-Matebo Game Management Area IUCN Category VI
This is an extensive complex of miombo woodland, grassland, floodplains, wetlands and *Cryptosepalum* forest (Stuart *et al.*, 1990).

Mweru-Wantipa National Park IUCN Category II
This park covers an area of 313,400ha contiguous to **Kaputa Game Management Area**; grassland and swamp in the east is periodically flooded, forming the large open Lake Mweru-Wantipa. In the west the land slopes gently upwards to highly dissected hills. Miombo *Brachystegia-Julbernardia* woodland predominates away from the lake with large grassy dambos. The area supports a varied fauna including threatened species such as leopard *Panthera pardus*, black rhinoceros *Diceros bicornis*, elephant and two crocodile species. The park contains a seasonal fishing village and one permanent village; poaching and uncontrolled fires still occur. Measures to control the red locust have been a recurrent disturbance. Man-eating crocodiles cause problems and are cropped, the carrying capacity of the lake being over 4000. A dispute over the boundary has occurred between the national parks authority and local people (IUCN/UNEP, 1987).

Namwala Game Management IUCN Category VI
Part of the Kafue River system, a diverse mosaic of miombo woodlands, grassland, flood plains and swamps; human and conservation land-use conflict need to be resolved (Stuart *et al.*, 1990).

Nkala Game Management Area IUCN Category VI
19,400ha

North Luangwa National Park IUCN Category II
The park extends over 463,600ha from the Muchinga escarpment (1400m) in the west to the Luangwa River in the east and is surrounded on three sides by game management areas. Miombo *Brachystegia* woodland scrub mixed with *Colophospermum mopane* occur, depending on soils, with riverine forest in the meandering belt. The fauna includes threatened species such as leopard *Panthera pardus*, elephant, black rhinoceros *Diceros bicornis* and Nile crocodile *Crocodylus niloticus*. However, there is poaching, particularly of elephant and rhinoceros, and uncontrolled fires. Despite efforts by the Save the Rhino Trust all of North Luangwa is at the mercy of poachers due to lack of finance (IUCN/UNEP, 1987).

Nsumbu National Park IUCN Category II
The park, which covers 202,000ha, includes about 100km of the rocky shoreline of Lake Tanganyika, interspersed with some small beaches. The remaining area is a plateau traversed by the Lufubu River. On either side of the river are escarpments. Vegetation is varied, including woodland, grasslands and gallery forest. The varied fauna includes threatened species such as leopard *Panthera pardus* and elephant and it supports a number of ungulates. The lake supports Nile crocodile and rich avifauna. Poor water supply, lack of transport and manpower lead to poaching and uncontrolled bush fires. There is one permanent and one temporary fishing village in the park (IUCN/UNEP, 1987).

Nyika (Zambia) National Park IUCN Category II
This park of 8000ha is contiguous to **Nyika National Park and Vwaza National Park** in Malawi. It comprises the small part of the Nyika plateau in Zambia, an undulating area bounded by precipitous escarpments. The escarpment soils support miombo *Brachystegia-Julbernardia* woodland and there are small relict patches of montane forest and other forest types on the plateau. There is a rich mammal fauna including Moloney's monkey although larger mammals are uncommon and wattled crane *Bugeranus carunculatus* (of special concern) occurs. Uncontrolled fires are a problem (IUCN/UNEP, 1987).

Sandwe Game Management Area IUCN Category VI
Has important populations of large mammals. There is now a project (the Luangwa Integrated Resource Development Project) aimed at reconciling human and conservation uses of the area (Stuart *et al.*, 1990).

Sichifula Game Management Area IUCN Category VI
Part of the Kafue River system, a diverse mosaic of miombo woodlands, grassland, flood plains and swamps; human and conservation land-use conflict need to be resolved (Stuart *et al.*, 1990).

Sioma Ngwezi National Park IUCN Category II
This covers 527,600ha in a relatively flat area west of the Zambezi River. Vegetation is Kalahari sandveld with good stands of teak *Baikiaea plurijuga,* areas of mopane *Colophospermum mopane*, and small patches of a mixed woodland of *Burkea-Colophospermum-Baikiaea* associations. The park supports a number of large mammals including many antelopes and threatened species such as cheetah *Acinonyx jubatus* and elephant. Poaching and uncontrolled bush fires occur and the extraction of teak may go on (IUCN/UNEP, 1987).

South Luangwa National Park IUCN Category II
This park of 905,000ha is surrounded by game management areas; it includes the Luangwa river and rises gently to the Muchinga escarpment on the north-west boundary. Woodland savanna and miombo woodland are widespread, with grassland on the floodplain and some riparian forest. The park was originally gazetted to protect Thornicroft's giraffe, a subspecies endemic to the valley. Large mammals are abundant, particulary ungulates, and the park includes threatened species such as wild dog *Lycaon pictus*, leopard *Panthera pardus*, cheetah *Acinonyx jubatus*, many elephant and black rhinoceros *Diceros bicornis*. Birdlife is prolific and the Luangwa River is one of the major refuges for Nile crocodile in Zambia. Despite the efforts by the Save the Rhino Trust, large areas of South Luangwa are at the mercy of commercial poachers because of lack of finance; elephants were reduced by about 50,000 between 1975 and 1980. Elephants also damage trees during the dry season when grazing is poor; migration is restricted by the park boundary and overgrazing by overcrowded populations exposes soils to erosion. Prospecting for minerals and uncontrolled bush fires also occur (IUCN/UNEP, 1987).

Tondwa Game Management Area IUCN Category VI
An area of miombo woodland, grassland and swamps adjacent to the shores of Lake Tanganyika (Stuart *et al.*, 1990).

Victoria Falls National Monument IUCN Category III
Established in 1948; 1900ha

West Lunga National Park IUCN Category II
This gently undulating park covers 168,400ha and includes rock outcrops between the West Lunga and Kabompo rivers, lined by permanent swamps and three seasonally inundated grassy plains. Dry evergreen forest predominates. The park supports a number of ungulate species and elephant are fairly common. However, poaching occurs and there are uncontrolled bush fires (IUCN/UNEP, 1987).

West Petauke Game Management Area IUCN Category VI
Important concentrations of large mammals. There is now a project (the Luangwa Integrated Resource Development Project) aimed at reconciling human and conservation uses of the area (Stuart *et al.*, 1990).

West Zambezi Game Management Area IUCN Category VI
A large area along the Zambezi River, with ongoing poaching problems. It includes the Barotse flood plain, which supports a fishing industry upon which about 200,000 people depend. The area is grazed by about 300,000 head of cattle during the dry season (Hughes and Hughes, 1992; Stuart *et al.*, 1990).

OTHER MANAGED AREAS

Zambia's many forest reserves (IUCN Category VIII), including date of establishment and size, are listed at the end of the chapter. Individual forest reserves are only included in the text if additional information was available.

Luano Forest Reserve IUCN Category VIII
Established in 1974; 13,944ha. Has concentrations of large mammals. There is now a project (the Luangwa Integrated Resource Development Project) aimed at reconciling human and conservation uses of the area (Stuart *et al.*, 1990).

UNPROTECTED SITES

Busanga Swamp
14°10'S, 25°50'E (centre) Covering about 100,000ha of permanent swampland within the tsetse fly zone along the Lufupa River to the north-west of **Kafue National Park**. It is poorly known biologically, and little used by humans (Burgis and Symoens, 1987).

Lake Bangweulu
10°50'-11°50'S, 29°30'-30°05'E Covering about 273,300ha of open water and 700,000ha of swampland, this is one of the largest wetlands in southern Africa. Woody vegetation occurs on elevated ridges, and includes *Ficus verruculosa*, *Aeschynomene elaphroxylon* and galleries of swamp-forest. Over 86 fish species are found. Threatened birds include the shoebill *Balaeniceps rex*, wattled crane *Bugeranus carunculatus* and slaty egret *Egretta vinaceigula*. The two crocodiles *Crocodylus niloticus* and *C. cataphractus* occur, as well as hippopotamus, sitatunga, the endemic black lechwe, southern reedbuck, tsessebe and oribi. Elephant and lion are reported to survive in low numbers. It is highly desirable to extend the protected coverage of **Bangweulu Game Management Area** to cover as much of this area as possible. Plans would have to acknowledge the needs of people living in the area (Burgis and Symoens, 1987; Hughes and Hughes, 1992; Stuart *et al.*, 1990).

Lake Mweru
9°00'S, 28°45'E Situated on the border of Zaïre (**Lake Moero** in Zaïre), this large lake covers about 458,000ha. There are records of 94 species of fish. Both slender-snouted and Nile crocodiles are found, and the wealth of birdlife includes shoebill stork. Hippopotamus, sitatunga, lechwe, puku and elephant occur in the region (Burgis and Symoens, 1987).

Lake Tanganyika
3°21'-8°51'S, 29°04'-31°12'E This is the second deepest lake in the world (1470m), having a surface area of 3,280,000ha (of which 210,000ha are within Zambia). Measuring 659km by 85km, it generally has steep shores with adjacent high mountain ranges. A significant local fishery exists. Only a small part of the lake is protected (9600ha), in Tanzania, in **Mahale Mountain National Park** (Hughes and Hughes, 1992).

Luapula River Swamps
9°24'-10°05'S, 28°33'-28°48'E The current conservation needs of these swamps along the Luapula River, south of **Lake Mweru**, are unknown, but the threatened papyrus yellow warbler *Chloropeta gracilirostris* is known to occur (Stuart *et al.*, 1990).

Lukanga Swamp
14°20'S, 27°40'E This important wetland covers about 210,000ha, about 50km from the town of Kabwe; it includes the islands of Chiposha and Chilwa. Essentially a reed/papyrus swamp, it supports a local fishery. Cattle are grazed on the flood plain during the dry winter months (Hughes and Hughes, 1992; Stuart *et al.*, 1990).

Makutu Mountains
10°25'S, 33°17'E Montane forest, which is rare in Zambia, occurs in these hills (Stuart *et al.*, 1990).

Mafinga Mountains
10°00'S, 33°19'E These montane forests include *Entandophragma* and *Ficalhoa* forests, rare in Zambia (Stuart *et al.*, 1990).

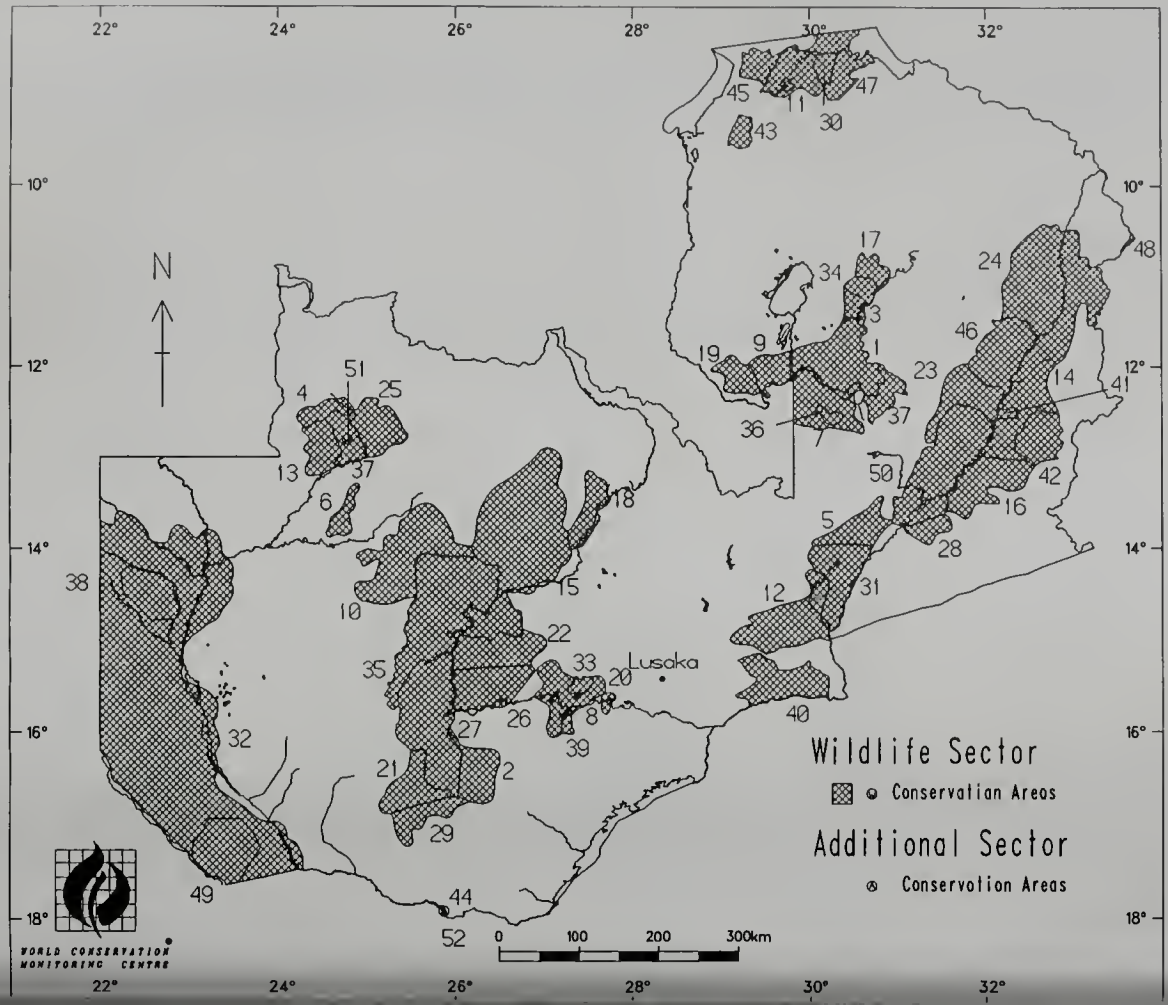
Mwinilunga Forests
11°45'S, 24°27'E These are isolated patches of lowland and gallery forest that are outliers of the main Zaïrean forest, occupying the headwaters of the Zambezi River. Their clearance would have serious negative effects downstream. Botanically, one of the richest areas in Zambia (Stuart *et al.*, 1990).

ZAMBIA - PROTECTED SITES

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Forest Reserves		
Acres	68,657	1990
Amenshi	700	1976
Bombwe	2,153	1934
Bondo	4,176	1968
Border	6,900	1957
Bovu	26,507	1951
Bushingwe	31,221	1961
Bwana Mkumbwa	1,704	1964
Bwingi Mfumu	104,800	1979
Chaba Extension	1,708	1968
Chaba	1,655	1953
Chacha	6,850	1975
Chamato	34,155	1958
Chambeshi Headwaters	19,303	1963
Chambezi Flats	4,856	1955
Chamchanga	2,104	1970
Chamulaza	4,812	1964
Chankhaze	870	1964
Chati	40,165	1975
Chavuma	9,430	1985
Chibanga	154	1955
Chibompo	123,024	1955
Chibuluma Extension	1,437	1953
Chibuluma	720	1971
Chibunda	4,735	1958
Chibwe	11,837	1973
Chichele	2,560	1976
Chidazi	239	1964
Chief Chipalo	4,411	1964
Chief Mpepo	34,620	1974
Chief Munkonge	13,950	1977
Chief Shimumbi	10,117	1964
Chief Tungati	3,248	1964
Chikanga	4,937	1966
Chikwalala	6,236	1970
Chila	2,307	1968
Chilowe	622	1965
Chilubi Plantation	16	1978

Fig 6.1 Zambia: protected ecologically sensitive sites



ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Chimakila	27,031	1973
Chimalilo	6,795	1979
Chimbe	9,227	1955
Chimimba Hills	28,300	1975
Chindindendi	1,578	1966
Chingola	660	1977
Chinsali Plantation	120	1973
Chinsinsi East	259	1964
Chinsinsi West	312	1966
Chinuma	19,020	1958
Chiobe	992	1973
Chipata	1,688	1954
Chipepo	1,874	1968
Chipilepile	9,877	1972
Chipoma	16,790	1979
Chipunga	2,720	1970
Chire	2,765	1978
Chisamba	5,789	1970
Chisambala	526	1966
Chisangwa	9,793	1964
Chisenga	4,706	1972
Chiswa	212	1964
Chiswa West	401	1964
Chitimukulu	3,180	1972
Chitope	323	1981
Chiulukire West	6,637	1966
Chiurukire East	5,403	1966
Chivuna Hills	589	1967
Chizela	960	1977
Choma	1,696	1962
Choma West	931	1956
Chombwe	158	1973
Chondwe	3,223	1968
Chungu	2,708	1966
Dambwa	14,930	1966
Diwa	429	1966
Dome	3,642	1945
Dongwe	50,840	1978
East Lunga	478,034	1964

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Fibale	1,720	1976
Fitanda	2,343	1978
Fungwe	36,500	1977
Hippo Pool	550	1946
Ichimpe	9,830	1976
Ifiluta	10,878	1973
Ila	44,880	1966
Ilangali	2,760	1977
Ipumbu	18,600	1973
Ituntwe	3,338	1970
Isoka Plantation	94	1973
Ituntwe	3,338	1970
Kaande	3,090	1978
Kabanga	46,010	1973
Kabembe	3,350	1978
Kabompo	113,838	1952
Kabwe	10,010	1976
Kabwima	28,854	1958
Kacholola	15,200	1964
Kadamnuzu	380	1966
Kafinsa Mushitu	161	1967
Kafue	1,967	1962
Kafue Headwaters	206,389	1959
Kafwelo	4,350	1958
Kafwira Extension	8,935	1961
Kafwira	15,483	1961
Kagwamaula	452	1964
Kaituka	3,550	1974
Kakula	5,827	1960
Kakwe	366	1973
Kalabo Falls	518	1943
Kalamba	680	1974
Kalenga	7,179	1960
Kalibu	269	1973
Kalilele	49,092	1967
Kalomboshi	9,269	1966
Kalomo Hills	16,200	1987
Kalulu	4,781	1963
Kalungwishi	102	1968

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	**Management area (ha)**	**Year notified**
Kaluwe	596	1973
Kambashi	22,825	1973
Kambinda	5,600	1978
Kambowa	1,610	1973
Kamenza	7,010	1977
Kamkomole	1,376	1966
Kamona	22,127	1979
Kanakantapa South	5,409	1966
Kanampende	1,730	1973
Kangansa	15,338	1958
Kangwa	3,513	1973
Kangwa	3,513	1973
Kangwa West	16,810	1973
Kanjenjesi	8,652	1964
Kanona	28,449	1970
Kanonge	26,548	1968
Kanyelele	327	1964
Kansamfwe	22,701	1964
Kanyanga	1,980	1975
Kanyelele	327	1964
Kaolole	9,700	1976
Kaoma	10,070	1977
Kapalala	762	1969
Kapele	7,900	1972
Kapirimponshi	840	1975
Kapoli	1,615	1970
Kapungwe East	1,327	1964
Kapungwe West	1,348	1964
Kapweshi	3,836	1970
Karubwe	9,245	1949
Kasama	4,146	1974
Kasanga	9,250	1981
Kasaria	6,273	1946
Kasemu	1,166	1973
Kasesi	1,081	1968
Kashiba	171	1972
Kasila	22,170	1979
Kasis Gorge	88	1973
Kasizhi	1,390	1973

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Kasoto	5,844	1960
Kataba	587	1973
Katakoli East	6,343	1969
Katanino	231	1957
Katanino	4,532	1963
Kateme	2,560	1972
Katendwa	259	1973
Katete	567	1952
Katoka	971	1958
Katombola Extension	4,617	1970
Katombora	4,766	1970
Kavungu	753	1960
Kawena	18,809	
Kayumbwana	3,575	1973
Kazimule	353	1965
Kazunamena	5,935	1972
Keembe	6,060	1972
Keyana	24,250	1976
Kipupu	34,615	1961
Kipushi	4,844	1968
Kirila	2,066	1963
Kondowe	1,396	1966
Konkola	3,845	1945
Kukwe	3,879	1964
Kuuli	3,530	1973
Lamba	103,817	1953
Lamba Headwaters	154,500	1953
Liangati	7,975	1980
Likonge	3,798	1973
Likonge nobala	25,040	1973
Lilengo West	2,177	1971
Lilundu	1,600	1973
Limpere	1,200	1973
Litoya	1,816	1977
Luakera River	32,820	1953
Lualaba	110,722	1961
Luanga Namakusi	7,830	1973
Luangondo	2,040	1975
Luangwa	281,370	1973

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Luano	13,944	1974
Luanshya	6,235	1976
Luba North	4,812	1968
Luba South	21,052	1968
Lubu	3,200	1970
Lubulafita	7,932	1964
Luchindashi	9,487	1972
Ludji	123,194	1961
Luembe	103,967	1967
Luena	13,756	1974
Luena Plantation	44	1973
Lufubu North	63	1965
Luinga	627	1958
Luitikila	108,094	1972
Lukangaba	7,163	1966
Lukona	544	1973
Lukona West	1,900	1973
Lukulaisho	6,285	1967
Lukunde Mushitu	220	1978
Lukwechele	2,448	1968
Lulenge	1,770	1979
Luma	11,056	1961
Lumbo	23,556	1974
Lumimba	10,117	1968
Lumina	4,530	1978
Lumuka	25,900	1957
Lunda	170,878	1958
Lundazi	374,800	1975
Lunga Hills	587	1966
Lungu	18,939	1963
Lunjofwa	7,339	
Lunzua Extension	1,785	1973
Lunzua	22,986	1964
Luombwa	14,885	1970
Luongo	37,220	1979
Lupande	5,613	1968
Lupasa	7,770	1978
Lupososhi	6,215	1977
Lusaa	1,380	1979

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Lusaka North	368	1961
Lusaka South Extension	2,100	1955
Lusaka South	6,655	1982
Lusengezi	37,057	1967
Lushishi	6,393	1974
Lusitu Headwaters	21,390	1967
Lusongwa	9,550	
Lusu	1,680	1973
Lutale	2,725	1973
Lutandebwe	22,400	1972
Lutembwe	468	1964
Lutengwe	190	1973
Lutondo	410	1973
Luwenga	1,303	1964
Lwanya East	1,560	1979
Lwanya West	2,590	1979
Lwao	4,605	1973
Lwelangwa	7,360	1978
Lwenga	264	1973
Lyenda	8,670	1973
Machili	47,783	1980
Machinje Hills	72,961	1968
Mafinga Hills	15,500	1972
Magoye South	1,320	1987
Mahilo	67	1974
Majamu	1,012	1958
Makasa	3,740	1968
Makutu	38,844	1953
Malanda	19,622	1966
Malanda Mushitu	34	1979
Malavwe Nachitwe	63,455	1943
Malumbwe	2,440	1973
Mambwe	3,460	1973
Mande Hills	6,290	1972
Mangoli	676	1964
Mankalala	38,300	1975
Mansa Plantation	150	1973
Mantanta	1,052	1966
Mantapala	9,884	1970

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Mapanza	171	1967
Maposa	8,982	1969
Martin	51,395	1953
Masansa	3,577	1971
Masese	60,835	1972
Masupe	900	1972
Mataba	6,749	1973
Mateya	6,310	1973
Matipa	20,279	1967
Mbala	1,860	1973
Mbanga	3,754	1983
Mbereshi	61,500	1972
Mbonge	6,373	1959
Mbunda	31,770	1971
Mbuta	2,480	1973
Mfumu	660	1964
Miengwe	8,094	1968
Milima Milobola	79	1972
Minga	6,653	1972
Misaka	28,400	1972
Misambo	17,256	1961
Mitanda	20,330	1972
Mkushi Headwaters	11,319	1968
Mkwawe	1,103	1964
Molodzera	959	1966
Monkey Fountain	51	1944
Mpangwe Hills	1,538	1964
Mpika Boma	2,811	1968
Mpomwa	6,698	1958
Mporokoso	6,791	1967
Mpoto	2,023	1968
Mpulungu	21,730	1970
Msima	14,799	1970
Msipazi	284	1967
Mtilizi	1,274	1970
Mubende	90,830	1980
Mubofwe	16,100	1982
Mufulira	6,433	1978
Mufumbwe	3,625	1979

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Mufundwa	9,712	1960
Mufundwa	11,938	1958
Mufwashi	54,840	1980
Muhonge	1,335	1958
Mukabi	6,600	1979
Mukalizi	10,430	1979
Mukunkuki	5,510	1973
Mukwe	1,225	1973
Mulambwa	22,000	1973
Mulembo	19,395	1971
Mulenga	7,021	1967
Mulobola	7,666	1967
Mulonga Plain	236	1974
Mulundu	5,450	1977
Mulungushi West	10,785	1975
Mumba	13,152	1962
Mumbo	12,050	1973
Mungu	1,000	1973
Mungwi	130	1973
Munte	340	1972
Munwa	18,532	1968
Munyeta	12,200	1976
Munyumbwe	1,315	1968
Mupya West	308	1964
Musaka	23,269	1961
Musangashi	11,630	
Mushingashi	15,100	1973
Mushota	97	1969
Musisa	11,800	1972
Musola	7,703	1972
Mutanda	12,930	1961
Mutulanganga	9,385	1968
Mutungi	7,738	1974
Muuyi	1,260	1973
Muva	3,187	1972
Muyama	18,093	1964
Muzenze	1,518	1958
Mvuvye	80,937	1960
Mwalanda	137	1973

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Mwamba	5,040	1968
Mwangazi	2,728	1980
Mwanjangulu	276	1964
Mwapula	12,560	1977
Mwekera East	2,072	1971
Mwekera	17,887	1957
Mwembe	13,152	1958
Mwenze	30,400	1971
Mwewa	2,266	1966
Mwimba	4,455	1973
Mwomboshi	4,087	1960
Myafi	2,080	1973
Mzewe North	7,885	1964
Mzewe South	21,044	1964
Nabiyoyo	12,026	1977
Nabowa	15,787	1974
Nadonga	5,222	1967
Nakabwe	5,589	1967
Nakonde	417	1981
Nalikena	1,940	1973
Nalugwa	20,374	1981
Nalusheke	430	1973
Namapombo	12,450	1973
Nambala	15,289	
Nambala Hills	764	1974
Namboma	2,100	1973
Namianji	4,750	1973
Namulubi	4,800	1975
Nanduka	910	1973
Nanga	1,430	1975
Nangombe	2,380	1973
Nanyota	3,432	1972
Nchelenge	210	1971
Nchembwe	654	1964
Ndaya	1,540	1973
Ndembo	45,871	1958
Ndenda	244,594	1973
Ndesha	44,455	1961
Ndola East	2,367	1970

Fig 6.2 Zambia: unprotected ecologically sensitive sites

ZAMBIA - UNPROTECTED SITES

Name of area and map reference (see Fig. 6.2)	Management area (ha)
1 Busanga Swamp	100,000
2 Lake Bangweulu	273,300
3 Lake Mweru	458,000
4 Lake Tanganyika	
5 Luapula River Swamps	
6 Lukanga Swamp	210,000
7 Makutu Mountains	
8 Mafinga Mountains	
9 Mwinilunga Forests	

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Zambezi Source	222	1984
Zeze Hill	7,948	1968
Zimba Hills	18,800	1985
Zungubo	950	1973
Game Management Areas		
1 Bangweulu	657,000	1971
2 Bilili Springs	308,000	1971
3 Chambeshi	62,000	1971
4 Chibwika-Ntambu	155,000	1971
5 Chisomo	339,000	1971
6 Chizera	228,000	1971
7 Kafinda	386,000	1971
8 Kafue Flats	517,500	1971
9 Kalaso Mukoso	67,500	1971
10 Kansonso-Busanga	778,000	1971
11 Kaputa	360,000	1971
12 Luano	893,000	1971
13 Lukwakwa	254,000	1971
14 Lumimba	450,000	1971
15 Lunga-Luswishi	1,334,000	1971
16 Lupande	484,000	1971
17 Luwingu	109,000	1971
18 Machiya-Fungulwe	153,000	1971
19 Mansa	207,000	1971
20 Mazabuka	25,400	1971
21 Mulobezi	342,000	1971
22 Mumbwa	337,000	1971
23 Munyamadzi	330,000	1971
24 Musalangu	1,735,000	1971
25 Musele-Matebo	370,000	1971
26 Namwala	360,000	1971
27 Nkala	19,400	1971
28 Sandwe	153,000	1971
29 Sichifula	360,000	1971
30 Tondwa	54,000	1971
31 West Petauke	414,000	1971
32 West Zambezi	3,807,000	1971

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
National Parks		
33 Blue Lagoon	45,000	1973
34 Isangano	84,000	1972
35 Kafue	2,240,000	1951
36 Kasanka	39,000	1972
37 Lavushi Manda	150,000	1972
38 Liuwa Plain	366,000	1972
39 Lochinvar	41,000	1972
40 Lower Zambezi	414,000	1983
41 Luambe	25,400	1972
42 Lukusuzi	272,000	1972
43 Lusenga Plain	88,000	1972
44 Mosi-Oa-Tunya	6,600	1972
45 Mweru-Wantipa	313,400	1972
46 North Luangwa	463,600	1972
47 Nsumbu	202,000	1972
48 Nyika (Zambia)	8,000	1972
49 Sioma Ngwezi	527,600	1972
50 South Luangwa	905,000	1972
51 West Lunga	168,400	1972
Natural Monument		
52 Victoria Falls	1,900	1948
Ramsar Wetland Sites		
Bangwelu Swamps: Chikuni	250,000	1991
Kafue Flats: Lochinvar and Blue Lagoon	83,000	1991
World Heritage Site		
Victoria Falls/Mosi-oa-Tunya		1989

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Sanje	10,846	1964
Sasare	2,600	1974
Serenje	29,680	1952
Shamendi	58,500	1975
Shelangu East	12,980	1977
Shelungu West	11,450	1977
Shidondwe	5,665	1973
Shii	1,550	1973
Shikundu	1,774	1974
Shili Plantation	148	1973
Shokosa	3,859	1974
Shomkamba	840	1973
Siganeka	5,504	1968
Sijulu	2,770	1973
Sikabenga	2,800	1975
Sikaleta	12,348	1968
Simemba	946	1973
Simonga	6,070	1959
Simuhange	9,887	1973
Simuhange South	3,200	1973
Simwami Muzum	72,000	1980
Sinda	3,790	1969
Sisheke	145	1976
Sisheta and Lushi	550	1973
Sishimba	1,798	1974
Sitwa	5,363	1974
Sitwita	766	1973
Soli	4,972	1967
Solwezi	700	1989
Songe Welala	5,698	1968
Soyaela	532	1973
Sunzutu	2,000	1973
Suwe	4,175	1973
Watembo	8,670	1981
West Mvuvye	62,726	1960
Yande	1,390	1973
Yanga	4,000	1973
Yongwe	8,620	1957
Zambezi	91,700	1976

ZAMBIA - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 6.1)	Management area (ha)	Year notified
Ndola	2,910	1976
Ndola West	2,140	1976
Ndondi	5,144	1966
Nembwalushi	1,363	1973
Ngala	2,752	1945
Ngazhi	19,526	1961
Ngomangulu	2,542	1973
Ngonzi	639	1964
Ngoza	1,012	1966
Ngumbo	21,003	
Njiri	6,698	1964
Njovu	18,616	1968
Nkana North	770	1977
Nkhanga	2,590	1968
Nkhundwe West	106	1964
Nkolemfumu	54,228	1954
Nkomba	1,133	1958
Nkundwe East	121	1966
Nkunyi	8,357	1958
Nkwali	235	1973
Nonwa	237	1973
North Swaka	110,276	1954
Nsangwe North	809	1964
Nsangwe South	1,959	1964
Nsato	15,216	1957
Nsombo Plantation	232	1976
Nsumbazi	2,141	1964
Ntambi	7,250	1970
Nyakulenga	18,590	1978
Nyambau	40,286	1960
Nyungu	2,800	1973
Pamadzi	791	1964
Pambashi	3,458	1970
Pando Hills	8,750	1971
Pembela	10,540	1979
Roan	3,853	1964
Samatela	6,485	1973
Samfu	1,590	1966
Samfya	2,677	1952

ZIMBABWE

INTERNATIONALLY DESIGNATED PROTECTED AREAS

Mana Pools National Park and Safari Areas IUCN Categories II, VIII and X
This contiguous complex of over 1,200,000ha includes **Mana Pools National Park** (219,600ha), **Chewore** (339,000ha), **Sapi** (118,000ha) (these three comprising a World Heritage site, inscribed in 1984), **Dande** (52,300ha), **Doma** (94,500ha) and **Charara** (169,400ha) **safari areas**. Most border the lower Zambezi River and include large areas of the rugged Zambezi escarpment, rising 1000m from the valley floor. Much of Chewore is deeply dissected with the 30km-long Mupata Gorge on the northern boundary. Grassy communities dominate the escarpment and higher Chewore areas and the valley floor is dominated by mopane woodland or dry highly deciduous thickets. The fauna is rich and varied and concentrates on the flood plains during the dry season when water is scarce. The area supports at least six threatened large animal species and an avifauna of 380 species. Natural seasonal flooding is seriously affected by the Kariba Dam. These areas are further threatened by a proposed hydroelectric scheme at Mupata Gorge which would flood 85,000ha over much of the Zambezi flood plain and halve the carrying capacity of Mana Pools. Poaching, especially of fish, and habitat destruction by elephants also occur. A main road passes through the area with associated settlements and there is a private estate. As of 1989 the site is threatened by proposed oil exploration making roads which lead to erosion and increase access for poachers. Rhinoceros poaching has decreased through an internationally financed anti-poaching effort (Buitron, 1989; IUCN/UNEP, 1987).

Victoria Falls National Park IUCN Categories II and X
17°56'S, 25°55'E This park of 2000ha is contiguous to **Zambezi National Park** (56,300ha) and to the **Matetsi-Kazuma Pan-Hwange** (Wankie) complex, forming an area of over 1,846,700ha in Zimbabwe. It is also contiguous to **Mosi-Oa-Tunya National Park** in Zambia, these both being part of a World Heritage site inscribed in 1989. The park includes the left bank of the Zambezi River above Victoria Falls, part of the falls themselves, and a series of deep gorges below the falls. Mopane *Colophospermum mopane* forest predominates with a narrow band of riverine forest; the forest within the waterfall splash zone is of particular interest. A variety of mammals visits the river. Victoria Falls also forms a geographical barrier between the distinct fish faunas of the upper and middle Zambezi River. The adjacent town of Victoria Falls and intense visitor pressure have caused drainage and erosion problems, now successfully rehabilitated at considerable cost. The road, railway and low-flying aircraft cause some adverse auditory and visual impacts. The waterfall-spray rain forest is vulnerable to disturbance by trampling which allows infestation by weed species (IUCN/UNEP, 1987).

NATIONALLY PROTECTED AREAS

Bangala Recreation Park IUCN Category V
Established in 1975; 2700ha

Boulton Atlantica Sanctuary IUCN Category IV
57ha

Bunga Forest Botanical Reserve IUCN Category IV
Established in 1975; 40ha

Chibwatata Hot Springs Recreation Park IUCN Category V
10ha

Chimanimani Eland Sanctuary IUCN Category IV
The mountainous terrain of this 1800ha sanctuary includes the Bridalveil Falls. The area has undifferentiated Afromontane vegetation with a diverse canopy flora. There is a relict eland population; wild eland have long been present in the area's forests, being the only species of large antelope to adapt to the artificial environment of pine plantations. The sanctuary also has waterbuck and zebra (IUCN/UNEP, 1987).

Chimanimani National Park IUCN Category II
19°50'S, 33°00'E The park includes 17,100ha of the Chimanimani Mountains, an area of rugged grandeur with peaks of over 2400m, waterfalls and deep gorges. It is an important catchment area. Vegetation is predominantly montane, including open grassland and relict forest patches, and the flora includes elements of south-western Cape flora. There is also some low altitude rain forest, uncommon in Zimbabwe. The park supports many antelope species and the occasional leopard; the avifauna is unique in Zimbabwe. A major problem is the frequency of fires spreading from outside the park which threatens relict forest patches in particular (IUCN/UNEP, 1987).

Chinhoyi Caves Recreation Park IUCN Category V
17°22'S, 30°11'E This is centred on the unique Sinoia (Chinhoyi) caves, containing a 90m deep pool of clear blue water, illuminated through a hole in the ceiling of the cave.

Chizarira National Park IUCN Category II
Most of this 191,000ha park is an undulating dissected plateau above a 500m-high escarpment through which rivers have cut deep gorges. It is an area of high rainfall and perennial springs, and an important catchment area, being much wetter than the fairly arid Zambezi valley. Vegetation has affinities with the wetter eastern parts of Zimbabwe and is dominated by miombo woodland with areas of open grassland. The park supports a wide variety of large mammals including at least four threatened species. Black rhinoceros, roan and tsessebe conservation is emphasised. Frequent fires and the rapidly increasing elephant population have severely depleted the woodland and encouraged grassland; elephants have had to be culled. It is separated from **Chirisa Safari Area** by a narrow unprotected corridor; there is a threat of poaching as, apart from the safari area, the park is almost surrounded by inhabited land. However, rhinoceros poaching has decreased through an internationally financed anti-poaching effort (Buitron, 1989; IUCN/UNEP, 1987).

Chisekera Hot Springs Botanical Reserve IUCN Category IV
95ha

Gonarezhou National Park IUCN Category II
The park covers 505,300ha of flat to undulating country crossed by several river valleys. Chipinda Pools cover nearly half the park area and attract large numbers of migrating game and it also includes Gorheve Pans which fill with water during the rainy season. The diverse vegetation includes *Brachystegia* woodland, dry evergreen forest and relict riverine forest. Gonarezhou is the only location in Zimbabwe for two aloes and a number of species with a coastal distribution. The reserve is part of a migration triangle for game from Kruger National Park in South Africa and Mozambique. The fauna includes threatened species such as elephant and reintroduced black rhinoceros *Diceros bicornis*, and the park supports a variety of antelopes. The park is mainly bordered by subsistence agriculture; poaching, particularly from Mozambique, is a constant threat. A combination of burning and bush clearance associated with past tsetse control, wildfire and the presence of numerous large herbivores especially elephant (who have been excluded from their former range) has seriously depleted some vegetation types. The flow and quality of the Lundi and Sabi rivers have been reduced by impoundment upstream. **Manjinji Pan** previously supported a rich avifauna with water being pumped into the pan but this scheme has been abandoned and the pan is silting up (IUCN/UNEP, 1987).

Great Zimbabwe National Monument IUCN Category III
This area of 746ha is in a rugged kopje-strewn valley with bushveld including *Senecio* spp. and *Albizia adianthifolia*. It is protected primarily because of its archaeological and cultural value but also supports a varied fauna, including many antelope, leopard and a rich avifauna (IUCN/UNEP, 1987).

Haroni Forest Botanical Reserve IUCN Category IV
20ha

Hwange (Wankie) National Park IUCN Category II
This covers 1,465,100ha and is contiguous to **Deka Safari Area**, **Matetsi Safari Area**, and **Kazuma Pan National Park** (31,300ha). Kalahari sand covers much of the park with seasonal pools or pans with high salt content. It is located at the transition between dry western deserts and moist savanna woodlands in the north giving way in the south to the Kalahari sandveld. Hwange supports 35 large mammal species recorded and 400 bird species which represent the variety of biotopes present. Black rhinoceros and white rhinoceros have been successfully reintroduced and there are strong populations of elephant. Past human activity including ranching and burning has altered habitats. The park is now isolated from the Gwai River, where animals used to congregate in the dry season, by settlement. Excess elephant were culled until 1986 but this stopped because of the controversy and had no effect because of elephant influxes from Botswana. Adjacent areas to the south are farmed (Booth, 1990; IUCN/UNEP, 1987).

Kariba Recreation Park IUCN Category V
This covers 283,000ha (the Zimbabwean part of lake Kariba) and is contiguous to **Matusadona National Park**. Kariba was formed by damming of the Zambezi River in 1958 and covers 518,000ha. Extensive beds of torpedo grass *Panicum repens* provide valuable grazing for fish and ungulates. The lake attracts a wide variety of waterbirds and supports a range of fish, some introduced. Small-scale poaching occurs and there is a danger of pollution from rivers entering the lake (IUCN/UNEP, 1987).

Kavira Hot Springs Recreation Park IUCN Category V
50ha

Kazuma Pan National Park IUCN Category II
This park of 31,300ha is part of the **Hwange-Matetsi-Victoria Falls** complex and surrounded by **Matetsi Safari Area**. Flat grassland predominates with large seasonally inundated pans in the south-west. Open grassland in the east is fringed by mopane *Colophospermum mopane* and Kalahari woodland. It supports a variety of large mammal species but populations are generally sparse and seasonal. This is the only area in Zimbabwe where the western population of the southern African oribi occur. Game concentrates in the wetter western sector and the pans are important to waterfowl. The spread of fires is a problem (IUCN/UNEP, 1987).

Kyle Recreational Park IUCN Category V
The park covers 16,910ha, including 9105ha of the waters of this artificial lake, constructed to supply vast irrigation schemes in the low veld. Grassy plains predominate, interrupted by densely wooded ravines. Many mammals have been reintroduced, partly for game viewing tourism, including white rhinoceros, giraffe, and a variety of antelope species. Crocodiles and a variety of fish inhabit the lake (IUCN/UNEP, 1987).

Lake Robertson (Darwendale) Recreation Park IUCN Category V
11,200ha

Manjinji Pan Santuary IUCN Category IV
Established in 1975; 300ha

Manjirenji Recreation Park IUCN Category V
This 3400ha area encompasses Lake Manjireni, where boating, fishing and unspoilt scenery are attractions for visitors.

Matobo (Matopos) National Park IUCN Category II
Matobo National Park covers 42,500ha. Occupies the core of the Matobo Hills, a complex of granite kopjes with numerous caves which are an important catchment area for southern Matabeleland. The flora reflects the wide diversity of habitats and the area supports 88 large mammal species, with high densities of leopard and klipspringer. Over 300 bird species occur. A highway passes through the park and poaching and illegal cattle grazing occur (IUCN/UNEP, 1987).

Matusadona National Park IUCN Category II
Matusadona comprises an area of 140,700ha contiguous to **Kariba Recreational Park**. It includes an steep escarpment separated from the lakeshore by an strip of flat land. Well grassed *Brachystegia* communities dominate the mountainous two-thirds of the park. Elephant have modified the plant communities and eliminated many large trees. The park supports a number of black rhinoceros *Diceros bicornis*, leopard *Panthera pardus* and elephant, all threatened species, as well as a variety of antelopes (IUCN/UNEP, 1987).

Mayfair and Palawan Recreation Park IUCN Category V
150ha

Mazowe Botanical Reserve IUCN Category IV
43ha

Mbaze Pan Sanctuary IUCN Category IV
Established in 1975; 40ha

McIlwaine Recreational Park IUCN Category V
This park of 6100ha is located on a 14.5km long artificial lake. Its fairly uniform topography includes scattered granite kopjes. Vegetation is typical Mashonaland highveld with woodland and vlei grassland plus areas of Msasa veld, some in its natural state, which does not occur in other conservation areas in Zimbabwe. The area supports a variety of antelope and primate species, leopard and 250 bird species. Tourist pressure is very high and affects the natural value of the area. Control of water hyacinth in the lake is necessary and there have been problems with water pollution. Fish poaching is common (IUCN/UNEP, 1987).

Mosi-oa-Tunya - see **Victoria Falls National Monument**

Mufuli Recreation Park IUCN Category V
12,700ha

Mushandike Sanctuary IUCN Category IV
The sanctuary covers 12,900ha and includes **Mushandike Dam** (417ha) which is ringed by mountains. The area lies within the drier Zambezian miombo woodland vegetation zone, dominated by *Brachystegia* spp. and contains a variety of habitats. Mammals include white rhinoceros, leopard and a variety of antelope species (IUCN/UNEP, 1987).

Muzingwane Recreation Park IUCN Category V
Established in 1975; 1233ha

Mwari Raphia Palm Botanical Reserve IUCN Category IV
34ha

Ngezi Recreation Park IUCN Category V
18°30'S, 30°20'E Established in 1975, this 5800ha area includes the Ngezi Dam, which offers reasonable fishing. Game may be viewed on foot.

Nyamaneche Sanctuary IUCN Category IV
2480ha

Nyanga National Park IUCN Category II
This covers 33,000ha and comprises a large high-altitude plateau of volcanic rocks which is the source of several large rivers and includes a number of waterfalls. The vegetation appears to have strong affinities with the sclerophyll of southern Cape Province in South Africa and includes stunted *Brachystegia* woodland, high altitude heathlands and some exotic plantations. Nyanga is an important mountain sanctuary for wildlife in a region where exotic plantations dominate the landscape and supports a montane fauna unique in Zimbabwe. The feral exotic vegetation needs expensive long-term control. The disappearance of low altitude forest around the park is a threat to migratory species and the area would benefit from including the whole of Mount Inyangani. Several roads pass through Nyanga (IUCN/UNEP, 1987).

Pioneer Botanical Reserve IUCN Category IV
38ha

Rusitu Forest Botanical Reserve IUCN Category IV
150ha of low-altitude evergreen forest, near the confluence of the Rusitu and Haroni Rivers in south-eastern Zimbabwe, in the Ngorima Tribal Area, south of **Chimanimani National Park**. Trees include *Khaya nyasica*, *Uapaca kirkiana* and *Brachystegia* spp. Rare birds include Delegorgue's pigeon and chestnut-fronted helmet shrike. The forests are suffering from human encroachment (D. Butchart, pers. comm., 1991).

Sebakwe Acacia Karoo Botanical Reserve IUCN Category IV
60ha

Sebakwe Great Dyke Botanical Reserve IUCN Category IV
165ha

Sebakwe Mountain Acacia Botanical Reserve IUCN Category IV
53ha

Sebakwe Recreational Park IUCN Category V
This park of 2600ha includes the artificial Great Dyke reservoir (1518ha). It has spectacular cliff scenery and lies within the drier Zambezian Miombo woodland zone, dominated by *Brachystegia* spp. Flora within the botanical reserves includes *Acacia karroo* and mountain acacia *Brachystegia glaucescens*. The migratory game population includes sable antelope and several other antelope species, and the reservoir contains a number of fish (IUCN/UNEP, 1987).

South Camp Botanical Reserve IUCN Category IV
26ha

Tingwa Raphin Palm Botanical Reserve IUCN Category IV
16°40'-16°45'S, 30°55'-31°0'E At the northern end of the Great Dyke in northern Zimbabwe. It specifically protects the only populations of the palm *Raphia farinifera* in Zimbabwe, and also the possibly endemic shrub *Olinia vangueroides*. The palm is widespread in Africa. Threats include grazing by livestock, and fires (Frame, 1987).

Tolo River Botanical Reserve IUCN Category IV
44ha

Tshabalala Sanctuary IUCN Category IV
1100ha

Vumba Botanical Reserve IUCN Category IV
These are located in the Vumba Mountains (known as the 'mountains of mist') overlooking the plains of Mozambique, and include wooded granite hills. **Vumba Botanical Garden** (201ha) contains **Vumba Botanical Reserve** (42ha) and is contiguous to **Bunga Forest Botanical Reserve**. Thick montane evergreen forest and open scrub vegetation with aloes occur on steep rocky slopes. The botanic garden contains cycads, orchids and many trees and shrubs found nowhere else in Zimbabwe and its management policy is to emphasise indigenous highland flora. The reserves support a varied fauna including many birds and threatened species such as Swynnerton's forest robin *Swynnertonia swynnertoni*. Blue duiker and Samango monkey are encouraged within tolerable limits of their impact on the developed garden. The area is protected from fires (IUCN/UNEP, 1987).

Zambezi National Park IUCN Category II
The park of 56,300ha is contiguous to **Victoria Falls National Park** and the **Matetsi-Kazuma Pan-Hwange** (Wankie) complex, forming a total area of over 1,846,700ha, excluding forest reserves. It is also contiguous to **Mosi-Oa-Tunya National Park** in Zambia. The park is on the Zambezi River above Victoria Falls. The flora is dominated by *Baikiaea plurijuga* woodland, and the area supports a wide range of large mammals, including lion, elephant, sable antelope and buffalo, and over 400 bird species. The main highway from Victoria Falls to the Botswana border passes through the park. There is a relatively small fenced area close to Victoria Falls town, where land mines still occur (IUCN/UNEP, 1987).

OTHER MANAGED AREAS

Banti (protection) State Forest IUCN Category VIII
19°18'-19°20'S, 32°47'-32°49'E 2212ha; a protection forest of Mutare near the Mozambique border. The area consists of deep V-shaped valleys and narrow spurs, rising to the peak of Binga Mountain (1985m); rocks are mainly granite, with dolerite intrusions. The slopes are forested, with riverine forest in valleys. The vegetation is

classed as undifferentiated Afromontane forest, but this particular forest type, with high densities of yellow wood *Podocarpus latifolius*, is unprotected elsewhere in Zimbabwe. Threats include hand-clearing of vegetation, cultivation, stock grazing and tree felling by locals (Frame, 1987).

Cecil Kop Nature Reserve
This covers 1740ha of Cecil Kop hill which overlooks Mutare and includes a dam. Vegetation comprises natural mountain grassland, forest, open woodland and vlei. The area supports a variety of ungulates and elephant; two white rhinoceros have been introduced from Natal and numerous waterfowl use the dam. Poaching has now been stopped and fencing of the perimeter is under way (IUCN/UNEP, 1987).

Charara Safari Area IUCN Category VIII
The 169,400ha area includes broken country of the Zambezi valley escarpment and limited flat areas on the shores of Lake Kariba. *Brachystegia* communities dominate the upland slopes and mopane *Colophospermum mopane* woodlands, dry deciduous thickets and riparian communities occur by the lake. The fauna is similar to other Zambezi Valley conservation areas and includes threatened species such as elephant and leopard *Panthera pardus*. Game viewing is good but a tsetse control game fence running across the area is a significant disruption. Recreational hunting is allowed by permit but localised poaching also occurs. Poorly planned ribbon development on Lake Kariba's shore is a threat to the area's integrity and power lines from Kariba are a visual disfigurement (IUCN/UNEP, 1987).

Chegutu (Hartley A) Safari Area IUCN Category VIII
This covers 44,500ha and lies within the drier Zambezian miombo woodland zone dominated by *Brachystegia* spp. and *Julbernardia globiflora*. The area supports a variety of antelope species and warthog. Recreational hunting is allowed by permit (IUCN/UNEP, 1987).

Chesa State Forest IUCN Category VIII
14,250ha

Chete Safari Area IUCN Category VIII
This covers 108,100ha of broken country in the east with undulating areas in the west which is crossed by numerous seasonal watercourses. The artificial Lake Kariba has inundated the northern fringe and formed many bays. The varied vegetation includes scrub, mopane and open miombo woodland, with riverine vegetation along watercourses. A wide variety of mammals includes threatened species such as elephant, leopard *Panthera pardus*, black rhinoceros *Diceros bicornis* and Nile crocodile *Crocodylus niloticus*. Minor poaching from the south and east may increase as the human population of these areas increases. The numerous elephant cause extensive damage to lakeshore vegetation. Uncontrolled fires have been a problem (IUCN/UNEP, 1987).

Chewore Safari Area IUCN Category VIII
Established in 1964; 339,000ha

Chirinda State (Protection) Forest
20°25'S, 34°44'E On Mount Selinda in eastern Zimbabwe, 33km south of Chipinga in the southern Eastern Highlands. This is a significant area of 950ha. It is the type locality for many trees and for endemic Selinda mouse *Aethomys silindensis*. It is one of two known localities for forest green butterfly *Euryphera achylus*. Blue duiker and leopard occur. Threats include possible timber exploitation (Collar and Stuart, 1988; Frame, 1987).

Chipinge Safari Area IUCN Category VIII
The area covers 26,100ha and lies within the drier Zambezian miombo woodland zone. Mammals include threatened species such as elephant and leopard and a variety of antelope species (IUCN/UNEP, 1987).

Chirisa Safari Area IUCN Category VIII
This area of 171,300ha includes a 38,900ha research area. It is dominated by the Sengwa River valley and most rivers are deeply incised. The topography varies from rough scarps to gently undulating sandveld. Vegetation is locally diverse with open floodplain grassland, scrub and woodland although riverine communities have been greatly altered by elephant damage. The area supports a wide range of large animal species including about 9000 elephant, several other threatened mammals and a variety of antelope species; wildlife populations are generally expanding. Recreational hunting is permitted outside the research area and hunting rights leased to a safari hunting company. Poaching from surrounding areas is a problem but the area is otherwise remote. This safari area is separated from **Chizarira National Park** by a narrow unprotected corridor (IUCN/UNEP, 1987).

Chisengu (plantation) State Forest IUCN Category VIII
4006ha

Dande Safari Area IUCN Category VIII
Established in 1975; 52,300ha

Deka Safari Area IUCN Category VIII
Situated adjacent to **Hwange National Park** and **Matetsi Safari Area**, covering 51,000ha. It is well-managed, with populations of sable antelope, buffalo, zebra, elephant and lion (J. Culverwell pers. comm., 1993; Stuart *et al.*, 1990).

Diepfontein (plantation) State Forest IUCN Category VIII
814ha

Doma Safari Area IUCN Category VIII
Established in 1975; 94,500ha

Erin (plantation) State Forest IUCN Category VIII
10,700ha

Ewanrigg Botanical Garden
This area of 286ha includes a developed garden surrounded by undeveloped woodland and marsh. It is renowned for its collection of aloes, cycads, Barberton daisies, fuchsias, begonias and cacti and supports a diverse avifauna (IUCN/UNEP, 1987).

Fuller State Forest IUCN Category VIII
23,300ha

Gandangula Protected Forest IUCN Category VIII
19°02'S, 27°59'E Established in 1968, this 9920ha area consists of a strip of *Baikiaea* woodland on Kalahari sands lying south of and parallel to the Gwampa River, in Lupane Communal Land.

Glencoe (plantation) State Forest) IUCN Category VIII
2,050ha

Gungunyana State (Protection) Forest IUCN Category VIII
1,700ha

Gwaai State Forest IUCN Category VIII
144,230ha

Gwampa State Forest IUCN Category VIII
47,000ha

Harare Botanical Garden
67ha

Hurungwe Safari Area IUCN Category VIII
Established in 1975; 287,800ha

Imire Game Park
1,000ha

Inseze Extension State Forest IUCN Category VIII
8,400ha

Inseze State Forest IUCN Category VIII
35,200ha

Island 52 Safari Area IUCN Category VIII
4ha

Iwabe Game Park
20,000ha

Kavira State Forest IUCN Category VIII
28,200ha

Kazuma State Forest IUCN Category VIII
24,000ha

Lake Alice State Forest IUCN Category VIII
39,000ha

Lionhills (plantation) State Forest IUCN Category VIII
2747ha

Lukunguni River Protected Forest IUCN Category VIII
18°02'S, 26°05'E Established in 1966, this 5260ha reserve incorporates a strip of *Baikiaea* woodland on Kalahari sands; it is situated in Hwange Communal Land.

Mafungabusi State Forest IUCN Category VIII
82,100ha

Malipati Safari Area IUCN Category VIII
Established in 1975; 15,400ha

Martin (i)(protection)State Forest IUCN Category VIII
700ha

Martin (ii)(plantation) State Forest IUCN Category VIII
4300ha

Matetsi Safari Area IUCN Category VIII
Established in 1975; 295,500ha

Matetsi Safari Area IUCN Category VIII
The area of 292,000ha is contiguous to **Zambezi National Park** (56,400ha), **Kazuma Pan National Park** (31,300ha), **Hwange National Park** (1,465,100ha), **Victoria Falls National Park** (1900ha) and **Deka Safari Area**. It is the source of several rivers and is partly overlain with Kalahari sands with 30km of the Zambezi River on one side. Zambezian dry deciduous forest predominates with some mopane woodland, scrub communities and open grassland. The diverse fauna includes many large mammals similar to those in Zambezi National Park and the area is renowned for sable antelope. Roads to border posts cross the Safari Area and recreational hunting is permitted (IUCN/UNEP, 1987).

Mbembesi State Forest IUCN Category VIII
55,100ha

Mfurundzi Safari Area IUCN Category VIII
Established in 1976; 76,000ha

Molo State Forest IUCN Category VIII
2900ha

Mpindo Block Protected Forest IUCN Category VIII
Established in 1968; 14,880ha

Mtao (plantation) State Forest IUCN Category VIII
8170ha

Mudzongwe State Forest IUCN Category VIII
1420ha

Mvutu State Forest IUCN Category VIII
2100ha

Mzola State Forest IUCN Category VIII
67,200ha

Nesikwe Forest Protected Forest IUCN Category VIII
18°50'S, 28°51'E Established in 1968, this 3460ha area is a block of *Baikiaea* woodland on Kalahari sands between the Gweru and Shangani rivers.

Ngamo State Forest IUCN Category VIII
102,900ha

Nyamandlovu (Grants, Batley, Franklands) IUCN Category VIII
7505ha

Nyambewa (plantation) State Forest IUCN Category VIII
5484ha

Nyangui (plantation) State Forest IUCN Category VIII
16,600ha

Panda-Masuie State Forest IUCN Category VIII
35,500ha

Pumula Block Protected Forest IUCN Category VIII
Established in 1970; 24,850ha

Sapi Safari Area IUCN Category VIII
Established in 1975; 118,000ha

Sengwa Wildlife Research Area
This area of 37,300ha includes the Lutope River and its flood plain. Vegetation includes *Colophospermum mopane* woodland, *Brachystegia-Julbernardia* woodland, deciduous thickets, *Acacia* riverine communities and river terrace grassland. Mammals include impala, buffalo, lion and leopard (IUCN/UNEP, 1987).

Sibilobilo Islands Safari Area IUCN Category VIII
This covers 2270ha and comprises 12 islands which were formerly the crests of hills now isolated by the formation of Lake Kariba. Vegetation is that of the Zambezian mopane woodland vegetation zone. The fauna varies from island to island, representing populations isolated by the formation of the lake, including a substantial number of large mammals. Some populations which outgrew their island's carrying capacity have had to be controlled (IUCN/UNEP, 1987).

Sijarira State Forest IUCN Category VIII
25,600ha

Sikanda Protected Forest IUCN Category VIII
18°09'S, 26°02'E Established in 1968, this 2490ha area constitutes a block of *Baikiaea* woodland on Kalahari sand; situated in Hwange Communal Land adjoining the main Hwange-Victoria Falls road.

Sikumi State Forest IUCN Category VIII
54,400ha

Stapleford (Plantation) Forest Land IUCN Category VIII
24,600ha of montane rain forest, but the area is also considered important for the conservation of cycads (Frame, 1987).

Tandai (plantation) State Forest IUCN Category VIII
5450ha

Tarka (plantation) State Forest IUCN Category VIII
4343ha

Tuli Safari Area IUCN Category VIII
This covers 41,600ha of relatively flat countryside with the Shashi River valley in the east. The area lies within the Zambesian mopane woodland vegetation zone and is dominated by *Colophospermum mopane* woodland. Mammals include a variety of antelope species and elephant use the area seasonally. Some poaching and cattle trespassing occur. Legal hunting quotas are fully used but other visitor pressure is not heavy because of the area's remoteness. Sable antelope and roan antelope have

disappeared from the area within historical times, apparently as a result of habitat deterioration (IUCN/UNEP, 1987).

Umgusa State Forest IUCN Category VIII
32,200ha

Umzibani State Forest IUCN Category VIII
2471ha

Ungwe State Forest IUCN Category VIII
567ha

Umfurundzi Safari Area IUCN Category VIII
This area of 76,000ha supports a variety of mammals including several antelope species. Licensed hunting is permitted (IUCN/UNEP, 1987).

Vumba Botanical Garden
200ha

York (Protection) State Forest IUCN Category VIII
1455ha

UNPROTECTED SITES

Belingwe Peak
Well-established mountain Acacia *Brachystegia* spp. forest, 16km south of Mberengwa village in Mberengwa District. The forest covers some 200ha (Frame, 1987).

Binga Swamp Forest
17°48'S, 31°17'E, east of Harare. About 17ha of an unusual association of ground water forest in a granitic area, unprotected elsewhere in Zimbabwe. Trees include *Syzygium cordatum*, *Celtis africana*, *Rauvolfia caffra*, *Ilex mitis* and *Bequaertiodendrum magalismontanum*. On private land, belonging to the Chishawasha Mission, and of cultural importance as the grave site of Chief Chinamora. Threats include water loss from the swamp forest, and invasion by exotics (Frame, 1987).

Chirinda Botanical Reserve - see **Chirinda State Forest**

Dichwe Lemon
A fenced area of land on the properties of Richmond, Dichwe and Cotswold Estate A. Gazetted (Frame, 1987).

Gleneagles Estate
18°14'-18°23'S, 32°51'-32°58'E, near Nyanga in the Mutasa District. Abuts the eastern boundary of **Greater Nyanga National Park**, including much of Inyangani Mountain and Little Inyangani Peak. This is a rugged area of montane grassland with

forest relics in ravines, and closed vegetation on the eastern slopes. It has been purchased by National Parks for inclusion in **Greater Nyanga National Park** (Frame, 1987).

Greater Nyanga National Park Proposed

Mazoe A and B
North of Christon Bank, on the Mazoe River. 'A' covers 43ha and 'B' covers 3ha, preserving an example of highveld *Brachystegia-Julbernardia* catena. There is a well-developed riverine fringe on alluvial soils. Threats include firewood collecting and fires (Frame, 1987).

Mukuvisi Woodland
17°50'S, 31°05'E This is a natural area only 5km from the centre of Harare, covering 266ha. It consists of *Brachystegia juvenalia* woodland, with the Mukuvisi river flowing amongst granite boulders. There are records of 265 bird species, and game mammals that have been reintroduced include zebra, blue wildebeest, tsessebe and impala. About 115 species of woody trees and shrubs occur. A non-profit charitable institution runs the area, which has environmental education as its primary objective (Jackson, 1983).

Tarka Forest Land
Montane rain forest (Frame, 1987)

Umfindo Forest
19°10'S, 27°36'E Established in 1968, this 14,880ha area consists of a strip of *Baikiaea* woodland on Kalahari sands in Tsholotsho Communal Land.

Vimba and Mukurupini Forests - see **Rusitu Forest Botanical Reserve**

Vumba Highlands
19°07'S, 32°46'E Situated to the south of the town of Mutare in the Eastern Highlands, supporting numerous discontinuous relict closed evergreen forests, partly protected in **Bunga Forest Botanical Reserve** (495ha) and **Vumba Botanical Garden** (201ha). Rare birds occur, and annual grass fires are a threat (Collar and Stuart, 1988).

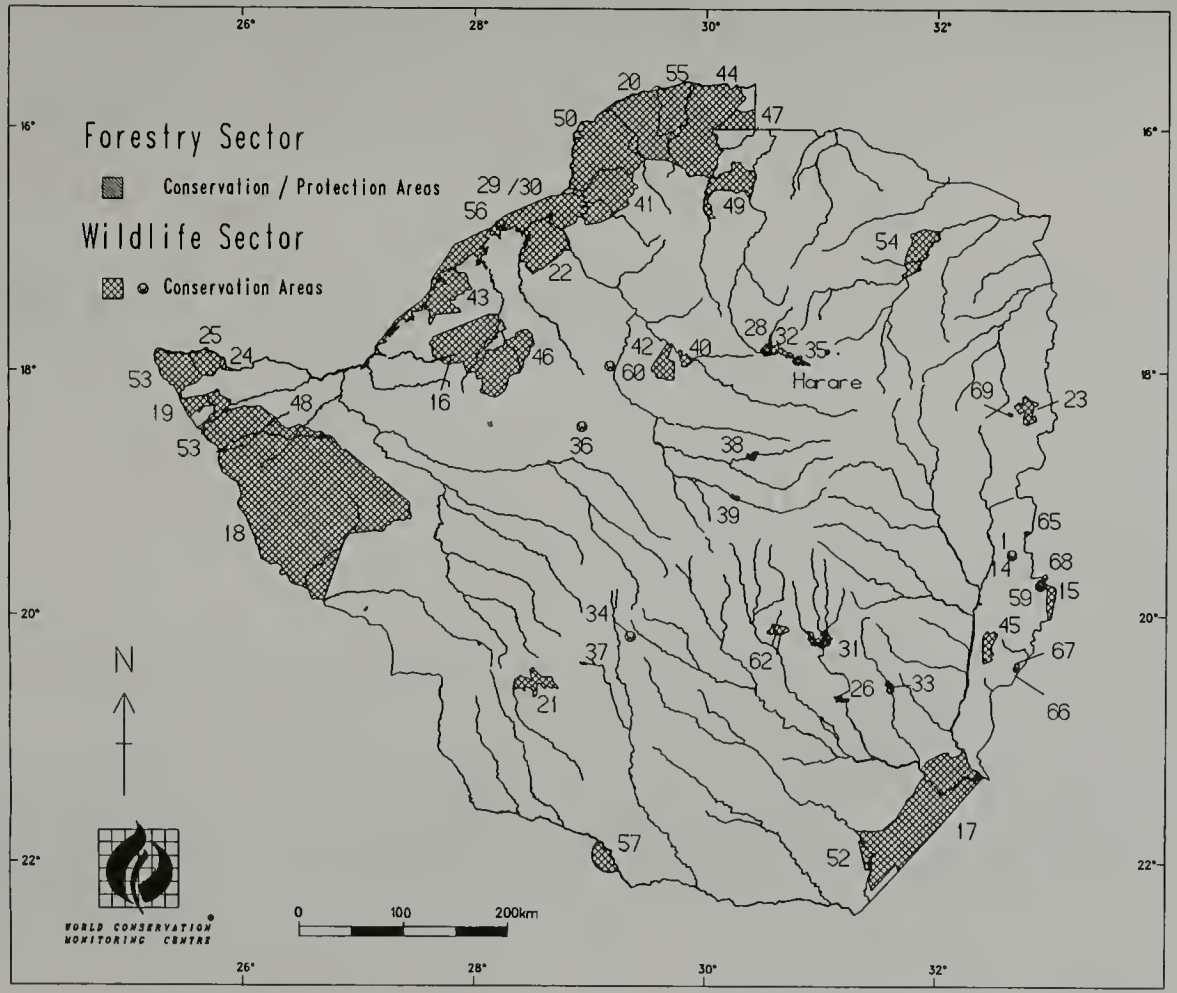
Wedza Mountain
18°41'-18°47'S, 31°32'-31°39'E 10km south-east of Wedza Township in Hwedza District. Highest peak is 1789m above sea-level. Well-developed *Brachystegia* woodland, covering 4000ha. There is pressure on timber resources from surrounding populations (Frame, 1987).

ZIMBABWE - PROTECTED SITES

National/international designations

Name of area and map reference (see Fig. 7.1)	Management area (ha)	Year notified
Botanical Reserves		
1 Bunga Forest	40	1975
2 Chisekera Hot Spings	95	
3 Haroni Forest	20	
4 Mazowe	43	
5 Mwari Raphia Palm	34	
6 Pioneer	38	
7 Rusitu Forest	150	
8 Sebakwe Acacia Karoo	60	
9 Sebakwe Great Dyke	165	
10 Sebakwe Mountain Acacia	53	
11 South Camp	26	
12 Tingwa Raphin Palm	290	
13 Tolo River	44	
14 Vumba	42	
National Monument		
Great Zimbabwe	746	
National Parks		
15 Chimanimani	17,100	1950
16 Chizarira	191,000	1975
17 Gonarezhou	505,300	1975
18 Hwange (Wankie)	1,465,100	1949
19 Kazuma Pan	31,300	1975
20 Mana Pools	219,600	1975
21 Matobo (Matopos)	42,500	1926
22 Matusadona	140,700	1975
23 Nyanga	33,000	1950
24 Victoria Falls	2,000	1952
25 Zambezi	56,300	1979
Recreation Parks		
26 Bangala	2,700	1975
27 Chibwatata Hot Springs	10	
28 Chinhoyi Caves	148	1975
29 Kariba	283,000	1979
30 Kavira Hot Springs	50	
31 Kyle	16,910	1975

Fig 7.1 Zimbabwe: protected ecologically sensitive sites



ZIMBABWE - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 7.1)	Management area (ha)	Year notified
32 Lake Robertson (Darwendale)	11,200	
33 Manjirenji	3,400	
34 Mayfair and Palawan	150	
35 McIlwaine	6,100	1975
36 Mufuli	12,700	
37 Muzingwane	1,233	1975
38 Ngezi	5,800	1975
39 Sebakwe	2,600	1975
40 Umfuli (Hartley A)		
Safari Areas		
41 Charara	169,400	1975
42 Chegutu (Hartley A)	44,500	1975
43 Chete	108,100	1975
44 Chewore	339,000	1964
45 Chipinge	26,100	1975
46 Chirisa	171,300	1975
47 Dande	52,300	1975
48 Deka	51,000	1975
49 Doma	94,500	1975
50 Hurungwe	287,800	1975
51 Island 52	4	
52 Malipati	15,400	1975
53 Matetsi	295,500	1975
54 Mfurundzi	76,000	1976
55 Sapi	118,000	1975
56 Sibilobilo Islands	2,270	1979
57 Tuli	41,600	1975
Sanctuaries		
58 Boulton Atlantica	57	
59 Chimanimani Eland	1,800	1975
60 Manjinji Pan	300	1975
61 Mbaze Pan	40	1975
62 Mushandike	12,900	1975
63 Nyamaneche	2,480	
64 Tshabalala	1,100	

ZIMBABWE - PROTECTED SITES (cont.)

National/international designations

Name of area and map reference (see Fig. 7.1)	**Management area (ha)**	**Year notified**
State Forests		
65 Banti	2,212	
66 Chirinda	950	
67 Gungunyana	1,700	
68 Martin (i)	700	
69 York	1,455	
World Heritage Sites		
Mana Pools National Park, Sapi and Chewore Safari Area	676,600	1989
Victoria Falls/Mosi-oa-Tunya		1989

ZIMBABWE - UNPROTECTED SITES

Name of area and map reference (see Fig. 7.2)	Management area (ha)
Proposed (National Park)	
Belingwe Peak	
1 Bingwa Swamp Forest	17
Dichwe Lemon	
2 Gleneagles Estate	
Greater Nyanga National Park	
Mazoe A and B	46
3 Mukuvisi Woodland	266
Tarka Forest Land	
4 Umfindo Forest	14,880
5 Vumba Highlands	
6 Wedza Mountain	4,000

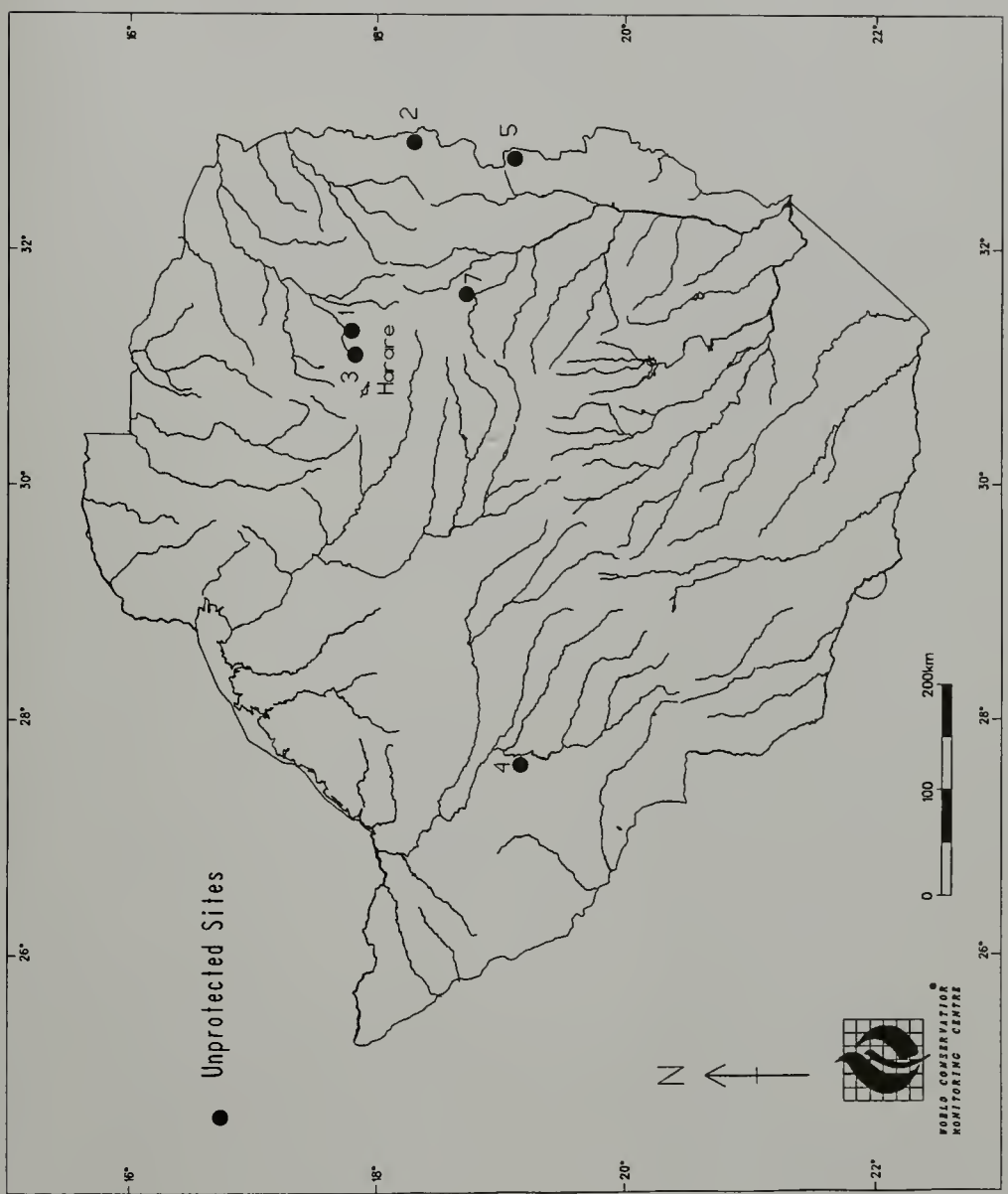


Fig 7.2 Zimbabwe: unprotected ecologically sensitive sites

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