



# MAB IN AFRICA

PROGRESS AND PROSPECTS  
FOR THE 21ST CENTURY

1997

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## **Progress and Prospects for the 21<sup>st</sup> Century**

UNESCO-Dakar  
Natural Science and Technology Unit/NST

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### What is Biodiversity?

*Biodiversity is defined by the Convention on Biological Diversity as 'the Variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species and ecosystems'. In other words, biodiversity is the variety of the world's organisms, including their genetic makeup and the communities they form.*

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## FOREWORD

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**T**he severity of deterioration of natural resources and environment in most African countries came into wider global focus between the sixties and seventies following the great sahelian drought. This degradation and depletion of natural resources resulted in the low agricultural productivity and increased poverty. These processes have since been aggravated by rapid population growth leading to encroachment into nature reserves and into fragile ecosystems, continuous drought, and lack of environmentally sound policies to combat the degradation problems.

The pressures on Africa's environment and natural resources are occurring in the context of inadequate economic growth. As economic growth resumes, the pressure on the natural resources and the environment may be even more severe than now. Growth is necessary in order to raise the standards of living of the populations of Africa, which are among the lowest in the world today. The challenge is to ensure that economic growth now, especially in the agricultural sector, does not jeopardize the prospects for growth in the future. This call for improved management of natural resources and environment, with environmental considerations becoming an integral part of economic and social policy.

The growing realisation of the enormity of degradation and depletion of natural resources and environment has led to increased attention being paid to environmental management since the late 1980s. Many African countries, particularly those south of the Sahara, have in collaboration with their international partners, initiated strategic framework exercises as a process for the programming and implementation of activities related to the environment and natural resources management. Examples include: National Plans to combat desertification (NPACD), National Conservation Strategies (NCS), Biosphere Reserves and Biosphere Reserves Action Plans, National Environmental Action Plans (NEAP), Tropical Forestry Action Plans (TFAP), and Natural Resources Assessments (NRA), etc.

However, the national institutions dealing with these complex initiatives are weak and under-funded. This has been highlighted in many African Fora on environment including: the First Regional Conference on Environment and Sustainable Development in Africa (Kampala, Uganda, 1989), the Pan African Ministerial Conference on Environmental and Sustainable Development (Bamako, Mali, January 1991), the OAU Heads of States Summit (Abuja, Nigeria, June 1991), the Second Ministerial Conference on Environment in Africa (Abidjan, Cote d'Ivoire, November 1991), and the UNESCO's meetings such as the: Seville Conference on Biosphere Reserves (Seville, Spain 20-25 March 1995) and Regional Conference for Forging Cooperation on Africa's Biosphere Reserves for Biodiversity Conservation and Sustainable Development (Dakar, Senegal, October 1996).

The inadequate means and capacity for African countries to deal with environmental problems have led the international community to go beyond discrete project assistance in natural resource rehabilitation, to support planning frameworks for natural resources management and environment. These international communities have gone to the extent of organizing workshops as fora for sharing experiences in the development and implementation of strategic frameworks and emerging conventions such as on: the Conservation of Biological Diversity; Combating Desertification in those Countries experiencing serious drought and/or desertification particularly in Africa and Framework Convention on Climate Change, for environment and natural resources management. It was during a workshop of this nature in Dakar, Senegal, organized by UNESCO in October 1996, where participants from 29

African Countries, several multilateral organizations and NGOs, recommended that a Network of Man and Biosphere (MAB) Programme of UNESCO for African Countries be formed as implementation mechanism for Africa of the "Seville Strategy" and "Statutory Framework" for Biosphere Reserves, and for the development of this strategic framework for sustainable development. The Network was named AFRIMAB. At the workshop the participants strongly supported the recommendation that an African-based follow-up committee be established to coordinate the initial follow-up activities of the Network. The goal of the AFRIMAB network as resolved by the Dakar meeting is: "To promote and reinforce cooperation among African countries in the area of biodiversity conservation and sustainable development - Particularly in Biosphere Reserves".

The Dakar conference recognized that natural resources and the Biosphere reserves are people's business, which implies that activities must be programmed around the people they aim to serve. Links must be created between natural resources and environmental well being and national conservation policies on the one hand, and needs, desires and opportunities at the community level on the other. Links must be established between policy makers researchers and the end users of research findings in order to create much needed partnership in decision-making. Gradually this will enable a dialogue, creating the possibility for behavioral change on the part of all concerned parties and on the part of resources users in terms of responsibility for and ecosystems maintenance. Effective communication between all parties should be fostered and should be the basis for listening and two-way dialogue, advocacy, social mobilization and participation.

The Dakar workshop recognized the need for proper capacities at all levels concerned with natural resources and biosphere reserves management as a prerequisite for both the change towards a people oriented and the holistic approach required. The workshop emphasized the need for awareness raising, training, more research and information exchange.

It is now time for Africa to make the political commitments made by governments following the United Nations Conference on Environment and Development (UNCED) (Rio de Janeiro, Brazil 1992) and by the member states of UNESCO as per 28 c/5 Resolution 2.4 of the UNESCO General Conference in November 1995 when the Seville Strategy and Action Plan for Biosphere Reserves were adopted, operational. To strengthen the recognition of the need for protecting the environment and its "life support systems" for the survival of its human resources and to develop capacities for the required wise use of resources at all levels. It is now time to make the environment for all a real regional priority.

**Pai OBANYA**  
Director  
UNESCO-Dakar

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## PREFACE

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**I**n 1996 UNESCO's Man and Biosphere (MAB) Programme celebrated the silver (25 years) Anniversary. The Programme launched by UNESCO in 1971, has a broad objective to contribute to the development of scientific knowledge necessary for the rational management of natural resources and to train personnel in this domaine.

The MAB programme has expanded over the years in response to global demands in terms of its activities and scope. Similarly MAB has contributed to the shaping of the global arena on environment from the first World Conference on Environment to Stockholm (1972) to United Nations Conference on Environment and Development (UNCED) named the "Earth Summit" (Rio de Janeiro 1992) and Earth Summit +5 (23-27 June 1997). UNESCO through MAB has contributed to the creation of several national, regional and international environmental agencies - governmental, intergovernmental as well as non-governmental.

The scientific knowledge generated by MAB programme is contained in volumes of publications found world-wide. There is however little information on historical development of this important programme in Africa.

This report written primarily for the MAB "family" in Africa attempts to provide the "bird-eye view" of Africa's efforts and contributions to the development of MAB programme, since 1971 and to give a genuine impetus to continued development of MAB in Africa as an instrument for Africa's new commitment to environment and development into the 21st Century.

The environmental problems that face Africa and mankind, are so numerous and so complex that it is easy to take the position that all we can or should do is work at such clearly researchable components as fall within our individual competence. Yet the larger questions will go forever unresolved if we decline to attack them merely because they appear hazy and unanswerable in our life-times. We must keep them under constant pressure so that they will yield the more readily to better-informed minds and more-advanced means in the future. It is this spirit that we approached this task.

Environment, development, population, resources and land degradation are the central interlocking variables whose unsatisfactory management threatens our options. Views about this threat tend to be pessimistic or optimistic depending on the extent to which they focus on the magnitude of environmental complexity of the problems. Looking at Africa, clearly the problems of land degradation cited in this report will be ameliorated only by realistic formulation and action. The adequacy and the quality of resources, both in the near future and in the decades and generations ahead, are confining forces of major and increasing magnitude and many of the variables that affect them are inadequately understood. Unremitting, imaginative, determined and large-scale effort will be necessary to deal with the problems posed by these confining forces and our still inadequate understanding of them.

Plans that are flexible and of long range and scope are needed to assure the sufficiency and integrity of the environment. They must be based on informed foresight, designed to preserve a variety of choices for the future. Hence the challenge for MAB in Africa.

This report covers a period (1971-1997) when Africa could be said to be faced with one of the greatest environmental and economic development calamities of the century. It is a period mired by droughts, desertification, hunger, inter-ethnic wars, refugees, diseases, etc. The awareness of these issues appear significant in Africa; and in spite of the difficulties the continent is going through, some efforts are being

made to meet some of these challenges particularly under the UNESCO's Man and Biosphere Programme.

Chapter 1 of this report presents an overview of environmental problems that are facing the continent and the global efforts to halt land and Environmental degradation. Chapter 2 cover in detail the evolution of MAB programme, the original objectives as outlined in the first Intergovernmental coordinating Council (ICC) of MAB. The chapter include the MAB role in global concerns about the environment and its vital contribution to establishing various agencies dealing with the environment. The innovative *in situ* conservation programme promoted by UNESCO - the Biosphere Reserves, and their development is highlighted particularly focusing on the two world meetings that have shaped the development of the Biosphere Reserves concept: the First International Biosphere Reserve Congress held in Minsk, Belarus in 1983; and the International Conference on Biosphere Reserves held in Seville, Spain in 1995.

Chapter 3 constitute the key chapter of the report as it highlights the achievements, challenges and problems of MAB programme in Africa. It has not been possible to cite all case examples but efforts have been made to highlight few major projects. The Chapter presents the state of knowledge on Africa's biosphere reserves, and major activities that are on-going in desertification control and on combating land degradation. The Dakar Conference on Africa's Biosphere Reserves and Biodiversity Conservation held in October 1996 is presented as the framework for future MAB action and cooperation in Africa.

Chapter 4 dwells on the whole future prospects for the conservation of biological diversity for sustainable development. Of particular focus are the use of traditionally managed ecosystems (eg. Sacred Groves) approach for sustained biodiversity conservation and the need for improved information technologies for MAB-Africa Programmes. In conclusion the report highlight the modalities for cooperation and external assistance for MAB activities in Africa. It is hoped that this collaboration will continue with UNESCO's external partners for continued MAB development in Africa.

I would like to thank Dr. Sandy BOCKARIE of University of Sierra Leone for his immense contribution to the compilation of this Report, and those who took the time to provide extensive comments on earlier drafts.

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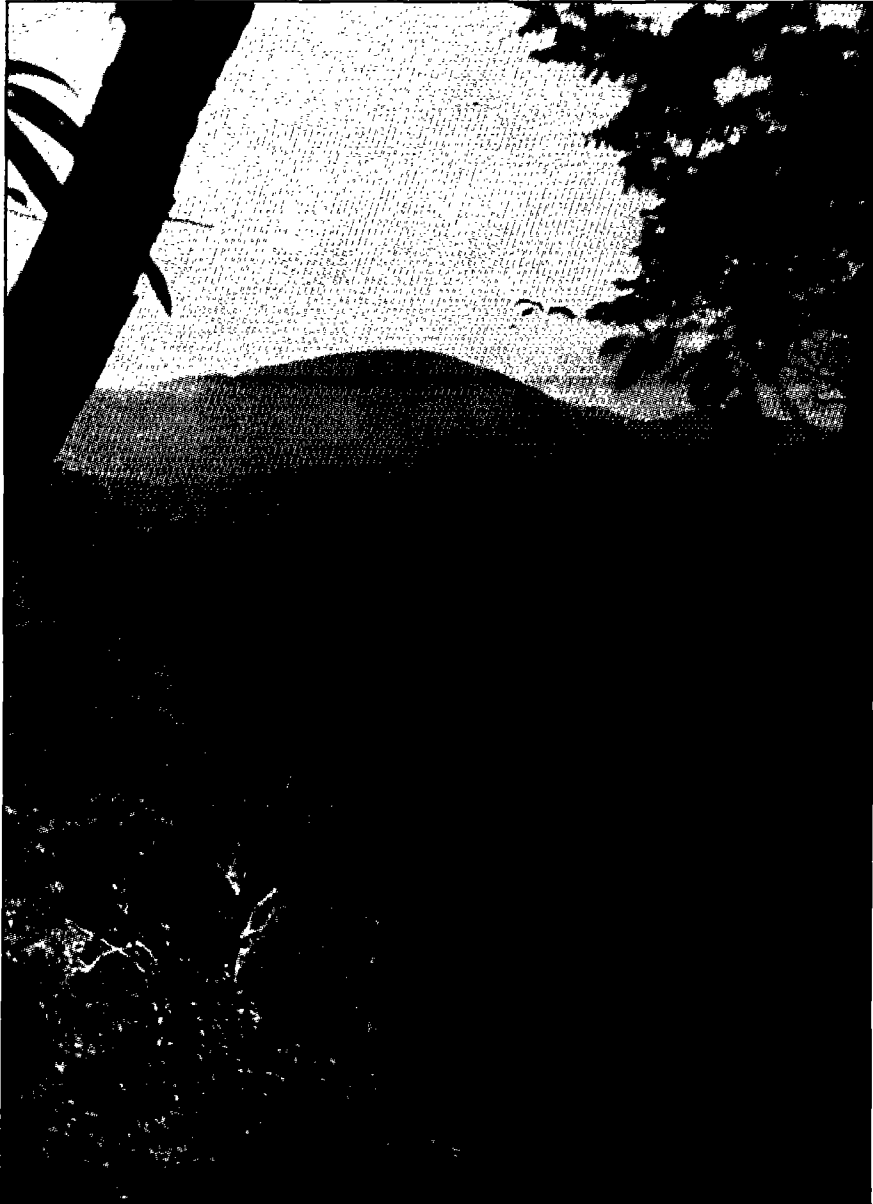
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# CONTENTS

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<i>Chapter</i>	<i>Page</i>
<b>I. INTRODUCTION .....</b>	<b>11</b>
- Forms of Land and Environmental Degradation .....	11
- Measures to halt land and Environmental Degradation .....	18
<b>2. UNESCO'S MAN AND THE BIOSPHERE (MAB) PROGRAMME .....</b>	<b>21</b>
- Antecedents and Origins of MAB .....	21
- The MAB Programme .....	22
- Evolution of MAB .....	24
<b>3. MAB IN AFRICA: ACHIEVEMENTS/CHALLENGES/PROBLEMS .....</b>	<b>29</b>
- Biosphere Reserves .....	30
- The Dakar Conference on Africa's Biosphere Reserves and Biodiversity Conservation .....	32
- The M'passa Biosphere Reserve of Gabon: An Example of Forest Zone Biosphere Reserve .....	37
- Border Areas and Sacred Land .....	38
- Effects of the Biosphere Reserve Concept .....	39
- Biosphere Reserves environment after effects of war .....	40
- Integrated Projects .....	40
- RCS-Sahel: An Example of an Integrated Transborder Project .....	43
- Key Concepts in the MAB Programme in Africa .....	47
- MAB's Contribution to the Desertification Control Programme for the Sahel and Southern Africa .....	51
<b>4. INNOVATIONS AND FUTURE PROSPECTS .....</b>	<b>53</b>
- Sacred Groves: Tradition turned Innovation .....	53
- Cooperative Integrated Project on Savanna Ecosystems in Ghana (CIPSEG): An example of a tradition turned Innovation .....	56
- Conservation of Biological Diversity .....	57
- Combating Desertification .....	59
- People and the MAB Programme .....	60
- Gender and the environment: the role MAB .....	62
- Information Technologies in the MAB Programme .....	62
- Benchmarks and indicators .....	63
<b>5. MODALITIES OF EXTERNAL ASSISTANCE .....</b>	<b>65</b>
- State of Cooperation in the MAB Programme in Africa .....	65
- Objectives of the African Network of Biosphere Reserves (AFRIMAB) .....	66
- Intra-African Regional Cooperation .....	67
- International Cooperation .....	68
- Funding of the MAB Programme in Africa .....	69
<b>6. CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>72</b>





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## **INTRODUCTION**

1. Since independence in the sixties African countries have joined the other nations of the world in their awareness of environmental and ecological degradation and in the global demand to bring this phenomenon to a halt. In spite of this demand the environment has continued to be persistently abused in many parts of the continent. Most parts of Africa have suffered from severe forms of land and environmental degradation resulting from desertification, deforestation, soil erosion, depletion of marine resources, and extinction of flora and fauna, all of which are urgently required for sustainable development. The process of environmental degradation is often not so obvious because it is usually gradual and unnoticeable. It is however a serious mistake to ignore it because we see and accept areas of unused land as an inexhaustible reserve. Considering the rate and forms of land and environmental degradation it should be widely known that these reserves will not last. Consequently, conservation, the wise-use of natural resources to provide highest quality of living for mankind has become a household word in natural science circles. Conservation of the environment (the preservation of the sum total of biological, physical and chemical entities which constitute man's surrounding) has concerned the world of science and technology in recent years because the rate of natural resources degradation is appearing to be dictating the pace of human development. Conservation of renewable natural resources like forest reserves, soil quality and marine resources has become central because a lot can be done to exploit these resources and simultaneously make provision for their renewal contrary to what is happening to the non-renewable resources like petroleum, coal, diamonds and bauxite.

2. The essence of renewable resources conservation is to balance the rates of their use (through management) against those of their formation in

order to maintain stability and assure sustained yield. The rate and type of use of natural resources are dictated by the demands of society while ecosystem features mainly set the limits to which the process of renewal can be manipulated. Conservation is thus constrained by two sets of factors; socio-economic and ecological and the meaning given to conservation will depend on which of these two factors are emphasized. When the demands of society are emphasized conservation will mean rationalising use of resources among competing demands including demands of the present and future generations. When maintainance of ecosystem stability is stressed conservation takes the meaning of preservation of resources in their natural state.

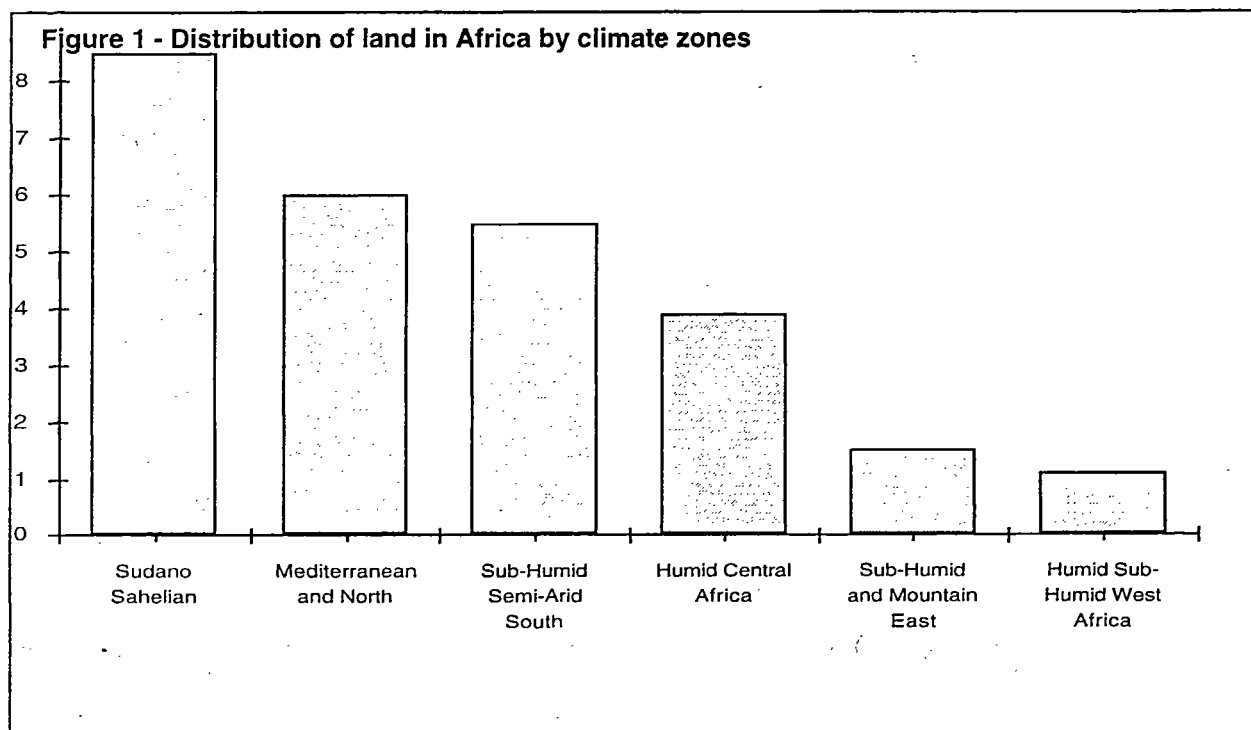
This report is on UNESCO's Man and the Biosphere (MAB) programme in Africa from the time of MAB's inception to date which judiciously combines the two kinds of conservation by recognizing as its primary responsibility the provision of human needs while ensuring environmental stability as well as sustained satisfaction of those needs.

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### **Forms of Land and Environmental Degradation**

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3. The forms of natural resources and environmental degradation on the African continent are many but the commonest and most destructive are soil erosion, effects of mountains and highlands, desertification, human activities, deforestation, coastal, small island and marine resources depletion, and shortage of water (drought). The ways in which these forms of natural resources and environmental degradation affects the landscape and environment are described below. The distribution of the African land area by climatic zones is as shown in Figure 1.



4. *Soil erosion:* There is virtually no inhabited area of Africa that is not prone to soil degradation of one sort or another. Africa's soil resources are mostly fragile and sensitive to unwise use. Soil erosion affects more than 75 % of cultivable land in Africa. Some areas of Africa's soils are already in advanced states of degradation (e.g. gully and sheet erosion) in nearly every country. As a result, soil fertility is declining in cultivated areas and the natural vegetation is severely disturbed. Except in humid forest areas, wind erosion and desertification are also taking their toll.

**BOX 1**

*The driving force behind much environmental policy in Africa is a set of powerful, widely perceived images of environmental change. They include overgrazing and the "desertification" of drylands, the widespread existence of a "woodfuel crisis", the rapid and recent removal of once-pristine forests, soil erosion, and the mining of natural resources caused by rapidly growing populations.*

5. On most parts of Africa vulnerability to sheet erosion is closely related to slope and vegetation. On steep unprotected land water running down hill cuts multiple channels deep into the soil making cultivation of the fields difficult if not impossible. Soil crusting is one of Africa's most serious physical soil management problem. In severe cases it prevents seedlings from emerging through the soil surface and it

decreases the amount of water entering the soil and thereby increases run-off causing erosion.

6. Many of African's soils have poor nutrient retention capacity and hence are heavily leached. This is exacerbated by «Soil mining», the removal through cropping of many times more plant nutrients than are being returned to the soil by mineral or organic fertilisers, or by natural processes. Many African countries have already lost a significant quantity of their soils to this form of degradation. Figure 2 below illustrates the comparison of land

steepness and nutrient retention of different climatic zones of Africa.

Some areas of the continent are said to be losing over 50 tons of soils per hectare per year. Serious erosion areas in the continent can be found in Sierra

Leone, Liberia, Guinea, Ghana, Nigeria, Zaire, Central African Republic, Ethiopia, Senegal, Mauritania, Niger, the Sudan and Somalia.

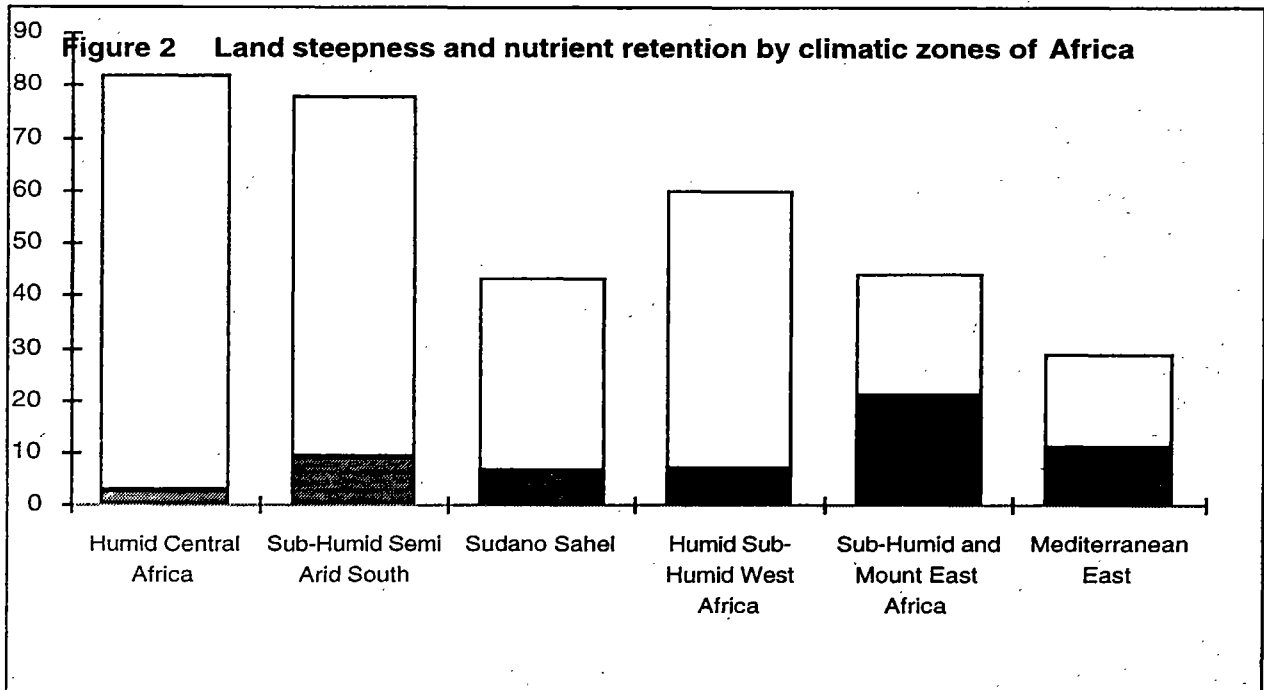
7. Soil degradation caused by deforestation is also a serious threat in Africa. Deforestation exposes the soil to high temperatures which breaks down the organic matter, increases evaporation and makes the

soil vulnerable to erosion. In Africa 337 million hectares of forests and woodlands are said to be disappearing per year (FAO, 1986), an indication of the amount of land exposed to soil erosion through this method. More serious still is the gradual removal of trees from farms and pastures, which are crucial for protecting productive land from the above forms of erosion.

8. In Africa, the manifestations of soil erosion include the creation of deep gullies; of crusts that water cannot penetrate, rock-hard layers; laterites that hand tools and roots cannot pierce and shifting sand dunes that swamp villages and fields. The United Nations Environmental Programme (UNEP) has estimated that more than a quarter of the African continent is at present in the process of becoming useless to cultivation due to land degradation as a result of soil erosion.

highland area is significantly eroded reducing yields by between 2% and 3% a year. According to FAO (1986) over 1900 million tons of soil are lost from the highlands annually. If this trend continues, some 38 000 km<sup>2</sup> of land area will be eroded to base rock by the year 2001 and a further 60,000 km<sup>2</sup> will have a soil depth of 10 cm below which the soil will be too shallow to support cropping. About 2 million hectares of farmland are already estimated to be beyond recovery in the highland areas of Africa.

11. *Desertification.* Of about 38 million square kilometers of world desertification 6.9 square kilometers (23%) are in sub-sahara Africa (Oldeman 1991). More than 20% of Africa is already covered by desert and another 60% suffers from a high risk of accelerated erosion if cultivated without appreciable conservation measures. One of the most widespread forms of desertification is sand encroachment, often accelerated by increasing human



9. *Mountains and highlands:* Mountain ecosystems and their interface are also fragile due to altitude, a factor which increases erosion as well as population pressure. In Africa, the mountains, highlands and their interfaces constitute preferential areas for human habitation. In countries like Madagascar and Ethiopia the proportion of inhabitants who live in areas above 1000 metres is between 50% and 60%. The population pressure aggravates the problem of erosion, deforestation and agricultural practices which show little concern for conservation.

10. In Ethiopia, about half of the country's

and animal pressure on marginal land.

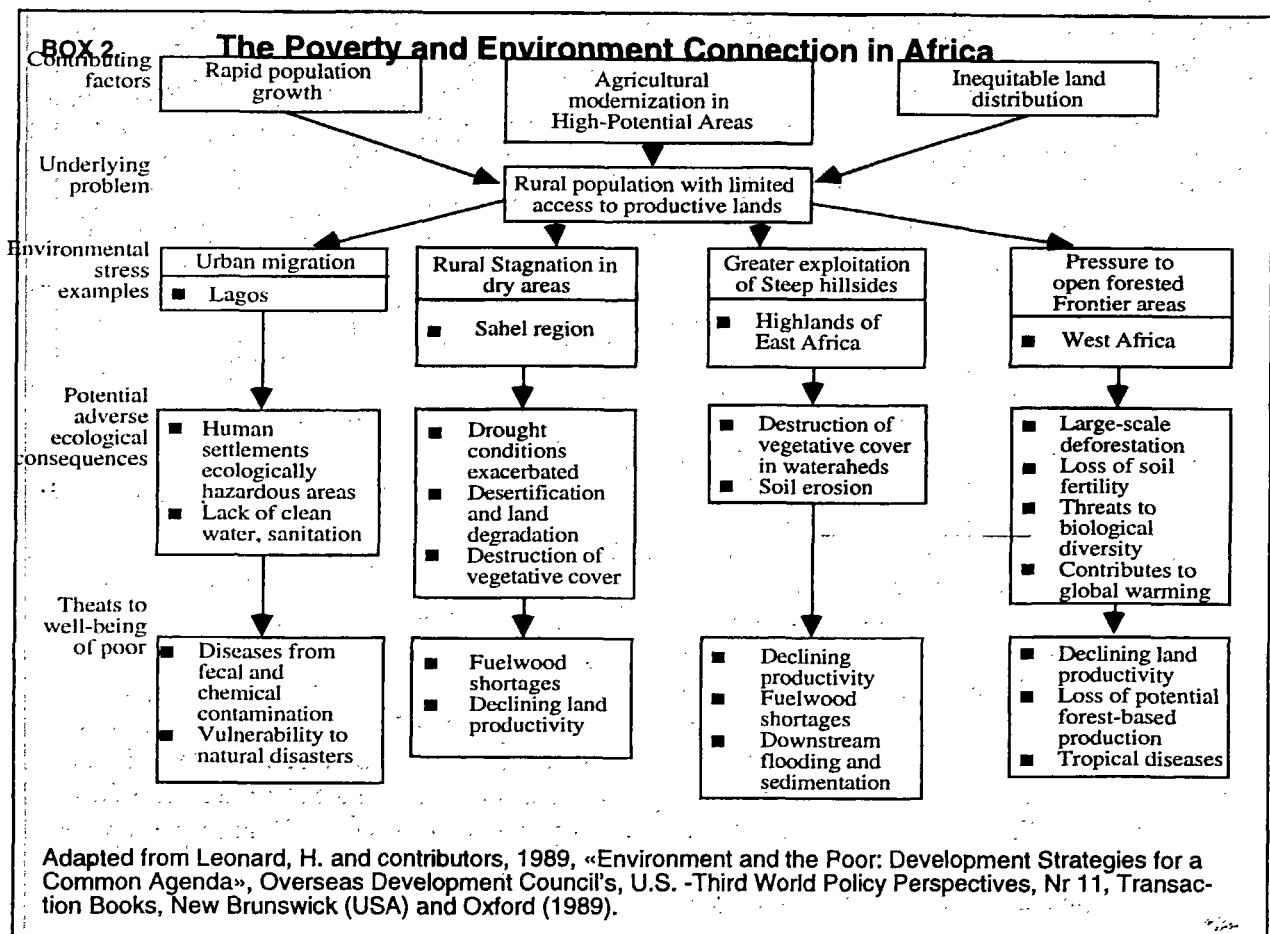
12. Desertification is a serious problem in the continent. It has been estimated that 319 million hectares of Africa are vulnerable to desertification hazards due to sand movement (FAO/UNEP 1992). An FAO/UNEP assessment of land degradation in Africa suggests that large areas of countries north of the equator suffer from serious desertification problems. For example, the Sahara desert is said to be moving at an annual rate of 5 km in the semi-arid areas of west Africa.

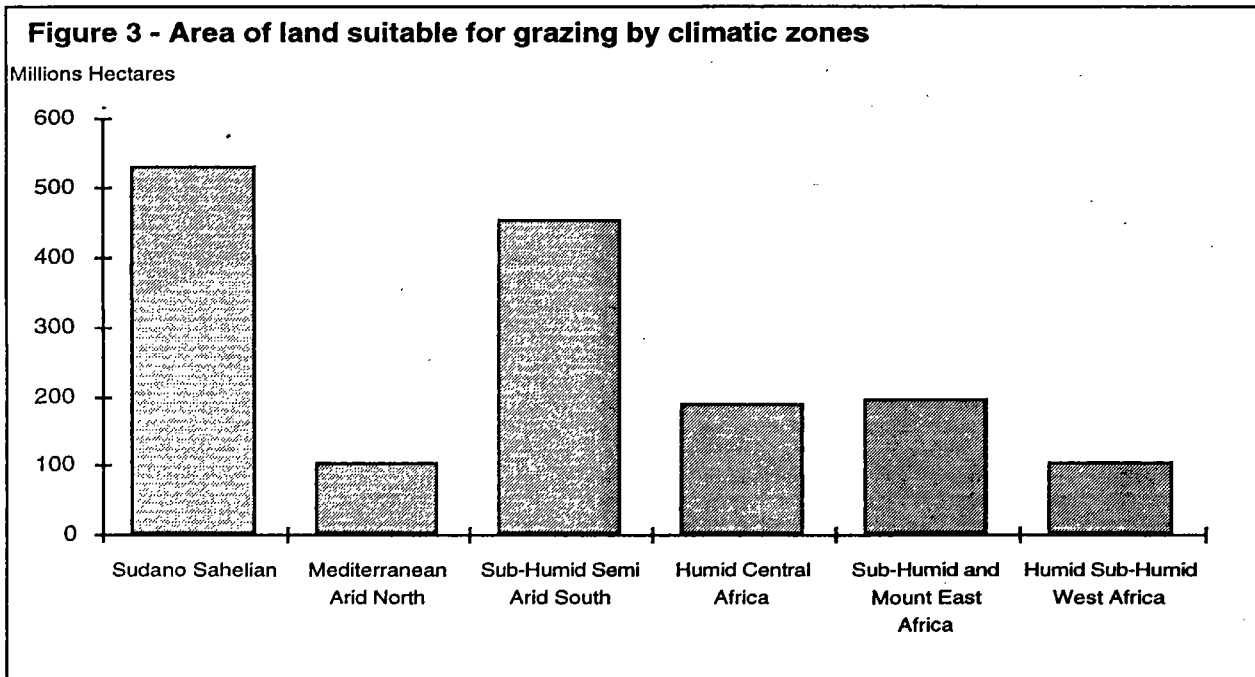
13. Desertification, of course, did not begin with the recent droughts. Archeological records suggest that Africa's arid areas have been getting progressively drier over the past 5000 years. What is new is the coincidence of the drought with the increasing pressure put on fragile arid and semi-arid lands by mounting numbers of people and livestock. This is basically what is accelerating land degradation by means of desertification throughout much of Africa. In the wetter areas there is a better chance that degradation can be halted and the land fertility restored.

14. *Human Activities:* In addition to degradation caused on the continent's geology and vegetation large parts of Africa have been occupied by human beings much longer than in other continents. Human activities in obtaining food, fibre, fuel and shelter have significantly degraded the continents land surface and ecosystems. Degradation in Africa is thus largely man-made and its pace is governed primarily by the speed at which population pressures mount. Causes of land surface degradation and ecosystem disturbance can be of two types-irregular natural events and man-made. Irregular events like droughts, flooding, land movements, etc, exacerbate the situation - but man-made degradation is the primary cause of land deterioration.

15. The rural poor, many of whom live in environmentally fragile areas, are both the main victims and the unwilling architects of land degradation. Nomadic herders in the Sahel region, increasingly impoverished as a result of drought and the expansion of arable agriculture, have been forced to graze their herds on the fragile grasslands. Similarly, staple food producers, working on marginal soils have little choice but to sacrifice the future for the present by clearing trees and mining soils in an unsustainable manner to provide a livelihood. They are often unable to invest in soil and water conservation. Fertile land on which their lasting food security depends is undermined by the accelerating environmental degradation. The tropical forests, vital to the maintenance of fragile ecosystems, are being cleared at the rate of 5 million hectares per year.

16. Nomadic herders, grazing animals on arid and semi-arid lands, are particularly vulnerable to drought, since this depletes their most precious asset: their livestock herds. In Northern and Eastern Kenya, the drought of 1992 decimated the livestock herds of pastoral communities, forcing herders to sell cheaply to local traders. At the same time shortages of cereals forced upwards prices of staple foods. This resulted in widespread malnutrition with an estimated 1 to 7





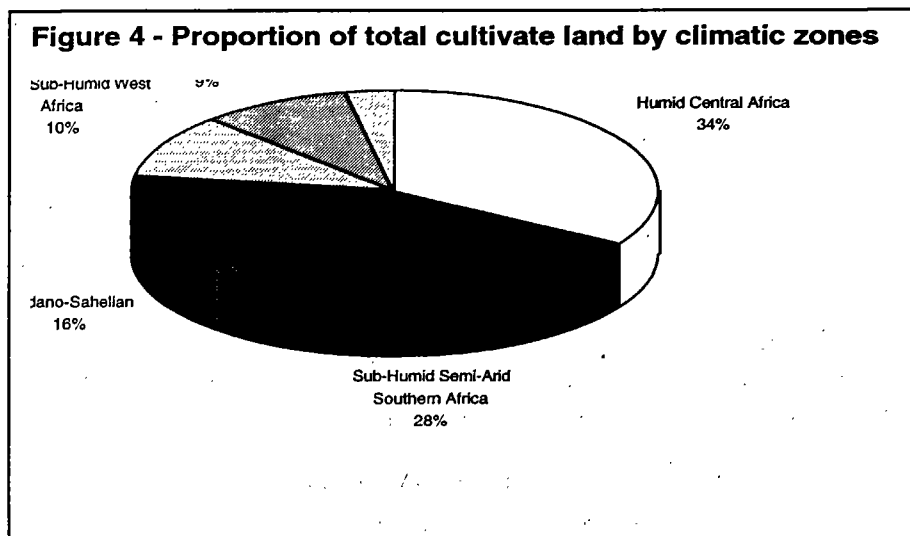
million people dependent on relief assistance. In Somalia the 1991 to 1992 drought forced the nomadic pastoralists of the central region to sell off their herds at a time of escalating food prices caused by ethnic and tribal armed conflicts and civil wars thereby exposing them to severe hunger.

17. The carrying capacity of range lands has already been exceeded in Sahelian and Southern African regions. If present livestock productivity levels were to continue unchanged, the projected populations in the year 2010 would require 84 % of the total area of Sahelian African, 99 % of East Africa, and more than the entire non-desert surface of North Africa - a clearly unacceptable situation.

The increase in the number of livestock is putting grazing land under intense pressure in many regions. Degradation of vegetative cover resulting from over-grazing is accelerating excessive foliation of pasture plants during their regenerative phase. The only effective technical solution to this problem is to control grazing pressure. Mismanagement of grazing causes damage which is not limited to the pasture since the increased erosion and run-off causes serious harm to arable land and infrastructure in the catchment. Pastures are also important as wild life habitat, as a source of useful medicinal

products and as *in-situ* reserve of genetic material.

18. In the drier parts of Africa millions of hectares of savana grazing and range lands are threatened with degradation - the arid north, the semi-arid south, the sahelian countries and in the drier parts of Cameroon, Ethiopia, Kenya and Nigeria. The range itself has been changed for worst with many of the perennial grass being replaced by nutritionally poorer annual grasses. This has permanently impaired the rangeland potential for recovery and decreased its carrying capacity. As the vegetation is removed the wind also winnows the small amount of silt that the soil contains thereby reducing its ability to retain moisture. This trend was reported for Botswana as far back as 1931 and it is an occurring phenomenon in most of the Southern Africa Development Community (SADC) Countries.



19. One of the causes of degradation is pressure due to increased population causing the farmers to cultivate increasingly marginal lands. In Malawi, for instance escarpment land that has a slope of more than 12% - and that should therefore be forested - is being cultivated, causing erosion, the flooding of fertile cropland below and the siltation of stream beds and irrigation canals. Siltation has been a major hazard in hydro-electric power plants such as the Tana River hydro-electric project in Kenya. Siltation has also caused several rivers and small dams to disappear leaving farmers and livestock without water.

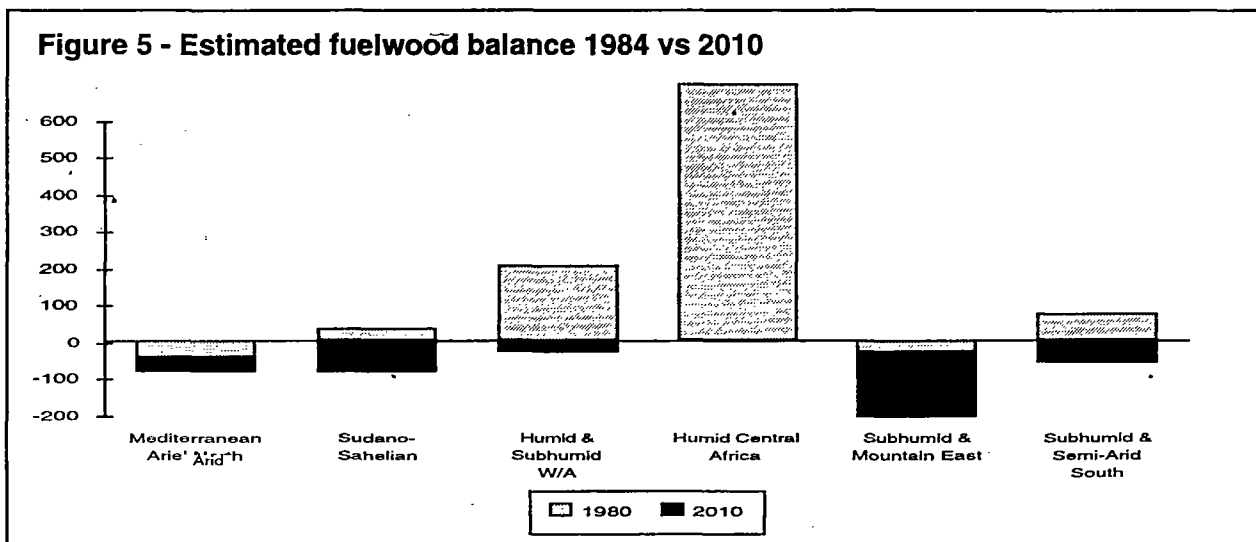
20. The belt of land running through the west African sahel region and the Sudan to North-East Ethiopia and Kenya is particularly vulnerable. Around 90 % of range land and 80 % of rain fed farm land in this area are affected by degradation and loss of woody vegetation which makes them less able to bear crop and pasture.

21. *Deforestation:* Africa loses an estimated 5 million hectares of tropical forest area a year (FAO, 1992). The cause of deforestation is mainly clearing for agriculture, but uncontrolled logging, gathering of fuel wood, fire and over grazing are also taking their toll. This loss of tree cover contributes to erosion by exposing soils to winds and rain. Sub-Saharan Africa's fuelwood consumption is running 30 % to 200 % ahead of the average increase in the stock of trees.

deforestation in Africa at 5 million hectares (largely in humid and semi-humid west Africa), an annual rate of 0.8% which compares favourably with Latin America (annual rate of deforestation of 0.9%) and Asia (1.2%). Spreading croplands, increasing demand for fuelwood and overgrazing of Sudanian savannas and woodlands and Sahelian steppes are the main causes of deforestation. Deforestation, like the steady depletion of trees in rural landscapes especially cropland and rangelands, is leading to loss of land fertility, reduced biodiversity and threats to sustained production of fodder, fuel and fibre. Woody vegetation is the primary source of fuel for most of Africa. Only in Liberia and Central African Republic is fuelwood still sufficient, elsewhere supplies are declining and there is either a deficit or a prospective deficit. The highest rates of forest destruction for fuelwood are in Cote d'Ivoire and Nigeria, whose annual losses are estimated around 300,000 hectares in each country. By 2010 the demand for fuelwood in Africa is estimated to double to over 900 millions cubic metres which demand can only be met in central Africa.

New forest plantations are insufficient to significantly improve the situation except in North Africa where about 100,000 hectares are created annually. In other African countries the ratio of forest planting to deforestation is as low as 1:30.

23. In Africa, trees play other important roles in protecting the environment. They provide countless medicinal and industrial products used in both the home and in small scale industry. They often supply



22. The state of Africa's forest resources is critical in many countries, although very large areas of the humid tropical forests of central Africa are still intact.

The preliminary figures of FAO's global forest resource assessment (FAO, 1990) put annual

food, are the main source of building material in the country-side, and directly or indirectly they are a source of employment for many rural Africans.

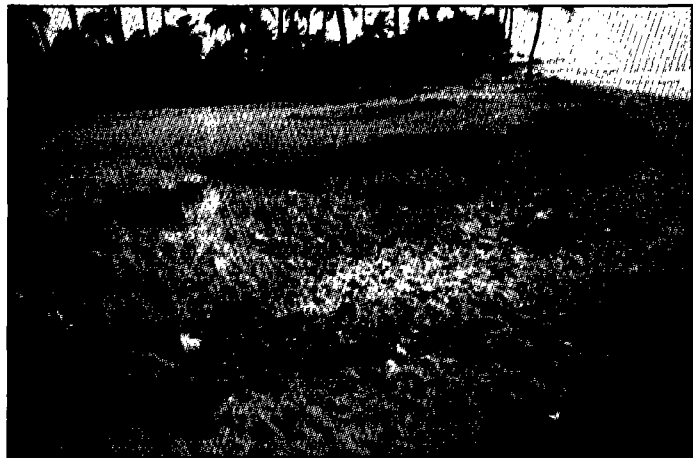
24. *Coastal Areas, small island and marine resources degradation.* Coastal and small islands

ecosystems in Africa consist of the delta areas and tributaries (the Niger delta, the Volta delta, etc.), the estuaries and lagoons (Saloum, Casamance, the ebie and Nokoue lagoons, etc.) and some archipelagos (the Bijagos Archipelago, the Los Islands) of the East and Indian Ocean which harbour highly valued biotopes. Majority of these ecosystems are characterised by systems of mangroves and coral reefs which are areas rich in biological resources and favourable for fishes. Ecosystems located in coastal regions and small island stretch from the West (Cape Verde to Congo) to the East (from Ethiopia to Madagascar and the island of Mauritius).

25. In countries of West Africa and parts of East Africa whose Urban growth is twice the national average due to high in migration and fertility rates coastal cities have doubled their size in less than two decades. This urbanisation, followed by industrialisation and environmental transformation along the sea coasts, is an emerging issue of global importance. Coastal areas are homes to more than 60% of the World's population. This concentration of human settlements, economic activities and resource mobilization in coastal areas is exceeding the capacity of natural systems in these areas to respond to and recover from development pressure. In other words, accompanying this explosive growth will be the heavy demands on water, public utilities, social services and remaining natural habitats along the coasts and unless steps are taken to manage this growth and increases in related activities, environmental degradation and exploitation of coastal and marine resources will eventually undermine productivity and intensify conflicts over the increasingly scarce resources of the coastal zones. The African coast is also exposed to pollution, soil erosion and other human as well as natural phenomena which alter the landscape and help to accelerate their degradation.

26. Africa's considerable fisheries resources which would make a greater contribution to the region's food supply and income has failed to do so primarily because of reduction in river and lake levels as well as over fishing. Coastal lagoons are often overfished and some are under environmental degradation resulting from the fishing activity. Most of the marine bottom fish resources are over fished or fully exploited including reef areas in East Africa. High valued species like shrimps, cuttle fish, squids and octopus are under high fishing pressure in West Africa. The Consequences of such heavy fishing are pressure on the genetic diversity and threats to adaptability of certain stocks.

27. The destruction of mangrove formations has been a severe blow to many coastal and riverine ecosystems and to the considerable populations dependent on these systems for their livelihood. Conservation of mangrove formations is a key element to coastal and river system productivity and is essential to maintaining the rich and diversified supply of fisheries product in coastal Africa. However, these mangroves are also exploited for fuel production.



Degraded Coastal area polluted and coastal erosion well advanced

28. *Shortage of surface water:* Shortage of surface water leading to drought is another natural effect that leads to environmental degradation. Africa has less surface water and higher rate of evaporation than Asia and Latin America. The flows of its rivers with the principal exception of the Zaire river, are markedly seasonal. Irrigation can make a dramatic impact in the drought prone Sahel but only a few of the major rivers flow through the region - notably the Senegal, Niger and Nile with the former two (Senegal and Niger) subject to particularly large seasonal variations. Most rivers would need substantial regulation if they were to supply irrigation water reliably throughout the dry season. These factors limit the potential for irrigation in Africa leaving a substantial land mass of the continent prone to drought. Only in the Mediterranean and North African region does actual irrigation exceed 50 % of the potential. For the regions south of the Sahara, the currently irrigated area is some 12 % of the potential.

29. There is however a possibility to expand the area of irrigated land in Africa to combat drought. Current estimates are that between 30 and 150 million hectares of African land are suitable for irrigation, 3 to more than 16 times the present irrigated area. In spite of this, irrigation is not being expanded as fast as in the past. Between the high rainfall tropical zone of Central Africa and the arid zones of the North and South lie very large sub-humid and semi-arid areas. These contain many small rivers and water courses, often with only seasonal flow. There



is considerable potential for small scale irrigation in this area using traditional technologies but the effort towards this end has not been encouraging. Thus, despite the great potential in Africa for irrigation estimated by FAO to be about 27 million hectares, only one sixth has so far been developed. As most of Africa has little tradition of irrigation, it is not likely that the rapid expansion of irrigation expected will happen soon. With so many setbacks enumerated above that lead to degradation of natural resources and the environment it appears that Africa and indeed the rest of the world is up to a herculean task in preserving itself.

### Measures to halt Land and Environmental Degradation

30. The long list of agents responsible for degrading Africa's land resources motivated FAO and other agencies interested in arresting land and environmental degradation in Africa to set in motion measures that will halt the trend which had become visible. The FAO Africa study Group recommended the development of a land conservation study. The result of this study is FAO's International Scheme for the conservation and rehabilitation of Africa's land.

31. While recognizing the great variety of land degradation problems, FAO established a number of basic principles to provide guidelines for action. These principles are outlined in the World Soil Charter (FAO, 1982), which was to be the basis for the control and reversal of land degradation. These principles include:

- i. developing a policy for wise land use according to land suitability for different types of utilization and needs of the country.
- ii. incorporating the principles of rational land use into an appropriate resource legislation.
- iii. developing an institutional framework for monitoring, supervising and coordinating the conservation of the country's land resources.
- iv. assessing all lands for their suitability for different purposes and the likely hazards of degradation
- v. implementing education, training and extension programmes at all levels in soil management and conservation
- vi. disseminating as widely as possible knowledge on the subject of soil degradation and its prevention
- vii. establishing links between administrators and

- land users for the implementation of soil policies
- viii. striving to create socio-economic and institutional conditions favourable to rational land resource management and conservation
- ix. conducting research programmes which will provide practical solutions to soil degradation problems but give due consideration to prevailing socio-economic condition.

The key element in these principles that is of direct relevance to Africa is the participation of populations in putting measures together that will ensure responsible and sustainable land utilization. In pursuance of this bias conservation in Africa was advised to be an integral part of the farming system and the general extension worker was to be the person to provide the necessary technical advice. But for this to happen the extension worker needs adequate training to recognise problems requiring expert and specialists assistance and where available to provide such assistance when needed.

32. The principles listed by the FAO study group also addressed the main goals of UNESCO's Man and the Biosphere programme which suggests that the issues surrounding the degradation of Africa's land resources are common but have not been fully and effectively addressed. The available evidence leaves no doubt that degradation of land resources caused by erosion, desertification, deforestation and poor agricultural practices is a very serious concern of very many members of the population but these do

#### BOX 3

##### **Poverty, population and the Environment**

*It is now widely accepted that the links between poverty, high population growth, and environmental degradation are circular and mutually reinforcing. Investing in people, which reduces poverty and population growth, is an urgent moral imperative and is essential, in the long run, for arresting environmental degradation ...\** (World Bank Group and the environment, Fiscal 1994, Washington, DC).

not participate in putting measures together that will ensure responsible and sustainable land utilization. As a result the continued degradation of land resource undermines the existence of African farmers, scientists and the general public who depend, for their survival, on the continent's natural resources. These grim prospects are all based on the assumption that past trends in land and environmental degradation will continue without any attempt to halt or reverse them.

33. Left with the African alone traditional practices

and methods of land conservation abound - the fallow period, shifting cultivation, the sacred nature phenomenon, etc. - but these may not suffice in the face of the present day development goals for modern Africa. In traditional Africa shifting cultivation allowed a fallow period during which the soil regained its fertility while the floral and fauna remained undisturbed for a long period. The sacred nature eg forest grove, river, single tree or animal species was a privileged area in which the concept of conservation of nature and cultural heritage fell in harmony. This principle illustrates the endogeneous character of the concept of conservation of the environment by the community.

34. It was in this regard that UNESCO, in pursuance of its mission to reflect its in-depth knowledge of African member states in their development and its response to specific global emergencies, decided in 1971 to launch the Man and the Biosphere (MAB) programme. The aim of MAB was to serve as a coordinating unit for International/ National organisations geared towards the goal of arresting the above trend in land and environmental degradation in Africa and the world as a whole while at the same time providing training, demonstration and research on ways of bringing about responsible exploitation of Man's biosphere for sustainable development. As concerns Africa, this approach of UNESCO was based on the firm conviction that poverty coupled with increasing population pressure was the biggest single cause of land and environmental degradation in Africa and that there is no way Africans can be made to overcome these problems by any legislation that will keep them away from their land. The rural poor, the overwhelming majority of Africa's citizens, destroy their own environment not out of ignorance, but simply to survive: peasant farmers preoccupied with a survival drive overcrop marginal land because there is no alternative employment and no better technologies they can afford. Pastoralists overstock pasture land to improve their chances of surviving the next drought, rural dwellers strip trees and shrubs for fuel wood because they need fuel. In the context of their short-term basic needs each of these decisions is rational but in the long run the effects are disastrous. The alternative to remove the rural poor from the land is equally disastrous as this makes him estranged and entirely unproductive. The MAB approach to overcoming this problem has been that he lives «responsibly» on his land acknowledging and ensuring conservation of the resources available so as to continue to sustain and develop himself.

35. Many other strategies have been tried and tested the world over to halt the degradation of natural resources while at the same time ensuring their utilisation by man because they are meant for him. The UNESCO Man and Biosphere programme yet appears to be the only human and working solution to this rather complicated problem. Other strategies so far found for preservation of natural resources through the relocation of native dwellers has been subject to much dispute in many countries. The ideal, as in the Man and the Biosphere Programme, is to successfully manage natural resources while preserving ecosystems and to initiate strategies aiming at reconciling utilisation and conservation. This approach is more advantageous than even the traditional practice of fallow period or sacred bush conservation as these two imply some amount of deprivation.



In Africa people destroy their environment not out of ignorance but to survive. A gold prospector.

36. The UNESCO MAB Programme has ensured conservation and sustainable use of land resources through the implementation of a new concept, the «Biosphere Reserves», which aims at :

- i. managing natural resources for the use of man
- ii. reconciling the needs of the constantly growing population with those of nature and
- iii. rehabilitating the global community in their role and responsibilities.

In the MAB programme Biosphere reserves constitute the focal point and main operational unit for conservation in Africa land elsewhere. Each reserve includes the land and all its inhabitants and the water surfaces suitable for activities. In other words the ecosystem of the biosphere reserve is left, as it always had been, with provision for the management of the natural resources. The reserve continues to provide the wide variety of resources to the neighbouring population as before: fuel and building materials, edible or curative plants, fertile soils for farming and plant and animal species for consumption and continuity.

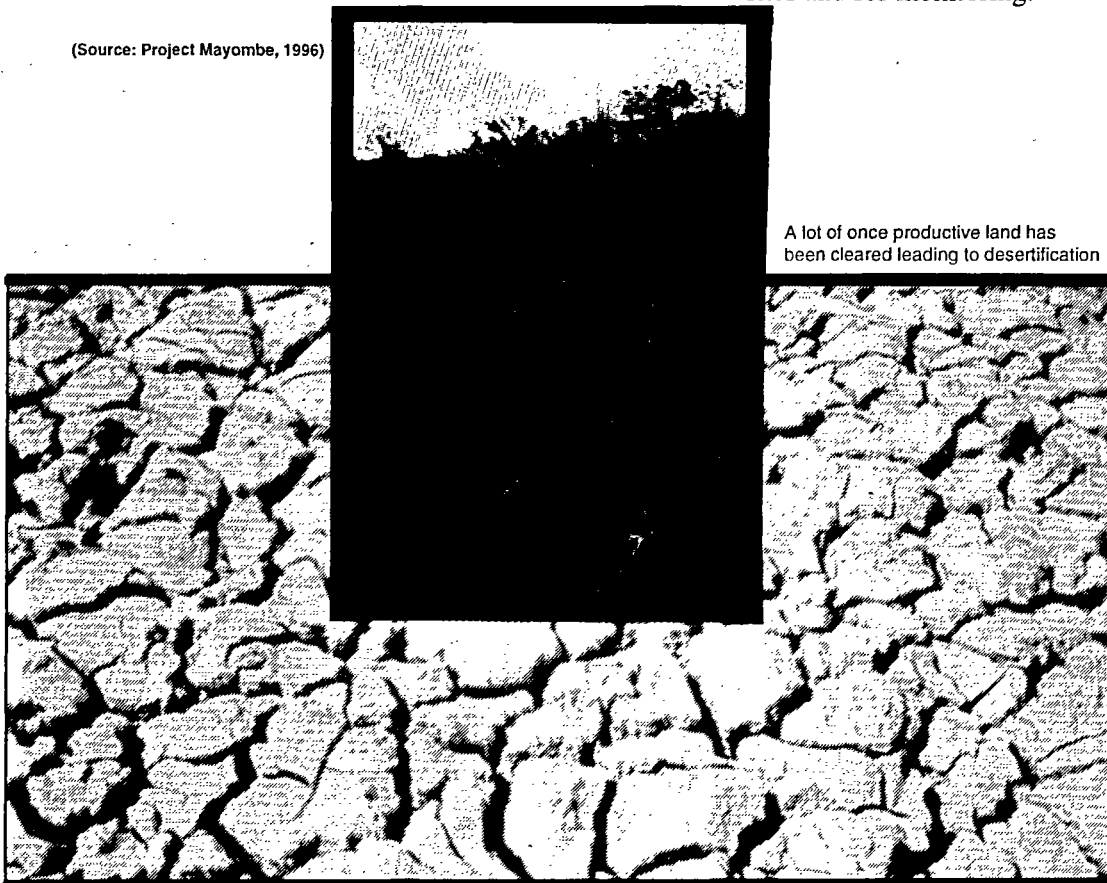
37. In the neighbouring agricultural regions biosphere reserves are protected from any form of land or environmental degradation such as wind and water erosion by the vegetation that will be allowed to exist to protect the reserve. The wild life that is allowed to exist plays an important biological role in the maintenance of the surrounding agricultural land. The reserves are useful for conservation of biological resources as each reserve shelters a great number of animal and plant species growing in their natural habitat and contributing to maintain genetic resources in order to meet the needs of the ecosystem in future. In this sense, biosphere reserves establish and maintain an equilibrium in the ecosystem with the net effect of no change in the flora and fauna.

38. Biosphere reserves, as promoted in the UNESCO's MAB Programme, undertake the transmission and study of traditional forms of land use so that the sustainable system of resource utilisation which had been found to have outstanding value can be adopted with necessary adaptation where necessary for the development of modern resource management methods. The reserves also help the population to improve their economic welfare and to maintain them in the rural areas where they are provided with a living.

39. Thus, it has been known that if land resources are used in accordance with their suitability and are appropriately managed land degradation can be minimised and food production and maintenance of biological diversity can be held up at present levels or increased. Environmental constraints exist but agricultural potential is considerable over large areas of the African continent and this can be exploited to the advantage of all including the rural poor who should stay on their land to sustain natural resources to ensure Africa's economic recovery early in the 21st century.

40. From the scientific point of view Biosphere reserves are outdoor laboratories providing knowledge not only of flora and fauna species but also of geological evolution and the natural history of the concerned sites and for monitoring.

(Source: Project Mayombe, 1996)



A lot of once productive land has been cleared leading to desertification

CHAPTER 2:

**UNESCO'S MAN AND THE BIOSPHERE (MAB) PROGRAMME**

41. The last twenty five years or so (1970 to date) witnessed the birth and existence of several initiatives on the protection of the natural environment. A number of international legal instruments were formulated during this period for internationally coordinating efforts in the field of natural resources conservation. Several international programmes were also launched for enhancing and managing natural resources. One of these programmes was launched in 1970 at the 16th Session of the General Conference of UNESCO.

**Antecedents and origins of MAB**

42. The MAB Programme was UNESCO's response to the environmental awareness that had gripped the world in the decade of the sixties. During this period global awareness of environmental problems was growing. This growth resulted firstly from the severe droughts of the Sahel and oil pollution of the oceans. The Southern African Community (SADC) Countries located in or on the fringes of the Kalahari desert could not express these concerns at the international forums as these countries were still under the colonial rule. As a result more emphasis was placed on the Sahel region, hence programmes for the arid zones of North Africa were justified.

43. A number of events culminated in the launching of MAB:

- establishment of an Advisory Committee on Natural Resources Research in 1965 as authorised by the General Conference of UNESCO, at its 13th session to the Director General to stimulate research and training relating to the natural environment and resources;
- conduct of the international Conference on the biosphere in 1968;
- existence of the periodical newsletter «Nature and Resources» which covered all activities in the field of natural resources research and complemented the efforts of the Advisory Committee on Natural Resources and Research;
- Coordination by UNESCO of the first work of

Ecological Programme through the International Biological Programme (IBP);

- pioneering work by major international non-governmental organisations like the International Union for Conservation of Nature and Natural Resources (IUCN) founded in 1948, the International Council of Scientific Unions (ICSU) especially its Scientific Committee on Problems of the Environment (SCOPE) and the Special Committee for the International Biological Programme (SCIBP). The Food and Agricultural Organisation (FAO) had also been concerned about the environment, nature and its natural resources and had carried out a lot of pioneering work;
- UNESCO itself had sought to encourage international cooperation in the biological and other life sciences in pursuit of environmental problems;
- an acute shortage of the critical mass of scientists required especially in the developing countries to cope with the problems of renewable natural resources and the environment. In cases where the critical mass existed there was the general lack of the mechanism through which they could interact with each - other wherewithal to ensure adequate flow of information between existing specialists in the area of conservation. In countries like Argentina, India and Egypt there were a considerable number of trained Scientists but these could not interact. In cases where specialists could be found their technical knowledge was not always relevant for providing the types of research information needed by planners division makers and land users because they lack the relevant training and skills that were required;
- as far as renewable resources were concerned existing knowledge of different geographical areas was unevenly spread. Most of the data available was on the temperate climatic zones and even the little that was on the topics was locked in books and international journal articles overseas. In many parts of the tropics the basic inventory of potential natural resources had not been done.

44. One element that was always absent from all of the earlier efforts was ensuring continued exis

tence of man in his environment while conservation and renewal of natural resources were pursued after exploitation through interaction with these resources and the environment. There were also the draw backs of quality and quantity of information on natural resources, their dissemination to areas of need and the availability of local manpower in the ecological and related sciences, especially in developing countries.

45. In particular, the critical mass of local scientists was difficult to be obtained because of the pressure and perhaps attraction to work in fields other than scientific research and training, hence foreign experts abound in these countries.

46. Thus, the UNESCO Man and the Biosphere programme was conceived out of the dire need for research findings, manpower, information and a mechanism of information flow on environment useful for scientific endeavours.

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## The MAB Programme

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47. MAB as a programme was centred on the interaction between man and his environment and the sustainable use of existing natural resources. It was conceived as a programme of applied interdisciplinary research in ecology, the social and natural sciences and for training and demonstration. The aim of MAB was to provide the scientific knowledge and the trained personnel required so that the resources of the living world were managed as they should be : rationally and continuously, both for now and the future. The programme operated around 14 international themes or projects as listed in the box below:

**BOX 4.**

**PROJECTS/THEMES OF THE MAB PROGRAMME**

1. Ecological effects of increasing human activities on tropical and sub-tropical forest ecosystems.
2. Ecological effects of different land-use and Management practices on temperate and Mediteranean forest landscapes.
3. Impact of human activities and land use practices on grazing lands: savanna, grassland (from temperate to arid lands).
4. Impact of human activities on the dynamics of arid and semi-arid zones' ecosystems with particular attention to the effects of irrigation.
5. Ecological effects of human activities on the value and resources of lakes, marshes, river, deltas, estuaries and coastal zones.
6. Impact of human activities on Mountain ecosystems

48. As MAB developed over the years four themes received priority attention from countries, and these were:

- i. the humid forests;
- ii. arid and semi-arid lands;
- iii. urban areas considered as ecological systems
- iv. biosphere reserves as a new dynamic approach to the conservation of genetic biodiversity.

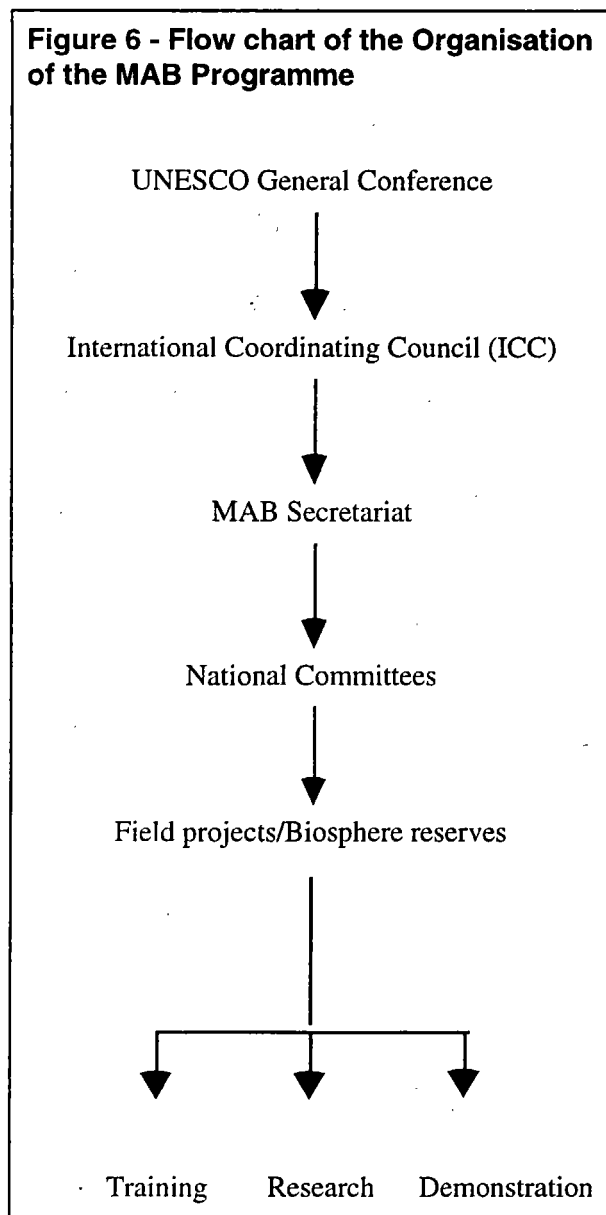
MAB field research projects under these themes were of variable duration and complexity ranging from 2 to 5 years and many involved scientists from a range of natural and social science disciplines. In 1981, there were 972 field research projects being carried out under the sponsorship of MAB national committees in 78 countries with over 10,000 scientists taking part. In compaision, after 25 years of operation of the programme this number grew to over 112 national committees, 328 biosphere reserves and ten of thousands of scientists. Most of these projects focused on concrete problems of resources management. Among them are a number pilot projects which are of regional or international significance and which include the triple functions of research, training and demonstration.

49. The activities of MAB are coordinated by an international coordinating council which inter alia, had established the broad outlines of the programme. At the national level MAB operates through the framework of national committees which are responsible for planning and coordinating the field activities that make up the programme. The International Coordinating Council (ICC) is the main policy making body of MAB and it is made up of scientific representatives of 30 countries elected by the General Conference of UNESCO, and observers from collaborating international organisations. The Council

7. Ecology and rational use of island ecosystems
8. Conservation of natural areas and of the genetic material they contain.
9. Ecological assessment of pest management and fertilizer use on terrestrial and aquatic ecosystems.
10. Effects on Man and his environment of major engineering works.
11. Ecological aspects of energy utilization in urban and industrial systems.
12. Interactions between environmental transformations and genetic and demographic changes.
13. Perception of environmental quality
14. Research on environmental pollution and its effect on the biosphere.

meets every two years to review and evaluate progress made in implementing the programme. A six member bureau is elected by the Council at each session to deal with policy matters between council sessions. A small secretariat provided by UNESCO ensures overall coordination at the international level.

The organisation of the MAB programme is as in figure 6.



50. Member states involved in the MAB programme operate national committees also called MAB committees which should encourage the programme's activities on the preservation of natural resource and the environment. The national committees in different member states and the project or projects undertaken are linked through sub-regional networks that are biogeographic or thematic in nature. Within each network similar projects are located within the same ecosystem. In all, there are 4 main

bio-geographic sub-regions in Africa: Forest sub-region (Forenet), Coastal and small island sub-region (Cossinet), Mountain and Highland sub-region (Mountnet), Arid and semi-arid sub-region (Asalnet). These sub-regions constitute a unique framework for comparative study of ecosystems in different parts of Africa. The various networks are located in regions of the Africa that give them unique characteristics. For example, vis-a-vis the equator Africa is divided into two vast regions for the MAB programme: North Africa and East and Southern Africa. North Africa includes the whole of Africa north of the Equator including the humid forests of the West and Central Africa through the wooded areas of the sub-saharan savannah to the Mediterranean. This area is subject to rapid population growth as well as deep alteration in land use systems. It is also an area of important inter-annual climatic variability. The East and Southern Africa region encompasses almost the whole of Africa south of the equator including the African savanna, wooded regions and the pastures and deserts of southern Africa. In the north of this area is the influence of the inter-tropical convergence zone. There are ecological pressures in this region noticeable by an impressive population growth and the resulting alterations in land use.

51. In recent times intra-continental networks have also been established as we now speak of AFRIMAB, ASIAMAB, EUROMAB etc. Thus, there are 4 levels of networking in the MAB programme:

- i. At the field project level between field projects or biosphere reserves
- ii. At the sub-regional level between sub-regional networks that are bio-geographical in nature
- iii. Regional network level between regions as designated
- iv. The international level between regions within or outside the same continent.

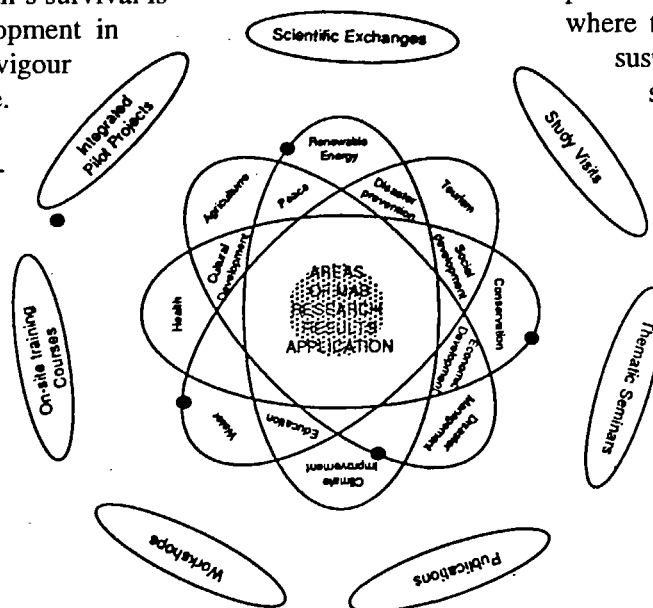
52. These networks and their different operational levels were intended to be the mechanism for information flow which had hitherto been absent in the field of scientific research. The extent to which this objective has been achieved has been limited as illustrated by the continuous effort by the MAB programme at improving this aspect. However the creation of the necessary structure as in the MAB has been commended.

## Evolution of MAB

53. After its launching the MAB programme evolved over the years through the efforts of its International Coordinating Council from a more focused definition of objectives and national and regional planning to a set of extended functional activities. The coordinating council met for the first time in 1971 to prepare the broad outlines of the programme. The 1972 United Nations Conference on Human Environment held in Stockholm (Sweden) which followed was the political landmark in developing global consciousness that the environment mattered both for developing and developed countries although the priorities and constraints differed in each case. The Stockholm conference went even further in confirming the social and human aspects of the environment and in shifting away from the «pollution» and «chemical» content of the 1965 definition of environment by stating that: «man is both Creator and moulder of his environment, which gives him the opportunity for intellectual, moral, social and spiritual growth. Both aspects of man's environment, the natural and man-made, are essential to his wellbeing».

54. By stressing growth of human well-being Stockholm represented a major step forward by all nations to base the development of their people and their concern for the environment on a conscious and intelligent appraisal of the impact of development on the environment and vice versa. In other words, these two elements (development and environment), according to Stockholm, are inextricably intertwined as far as man's survival is concerned. This development in Stockholm gave renewed vigour to the MAB programme.

55. The MAB programme had now been clearly conceived as an inter-disciplinary training, research and



demonstration programme for tackling, through environmental approaches the analysis of mutual relations between man and his environment. Its global aim had been identified as one of highlighting the required basis for sustainable use of natural resources. The programme also endeavoured to highlight the global relations between man and his environment using the natural and social sciences and to show the consequences of man's present actions on the future, and hence to enable him to efficiently manage the biosphere's natural resources. The research activities, in the form of projects, were identified as a new dynamic approach to conservation of genetic diversity.

### BOX 5.

«Within UNESCO, the progressive transformation (of environmental theme) can be traced through four Medium Term Plans in the past 20 years. The first phase (1977-1982) centered on the functioning of ecosystems. This was succeeded by a second phase (1984-89) of «human use systems», then a third (1980-1996) of «human welfare pre-occupations» to the present (1999-2001) of fostering «socially and environmentally sustainable development» at the turn of the century».

L. Dangagna, UNESCO Nairobi Office

Bulletin, January-June 1997

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56. In 1974, UNESCO formed a task force on the MAB programme. The concept of biosphere reserve originated from this task force. From conception, biosphere reserves were seen as sites where the objective of achieving sustainable balance between the sometimes conflicting goals of conserving biological diversity, promoting economic development and associated cultural values could be achieved.

BOX 6.

**CONCEPT OF BIOSPHERE RESERVE**

The concept of biosphere reserve was borne out of the quest for efficient and immediate use of natural resources, especially in Africa where the population was growing fast and where the creation of models for sustainable use of environmental resources was necessary. Biosphere reserves are «areas covering ecosystems and a combination of terrestrial and marine ecosystems acknowledged at the international level in the frame of the UNESCO programme on man and the biosphere (MAB). These resources are proposed by Governments and have to meet a minimum of criteria and gather a minimum of condition before admission into the network. Biosphere reserves are expected to fulfil three complementary functions:

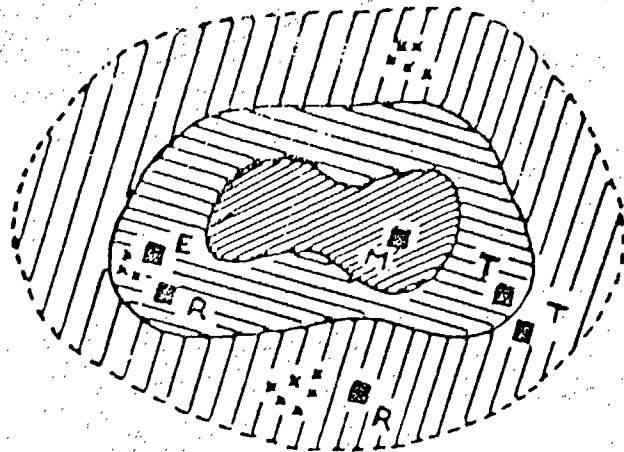
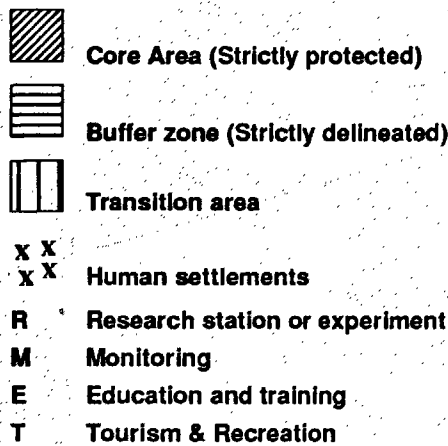
- a. a conservation function - to preserve genetic resources, animal and plant species, ecosystem and landscapes;
- b. a development function - to reconcile conservation and sustainable exploitation of the reserve's resources in close cooperation with the local population.
- c. a function of logistical support - to help and encourage research, training and monitoring activities in relation to local, national and global interests and activities aiming at conservation and sustainable development.

Usually, each biosphere reserve should include three elements:

- i. one or several strictly well protected core zones allowing to preserve biological diversity; more less disturbed ecosystems and carrying out preoccupying activities (ecological, tourism, and education, for instance)
- ii. a well defined buffer zone around or adjoining the core areas used for cooperation activities matching ecologically viable practices related to the environment including leisure, applied and basic research; and
- iii. transition zone or cooperation area that may include a number of farming activities, human settlement or other exploitation in which local communities, management agencies, non-governmental organisation, cultural and economic interest groups as well as stake holders work together in order to sustainably manage and develop the resources of the region.

The three zones, though formally, conceived as a series of concentric rings, were set up under different forms to adapt to local conditions. In fact, one of the strongest points of the concept of biosphere reserves resides in the flexibility and creativity within which it has been implemented in very diverse situations.

**Representation of typical biosphere reserves**



Source: Batisse (1986)

Some countries have enacted specific laws to set up their biosphere reserves. In many others the core zones and buffer zones of biosphere reserves are considered (wholly or partly) as protected areas by national legislation. A great number of biosphere reserves simultaneously belong to other systems of protected areas such as national parks or national reserves and/or international networks such as World heritage or Ramsar sites.

Property statutes for biosphere reserves also vary. In some countries the core areas of Biosphere Reserves belong to non-governmental organisations, in many others the buffer zones belong to individuals or communities which is generally the case for transition zones. An effective strategy for biosphere reserves must reflect the great diversity of these situations.

The principal beneficiaries of biosphere reserves are:

- (1) local populations (because of the protection of their resources, the improvement of abilities for resource management and their growing influence in decision making;
- (2) Scientists (because of the opportunities for interdisciplinary and international research; the development of data basis and the facilities for spreading the results;
- (3) Government decision makers and resource managers (in as much as research and training improve the capacity for evaluating present actions and predicting the consequences of alternative management strategies); and finally
- (4) World community (some of the methods used for integrating environment and development find application on a global scale possibly in so far as environmental problems arouse international concern).



57. During 1974 a regional meeting for North Africa was held in Niamey, Niger on the needs of integrated ecological research and training. This was followed, in 1975, by another regional meeting on specification of cooperative and interdisciplinary researches, training and development on the pastures of North Africa's arid and semi-arid zones. It was at this latter meeting that the basic planning of pilot projects at the regional level was started. Towards the end of that same year an integrated research activity and ecological training in West and Central Africa's humid tropics was conducted in Kinshasa, Congo. Up to the time of the Kinshasa meeting the activities of the MAB programme were consciously grouped into three categories viz:

- i. pilot projects on the terrain (of a particular ecosystem)
- ii. field training activities and development of capacities (their reinforcement or strengthening)
- iii. training and information exchange.

58. The pilot projects served various purposes including:

- i. application of existing knowledge
- ii. knowledge deepening and setting up of methodological basis for a research programmes, and
- iv. information dissemination.

59. As of 1975, biosphere reserves, as conceived in 1974, had grown in number to include 324 reserves in 82 countries. In 1976, a biosphere reserve network was launched. To date this network is a key component in MAB's objective of achieving sustainable balance between conserving biodiversity and promoting economic development.

60. The network of pilot projects is a dynamic element of the MAB programme because new pilot projects keep coming up as older ones get completed. In the 1980-81 period, for instance, several countries in the humid and sub-humid tropics indicated their interest in beginning pilot projects and regional and sub-regional pilot projects also got started while some older ones were folding up.

61. In 1977, the need to protect the environment in times of conflict was stressed in various United Nations and bilateral agreements including resolution 2603 A (XXIVV) of the UN General Assembly in a protocol added to the Geneva Convention of 1949.

62. In response the MAB programme had increased its number of pilot projects. This was reflected in a

statement by Ayensu (1981) at a symposium by the African Biosciences Network (ABN) held in Accra, Ghana in collaboration with the International Biosciences Network (IBN) in which the increased level of research in the humid and sub-humid tropics by groups such as the MAB programme was referred to. The MAB programme was said to have contributed «a respectable body of basic scientific information to current understanding of the dynamics of the humid tropics» but Ayensu requested that MAB should reorientate its sponsored research activities to provide the kinds of information that are relevant to the planning needs of decision-makers. It was also 1981 that marked the tenth anniversary of the UNESCO-MAB programme and so an evaluation was conducted which showed that the programme had made remarkable progress including the increase in the number of countries participating to 100 and researchers to over 10,000; high standards of practical results in land planning and resource management were also reportedly maintained.

63. In 1980 IUCN in collaboration with UNDP and the World Wild life Fund (WWF) jointly published the International Conservation strategy later produced by the same three institutions in a publication entitled «Save the planet Earth», in a response to the question how to reconcile the need to meet the ever-increasing needs of humanity with the conservation of biological diversity found in ecosystems which were increasingly becoming more fragile.

64. In 1983, UNESCO, in collaboration with UNEP convened the first international biosphere reserve congress in Minsk (Belarus) in cooperation with FAO and IUCN. The Minsk congress was a demonstration of the cooperation received by the UNESCO-MAB programme from other non-governmental and inter-governmental organisations involved in the preservation of the environment and its natural resources. The congress which was attended by 250 participants from 52 countries afforded an opportunity to review the progress made on the question of natural heritage conservation. It should be noted that the activities relating to the provisions of the convention for the protection of the World Cultural and Natural Heritage were becoming more and more closely associated with those concerning biosphere reserves. The activities of the congress thus gave rise to an action plan for biosphere reserves in 1984 which was generally endorsed by the UNESCO General Conference and the Governing Council of UNEP.

65. During this stage of the development of the MAB programme two issues were emphasized; increased social science inputs into the research projects of the programme and training activities provided by inter-governmental and non-governmental organisations associated with the programme. It was in this respect that the research on perception of environmental quality was re-emphasized together with renewed provision of training facilities for the programme.

66. The evaluation undertaken by the International Coordinating Council in 1981 included the production of various forms of information material intended to give the public an idea of the achievements of the MAB programme. Some of these materials included two issues of the UNESCO journal «Impact of Science on Society»; «Managing the Biosphere»; special issues of the UNESCO courier and articles in the International social science journal and the International Journal on the Environment «Ambio» published by the Swedish Academy of Sciences. Also published were the proceedings of the International Scientific Conference, «Ecology in Action»; a series of 10 radio programmes produced by Radio UNESCO and the publication of 18 articles on certain MAB projects in «UNESCO News». This Marathon publication drive was undertaken because of the considerable delays experienced in recording and monitoring of field projects (including the MAB information system) and the halt in the publication of abstracts of MAB research findings. In particular and as a response, the quarterly review «Nature and Resources», which publishes international news and information about UNESCO's programmes concerning environmental activities, natural resources research and conservation, was issued in four languages (English, French, Spanish and Russian) by 1982. From this year a new presentation of this review with photographic and other illustrations was undertaken and circulation notably increased.

67. In the decade following the Minsk congress (1983-1992) thinking about protected areas as a whole and about biosphere reserves had been developing along parallel lines. Most importantly, the link between conservation of biodiversity and the development needs of local communities - a central component of the biosphere reserve approach - was now recognised as the key to the successful management of most national parks, nature reserves and other protected areas. At the fourth World Congress on national parks and protected areas of 1992 held in Caracas, Venezuela, the World protected area planners and managers adopted many of the ideas

that had been essential aspects of biosphere reserves (community involvement, the link between conservation and development, the importance of international collaboration, etc.). This congress approved a resolution in support of biosphere reserves. New ideas were also introduced into the management of biosphere reserves by the MAB Programme including new methodologies for involving stake-holders in decision-making processes, resolving conflicts and the need to use regional approaches. New kinds of biosphere reserves also developed such as, cluster and transboundary reserves. The focus of the MAB programme also changed from conservation to integration of conservation and development. International networks, fuelled by technological advances including powerful computers and internet, which facilitated exchange of documents, greatly improved communication and cooperation between biosphere reserves. There was however a limited exchange of visits of personnel between biosphere reserves for the purposes of training or sharing of experiences.

68. It was against this background that the Advisory Committee set up by the Executive Board of UNESCO in 1991 for Biosphere reserves considered that it was time to evaluate the effectiveness of the 1984 action plan, analyse its implementation and develop a strategy for biosphere reserves as we move into the 21st century. It was to this end and in accordance with Resolution 21/C/2.3 of the General Conference that UNESCO organised the International Conference on Biosphere Reserves at the invitation of the Spanish authorities in Seville (Spain) from 20-25 march 1995. This conference was attended by 102 countries and 15 international/regional organisations.

69. The conference which was organised to evaluate the 1984 action plan, reflect on the role of biosphere reserves in the context of the 21st century also elaborated a draft statutory framework for a world network of biosphere reserves. The conference also drew the Seville strategy to which the International Coordinating Committee of the MAB Programme at its 13th session (12 - 16th June 1995) gave its strongest support. The Seville strategy clearly set out the goals, management, structure and functions of biosphere reserves gearing them towards promotion of conservation and sustainable development at the national, regional and international levels. The conference concluded among other things, that in spite of the problems and limitations encountered with the establishment of biosphere reserves the programme as a whole had been innovative and had had much success. In particular, the three basic functions of training, research and demonstration

were reported to have been achieved and were considered as valid then as ever. Through these functions and the strategies elaborated biosphere reserves were considered to be capable of preserving the natural resources that would ensure sustainability.

70. The Seville conference also helped to finalise the statutory framework setting out the conditions for the functioning of the world network of biosphere reserves. The framework comprised ten articles ranging from definition of biosphere reserves through the establishment of the world network of biosphere reserves, their function, criteria for member state participation, designation procedure, publicity, periodic reviews and the secretariat.

71. Both the Seville strategy and statutory framework were adopted under Resolution 28/C/2.4 of the UNESCO General Conference of 1995. These documents highlighted the new roles that biosphere reserves were now to play in serving to respond to some of the concerns of the United Nations Conference on the Environment and development (UNCED) and in particular, the convention on biological diversity which was signed at the Earth Summit in Rio de Janeiro in 1992, entered into force in 1993 and had then been ratified by over 100 countries. The major objectives of this convention on biological diversity compared favourably with the objectives of the MAB programme. Other Conventions resulting from UNCED of great relevance to MAB are the Convention on Desertification Control and the Framework Convention on climate change.

72. Biosphere Reserves were thus seen to be promoting this integrated approach and were well placed to contribute to the implementation of the convention on biological diversity. In addition, the above developments ensured that all the ideas in pilot

projects and other land management strategies were now circumscribed within the same conceptual framework as biosphere reserves which also provided a blue print for international approaches to the protection of the environment and the resulting sustainable development.

73. Since the Seville conference other developments of MAB have included the developments in strategies for dissemination of information between and within various MAB networks, personnel training and the termination of the work on the 14 international themes earlier on identified.

74. This year (1997) it is reported that based on recommendation of previous evaluations of the MAB programme and the network of biosphere reserves carried out respectively by the Scientific Committee on Problems of the Environment (SCOPE) in 1992 and 1995 work on the 14 international themes or projects have been formally terminated and the programme structure revamped. Since this decision emphasis has been shifted to biosphere reserves and coastal and urban ecosystems as well as new educational initiatives through the UNESCO-MAB Young Scientists Award Scheme. As of now more emphasis is placed on biosphere reserves - (including the twinning of reserves and the establishment of transboundary reserves) - biosphere society interactions and collaborative programmes like *Diversitas*. The new areas of research are to include greater transdisciplinarity in assessing economic evaluation of ecological processes and the relations between sacred sites and cultural and biological diversity. The new MAB projects will focus on and respond to regional concerns and Africa is said to remain a priority continent for strengthening environmental sciences, especially land management and conservation.



Planners and decisionmakers must be sensitized to environmental problems as here in UNEP-UNESCO regional training program in Desertification Control for SADC countries. Bulawayo, Zimbabwe 1996.

## ACHIEVEMENTS, CHALLENGES AND PROBLEMS

75. The MAB programme as concerns Africa finds itself at a time of evolving Environment and Development Context, from which it cannot isolate itself. The shifting priorities - North/South; Sovereignty over resources; the role of environment and trade, international cooperation- Financial and technical; legal instruments; and hardships of climbing the economic development ladder, etc. The role of the governments is also changing for example due to expanding frontiers of democracy- from elected democracy to participatory democracy- or from no democracy at all to the former two; participatory decision making; etc. All this result to: greater complexity in scope and scale of issues, interdependence of issues; participatory decision making; demand for policy relevant science; need for fact and consensus building and the importance to understand the political process. In order to address these complex issues, governments have to mobilize all available resources- scientific, technical and financial. The scientific programmes need on the other hand to focus research on policy relevant issues and enhance the ability to predict the consequences of various stresses associated with human activities on ecosystem integrity. MAB in Africa will have to address these issues to advance in the next century.

76. 1990's saw the coming into force of the Convention on Biological Diversity (CBD), a legally binding international instrument governing the conservation, exchange and use of biological resources. 1990's also marked the conclusion of the Convention on Combating Desertification (CCD). In response to these international agreements, many governments are now enacting national legislation which are greatly influencing the way the world is conserving and using its wealth of biological resources. New institutions are being created, and many existing organisations are being reoriented to take advantage of the expanding opportunities. Recognizing these changing circumstances several new initiatives are

being undertaken by MAB, some have been described in detail in this report.

75. The overriding objective of all conservation is to ensure continued benefits from natural resources. In developing countries of Africa the most important reason for conserving natural resources has been permanence in the supply of materials to satisfy basic human needs, and provide for industrial development (local or foreign) as well as for export to earn foreign exchange. And even though the central goal in their efforts at conserving natural resources has been the improvement of the well-being of societies, African countries have been witnessing an ever increasing gap between increasing demand and a diminishing supply-base for resources like food, other fibres and forest products.

76. Another objective of conservation is protecting the environment to enhance water resources and check soil erosion, grazing lands against desert encroachment and stabilisation of coastal habitats. Conservation also ensures regulation of environmental balances in such factors as carbon dioxide, radiation levels and the biogeochemical cycles (water, carbon, nitrogen, phosphorous, etc...). It maintains the scientific value of natural ecosystems, the study of which is required to enhance conservation itself and the management of man-made systems.

77. Lastly, conserving natural resources protects amenity values including aesthetic, heritage, religious, medicinal, sentimental or ethical values.

78. In the African continent all of these objectives have been pursued by the MAB programme in different countries and to different extents. The strategies adopted in pursuing these objectives have also been different and the purpose of this chapter is to present the activities that the MAB programme has carried out in pursuance of these objectives and the

achievements, problems faced and challenges encountered.

79. The activities of the UNESCO-MAB programme in Africa for the achievement of sustainable development through land and environmental conservation can be categorised under two concepts that emerged from the activities of the programme itself: 1) The Biosphere Reserve, and 2) Integrated (Pilot) Projects. Research, training and demonstration including dissemination of information were the main elements of both of these categories of activities although some projects were either mainly research or mainly training biased while all projects disseminated information and demonstrated conservation practices. Also, all these three main elements of MAB were part of the activities of the biosphere reserves. Furthermore, most projects of the programme are located in biosphere reserves or areas that are intended to be designated as biosphere reserves because the reserves were designated following from the activities of the project. Thus, the achievements, challenges and problems faced by the MAB programme in Africa were associated with or directly resulted from these two categories of activities of the programme; biosphere reserves and integrated projects.

### Biosphere Reserve

80. This is the present major strategy on conservation and sustainable development employed by the MAB programme. Biosphere Reserve form the main unit of activity of the MAB programme today. There are 46 Biosphere Reserves in Africa located in 24 countries. The total land area of the African continent covered by these reserves is 23,294,946 hectares of which 77.7% is found in arid and semi-arid zones.

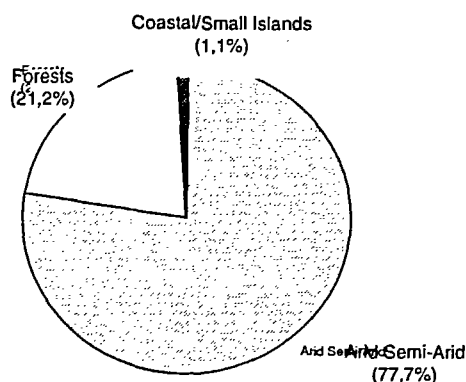
81. From this chart it is clear that more land area has been designated as biosphere reserves in arid and semi-arid areas as against forests, small islands, coastal areas and high lands and mountainous regions. Arid and semi-arid land areas contain limited renewable natural resources (plants and animal species) to be lost through natural

resource and environmental degradation. What is depicted by this chart is the desperate efforts being made to prevent further deterioration of land that is already deficient like the encroachment on the Sahel by the Sahara desert (e.g. Algeria has over 7 million hectares of land allocated to biosphere reserves). Similar efforts should be made to conserve large areas of forests, mountain, other highlands, small island and coastal ecosystems where a lot of the natural resources used today to provide food, medicine and shelter are located. These are over-exploited and degraded because they host a good proportion of the world's population today but the biosphere reserves found there are few. It is therefore necessary to establish big reserves especially in the small islands, coastal areas and highlands and mountains in comparison to those in arid and semi-arid ecosystems.

82. On the whole, the quantity of land area allocated to biosphere reserves in Africa is small considering the extent of land degradation taking place on the continent. Wangari (1996) suggests that as part of use of their initiatives national MAB committees should be encouraged to promote new programmes of biosphere reserves which have the potential to attract funds from donors as well as their intrinsic conservation and development values. The situation in Africa as depicted by the chart above is contrary to the link that should exist between conservation and development. It is believed that development must seek to conserve, replenish or improve natural resources otherwise it is bound to be self-defeating because it will eventually devour its own life substance.

83. Algeria and Egypt are the greatest contributors to the high proportion of land area allocated to biosphere reserves in arid and semi-arid regions. While this may have been a way of protecting the

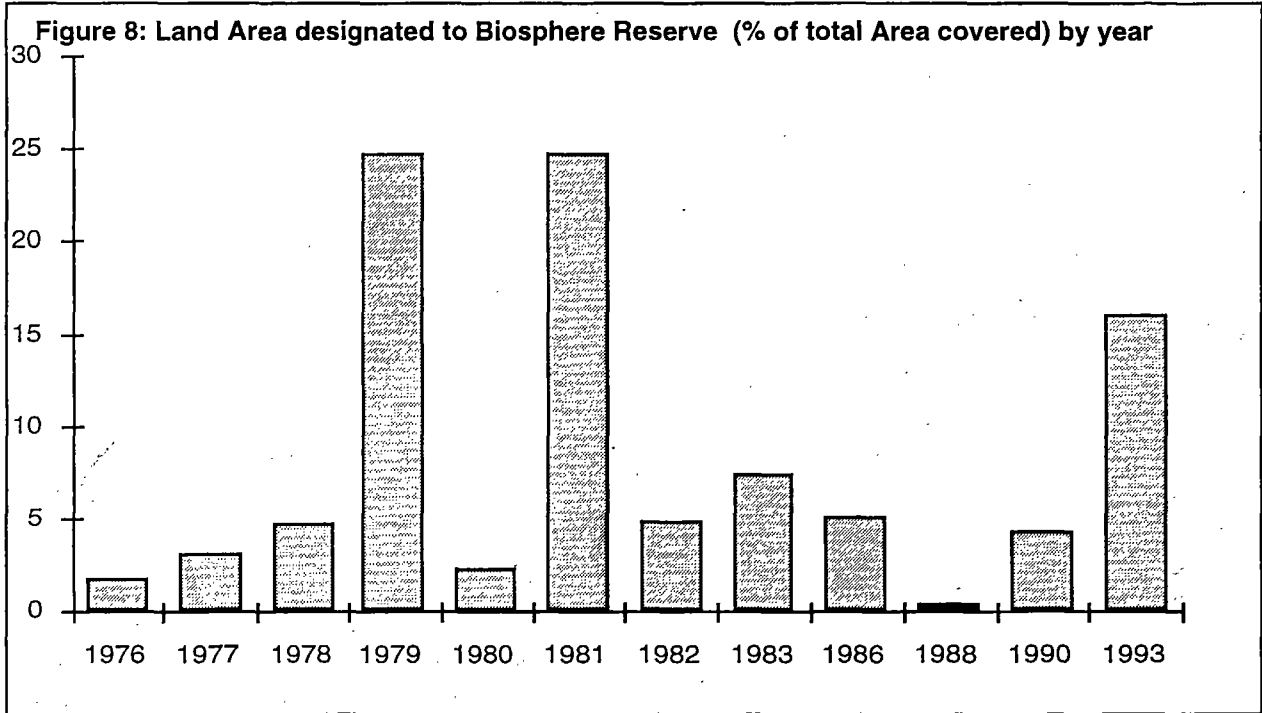
**Figure 7: Percentage of total land Area covered by different ecosystem types of Biosphere reserves:**



land areas that are prone to desertification, efforts have now been made to prevent the Sahara from expanding southwards by encroaching on the savanna and humid tropical rain forests through projects specifically intended for the arid zones which are

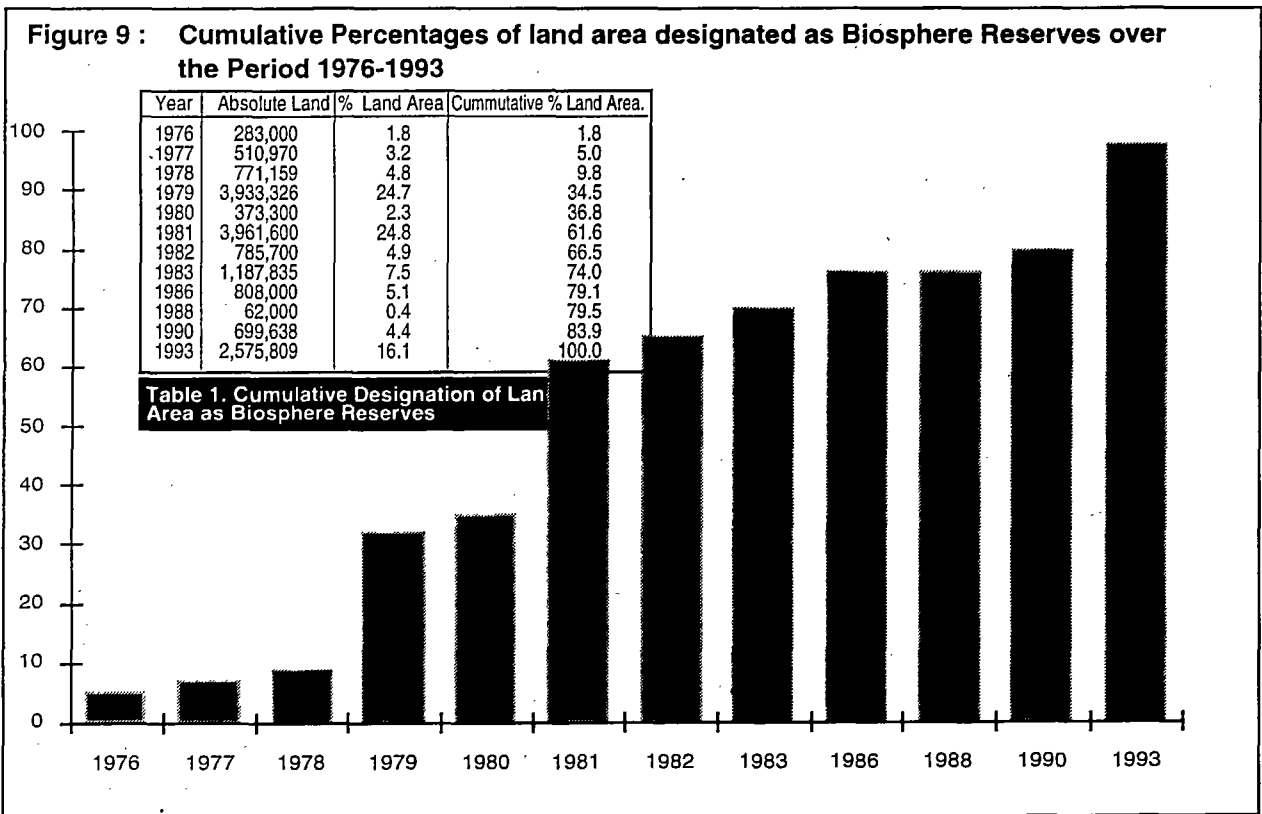
covered in this report under integrated projects.

84. The activities of the MAB programme in Africa can also be shown by the amount of land area that was designated as biosphere reserve each year from 1976 to 1993 as shown in figure 8 below.



The progress of the programme over the same period is shown in the cumulative designation of land area as biosphere reserve as shown in table 1 and figure 9 below.

85 The chart and figures above show that the first years of the introduction of biosphere reserves in the MAB programme in Africa witnessed a steady increase in land area designated, an indication of the



growth of the programme. The years 1984, 1987, 1989, 1991 and 1992 did not witness designation of new biosphere reserves in Africa. The years 1979 and 1981 witnessed the typical bandwagon reaction to innovations, such as the biosphere reserves while 1993 may have been the result of the several world events including the Earth Summit, Convention on biodiversity, World Congress on national parks and protected areas, which promoted the establishment of several biosphere reserves. In particular the World Congress on national parks and protected areas led to the transformation of large national parks and protected areas in Africa into biosphere reserves (e.g. Egypt's Wadi Allaqui) as many of the protected area planners and managers adopted many of the ideas that had been essential aspects of biosphere reserves. It should be recalled that after this congress new kinds of biosphere reserves also developed such as cluster and transboundary biosphere reserves.

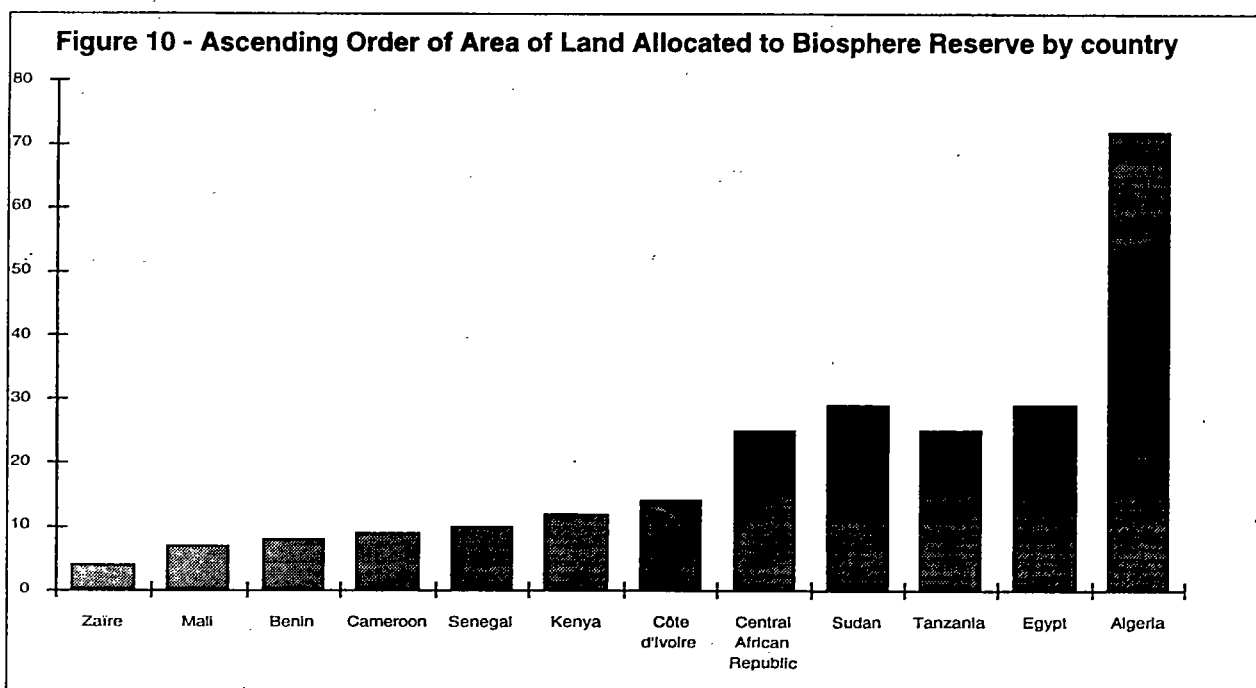
86. The countries with the largest participation rates in biosphere reserve designation as depicted by land area covered up to 1996 are in descending order, Algeria, Egypt, Tanzania, Sudan, Central African Republic, Côte d'Ivoire, Kenya, Senegal, Benin, Cameroon, Mali, Zaire, Uganda, Congo, Madagascar, and Guinea. These have over 100,000 hectares of land allocated to biosphere reserves and are as shown in Figure 10.

environment that local communities or national authorities are not comfortable with and so, many states either designate small pieces of land or not participate in the programme at all.

87. Majority of the African members States in the MAB programme have only one denomination of biosphere reserves even where the distribution of natural resources and climatic and vegetational zones suggest the possibility of more than one type. Only Kenya and Senegal have all three types of biosphere reserves that have so far been designated in Africa (Arid and semi-arid, Forest and Small Island and Coastal areas). Countries like Nigeria, Cameroon, Zaire, Tunisia, Algeria, Egypt and Guinea have the capacity and the natural resources to designate more than one denomination of biosphere reserve but have yet to do so.

### The Dakar Conference on Africa's Biosphere Reserves and Biodiversity Conservation

88. The above draw-backs on the development of biosphere reserves in Africa became the topic of a



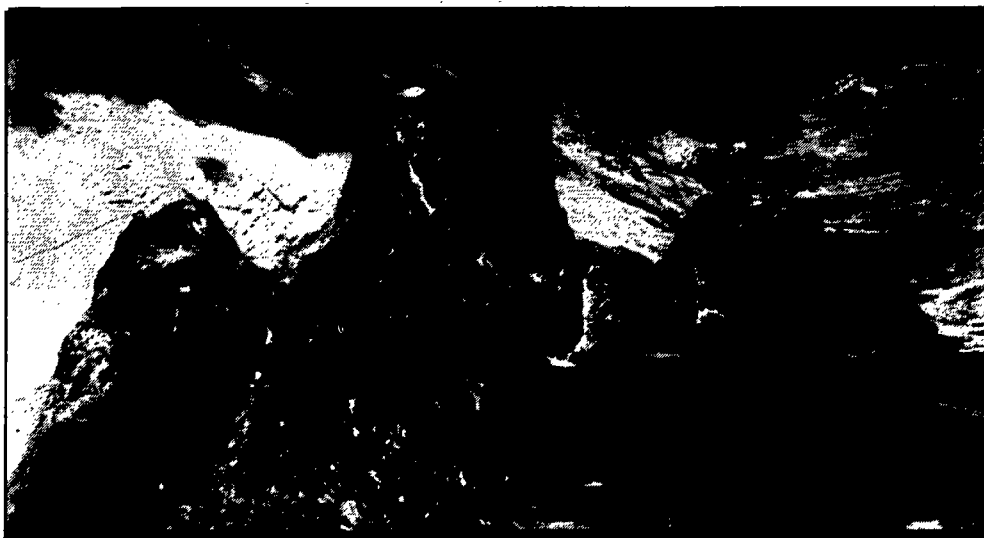
The other countries participating in the biosphere reserve network have land areas that are small and the reason for this might be that designation of land areas as biosphere reserves put so much restrictions on the exploitation of natural resources and the

major Regional Conference for forging cooperation on Africa's Biosphere Reserve for Biodiversity Conservation and Sustainable development held in Dakar-Senegal (UNESCO-BREDA) 7-9 October 1996. This Dakar Conference was a way to work towards

the implementation of the Seville Strategy and the Statutory Framework of the International Network of Biosphere Reserves. The Conference was also geared towards applying the special recommendation presented by the African group at the 13th session of the International Coordinating Council (ICC) of MAB which was to establish an African network of MAB to increase the participation in regional and international cooperation by African countries through biosphere reserves. The recommendation was also to strengthen cooperation between biosphere reserves and for this the network was essential.

89. Accordingly, among the objectives and concluding recommendations of this Conference was the establishment of an African network which specifically addressed the participation of member states. This was in pursuance of the recommendation earlier on presented to the ICC of MAB. The Conference therefore called on member states to immediately support the network when it was set up for regional cooperation in the continent on the MAB programme.

- ii) measures by UNESCO-BREDA to facilitate the revitalisation of national MAB committees or the establishment of new ones;
- iii) creation of a follow-up committee on the operation of the AFRIMAB network that takes into consideration the biogeographical and ecological character of Africa;
- iv) the establishment of training structures and specialised institutions to strengthen national capacities or reactivate existing ones to provide high and middle level man power specialised in the field of natural resources conservation;
- v) strengthening of existing research institutions working in the area of conservation by the states concerned with the tacit support of UNESCO and other development agencies promoting interdisciplinary research in harmony with the activities of the MAB programme;
- vi) the establishment of an information exchange network with a data bank on biodiversity along with a system for the dissemination of information within the framework of a Geographical



Mount Kenya Biosphere Reserve a source of most rivers supplying water for most of the Kenya population and a site rich in both flora and fauna diversity

90. The African network of Biosphere Reserves (AFRIMAB) which was set up by this Conference undertook an action programme of activities to make itself as active as other networks of the programme in Asia and Europe in the traditional areas of training, research and dissemination of information within the framework of field projects. Other recommendations of the conference included:

- i) the appeal by participants to UNDP for close cooperation to supplement contributions from UNESCO, Global Environmental Facility (GEF), and other cooperation agencies for the establishment and continued functioning of the network;

- Information System (GIS) and Environmental Information System (EIS), mainly as a segment of the activities of AFRIMAB.
- vii) survey of sacred groves with a view to identifying those which are viable for the conservation of biodiversity and have the potential for inclusion in the international network of biosphere reserves;
- viii) nomination for consideration by ICC, of transnational and transborder biosphere Reserves with countries involved for the conservation of biodiversity of a complete ecological system;
- ix) intensification of cooperation through the AFRIMAB network to enhance solidarity and regional coherence in dealing collectively with



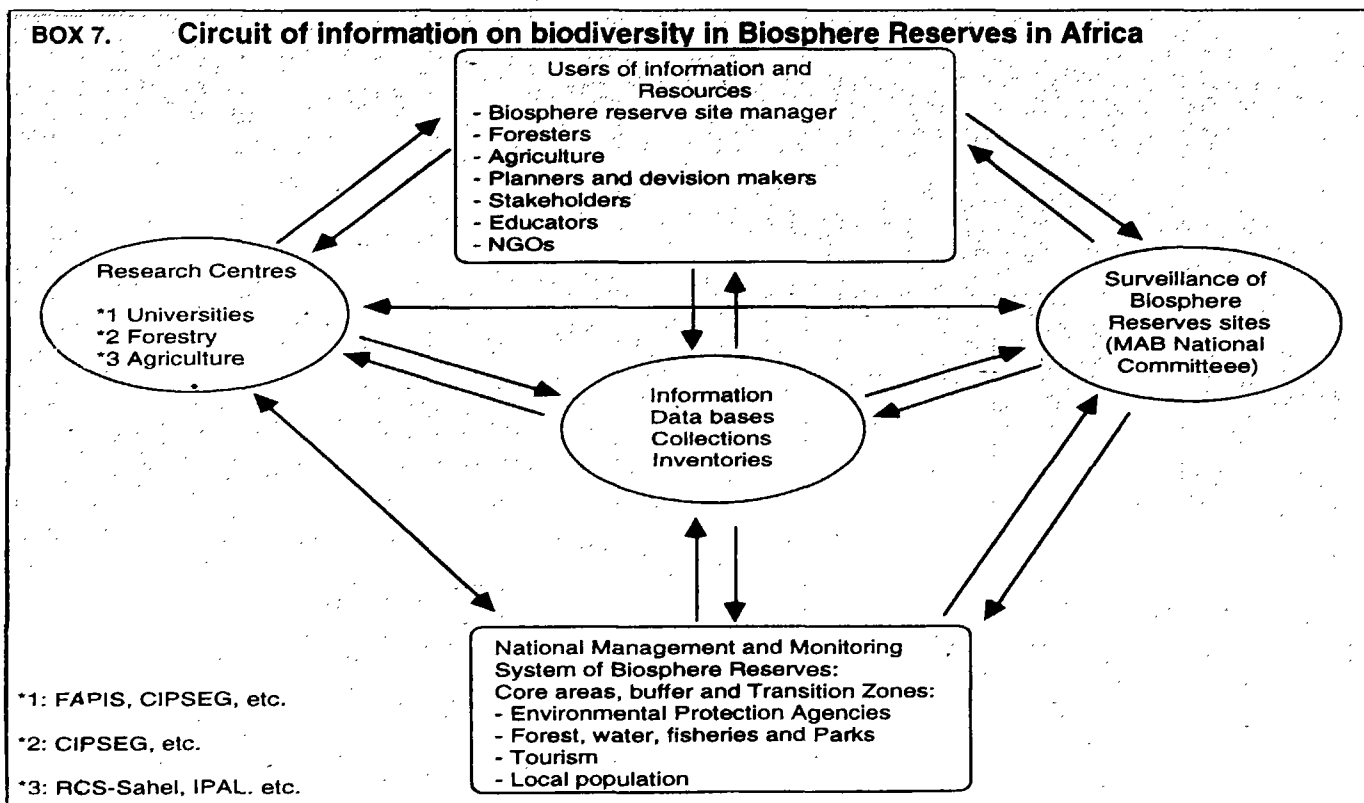
environmental problems of mutual interest;

- x) Promoting coastal and small island research and training for biodiversity conservation and strengthening management capacities for these MAB national committees to set up comprehensive ecological planning programmes for coastal areas;
- xi) reinforcement of participatory approaches in conservation work including the mastery of conservation technology by the local communities through information, education and interactive communication;
- xii) mounting of short and long term courses in African institutions leading to qualifications in areas relevant to conservation work for managers and planners of biosphere reserves;
- xiii) promoting mountain biosphere reserves of the AFRIMAB network by establishing a cooperative integrated project on major African mountains for the conservation of biodiversity.

91. Throughout this conference and in some of the recommendations made appreciation of and requests for funding from outside agencies were made. However, the action programme from this conference was advised to be well defined and made up of simple and practical activities which could be initiated without external funding, and which should take African socio-economic realities into consideration. The idea of conducting activities of the MAB programme without external funding as referred to at the Conference was not new. In some member states of

the MAB programme, like Nigeria, there are dotted projects that have been funded either fully or partly from national sources and these are reported to have contributed to the development of MAB. Projects in the Nigerian rain forest like the Omo Biosphere reserve are funded partly by the Nigerian Federal Ministries of Education and Science and Technology through the UNESCO national commission and partly by extra-budgetary funds in trust or regular programmes. Such a development is most desirable for land and environmental resources conservation in Africa. Firstly, it is an indication of national commitment to conservation of renewable natural resources and the environment which is an improvement over the mere awareness of the 1960's. Secondly, with this development it will be possible to designate new biosphere reserves for support from national resources as a deliberate and conscious attempt at reducing the dangers of land and environmental degradation in Africa.

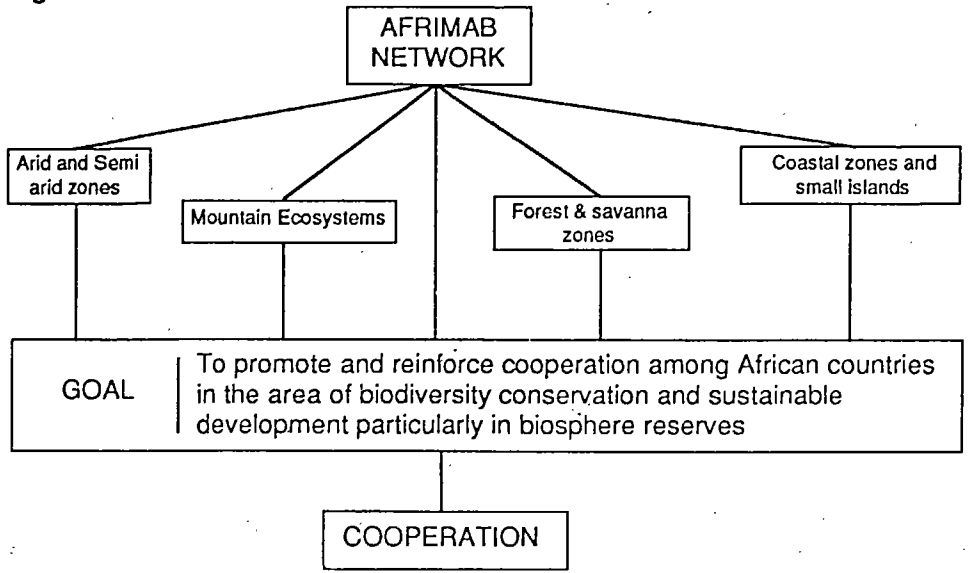
92. As a follow-up to the International Conference on Biosphere Reserves held in Seville (1995) the Regional Conference for forging cooperation in Africa's Biosphere Reserves undertook to work towards the implementation of the Seville Strategy and Statutory Framework of the World Network of Biosphere Reserves. In the first place AFRIMAB was patterned very much along the lines of the World Network founded in Seville including its statement of goals and objectives and the legal provision in the Statutory Framework. Article 4 of this framework



which spelt out the criteria for an area to be qualified for designation as a biosphere reserve was of interest

regional network (Asalnet, Forenet, Mountnet and Cossinet).

Figure 11 - AFRIMAB Network



The structure of the African network recommended and approved was as presented in Figure 11 below:

94. The regional offices in Dakar and Nairobi were appointed to act as coordinating secretariats of the two regional networks of Africa created in the conference. By this arrangement the focus of MAB in Africa required the orientation of existing activities as well as the pursuit of completely new initiatives. The sub-networks were expected to be expanded into

to the Region Conference on African Biosphere Reserves. In this connection highlands and mountain ecosystems which had not seen much of the light of day for designation were of interest to the conference with respect to their fulfilment of the criteria. As stated above these land-form types were to be promoted for designation.

93. The African Conference on Biosphere Reserve also proposed a structure of the AFRIMAB network conscious of the fact that the multi sectorial nature of the management of natural resources made it mandatory to have a good coordination at the sub-regional level to avoid mistakes, duplication and interference. Also, in view of the meagre resources of the African countries special attention was paid to the operational mechanisms of the network so as to avoid the situation whereby after it set up it does not turn up to be yet another framework too many. The simple framework arrived at in the conference comprised:

- i) at the national level focal points which should be the national committees for MAB or persons and/or institutions in countries where there were no committees;
- ii) at the regional level two focal points for each selected ecosystem;
- iii) the follow-up technical committee which should be made up of scientists from African;
- iv) Commission on the follow-up committee consisting of a president, vice president, rapporteur, and two member states per sub-

multidimensional information systems, having selected centres of excellence with successful programmes as well as project experiences in biosphere

The Dakar MAB Conference (October 1996) that created and launched AFRIMAB Network. 70 scientists from 24 African countries attended.



reserves capable of being reproduced in other countries. The network was to find sources of support to multiply its efforts and it was designated to identify, distil and propagate positive approaches that have been discovered to work. The leaders and groups (including local populations) who were to be strengthened, formal counterparts in corresponding biosphere reserves and each focal point was to act as a transfer agent putting successful approaches into the hands of policy makers and practitioners while at the same time seeking solutions to local biosphere reserves development problems.

### Problems of Biosphere Reserves

95. The different ecosystems that make up different biosphere reserves had been faced with problems of

land and environmental degradation, population pressure, and exploitation by man and cattle, etc. For example, the African coast is exposed to pollution, soil erosion and other artificial and natural phenomena which alter the landscapes. As a result the major coastal and island ecosystems had been so altered (e.g. Niger Delta of Nigeria, Volta Delta of Ghana, lake Manyara of Tanzania) that controls and checks became inevitable. There were no policies for sustainable management and preservation of the rich biological resources and diversity of these coasts except for the 1992 Convention on Biodiversity.

**BOX 8.****CONSTRAINTS**

*Most on site managers of biosphere reserves are either trained nationally, some through the military hierarchy, others in the regional institutions - Mweka Wildlife College in Tanzania for English Speaking Countries and Garoua College of Wildlife management in Cameroun for French Speaking African Countries. However most of these institutions need develop adequate knowledge base for sustainable Biosphere reserves management. While the MAB have made efforts to carry out some training in the use of Internet and GIS, major gaps still exist in the local capacity necessary for knowledge acquisition.*

96. Mountain and highland ecosystems were equally in danger because they are fragile due to altitude which increases erosion. To compound this problem mountains and highlands are preferred for human habitation in Africa and as a result of the increased population pressure these ecosystems have had increased problems of erosion, deforestation and agricultural practices which show little concern for conservation. One exception to this general trend is Madagascar which though located on a highland is a better managed biosphere reserve with policies on biodiversity that will lead to sustainable development. An environmental rehabilitation plan based on the principle of integrated approach to the problems of conservation and development had been taken up for this island in 1990.

97. The fragile nature of forest and savanna ecosystems of Africa (Omo of Nigeria, Samba Dia of Senegal, M'passa of Gabon and Tai of Cote d'Ivoire) have resulted from the system of land utilisation and the sectorial implementation of land conservation projects. The natural resources found in these forests constitute an inestimable reservoir of highly complex genetic material and Biodiversity. The resources which the ecosystems in these forests harbour are threatened in their entirety by population and economic pressure. The level of exploitation and degradation of biological resources in this zone far

out-pace the rate with which the areas concerned are renewed and rehabilitated. The net effects in these areas are a decline in soil fertility and natural biomass.

98. Biosphere reserve in arid and semi-arid areas, like Tassili of Algeria, Djebel Chambi of Tunisia and Niokolo Koba of Senegal, are faced with the common problem of soil infertility, the disequilibrium of the ecosystem and the permanent threat of desertification aggravated by the pressure from increasing animal population on grazing land which continues to recede as a result of overgrazing and bush fires, well as increasing demand for fuelwood by the local population.

99. Forest and savanna ecosystems have also been reported to be bringing their toll of human suffering on populations that live in them. The human and livestock population suffer the effects of insects of the forest through the development of parasitic and infectious diseases such as, bilharzia, malaria, sleeping sickness, and onchocerciasis. In addition, there are numerous parasites such as round worms, pin worms, whip worms, hook worms and guinea worms all of which have a debilitating effect on man and his livestock (Ayensu 1981). Thus it has been suggested that the basic biological problems to be solved in Africa involve the prevention and cure of diseases arising from contact with nature reserves in addition to provision of adequate food supplies. It is very likely that basic and applied research into insect systematics, physiology and life cycles and study of the other organisms that abound in the humid tropics may procure information that can find applicability in agriculture and health sciences and thus reduce human suffering. The perseverance of diseases such as the above have led to the abandonment of otherwise fertile land in Africa.

100. Indeed, various illnesses are reported to originate from wild life (Ebola fever from Congo, Guinea fever, Rift Valley fever, Lassa fever, Yellow fever). Most of the time these appear when the respective ecosystem is disturbed hence, the interest to identify and control the health indicators of suspected reserves. The stress should be laid on ecopathology like epidemic research on the interaction between wild life and the health of neighbouring population.

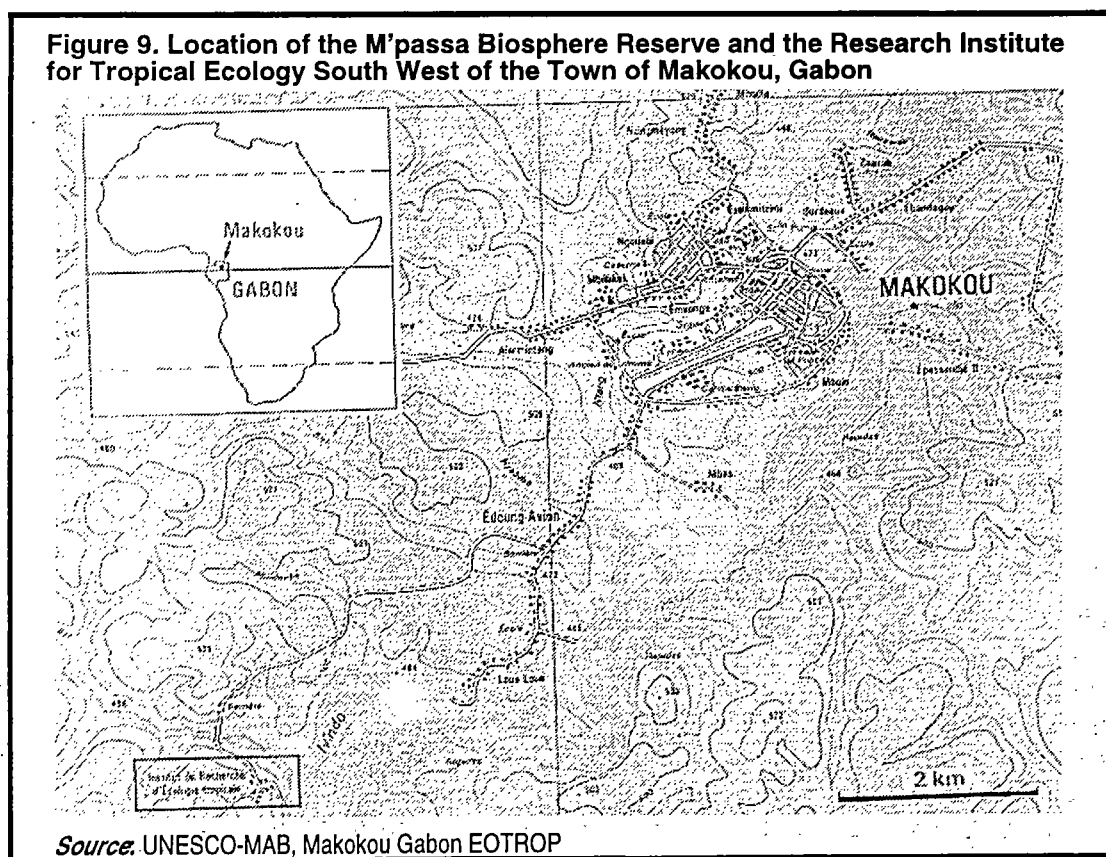
## An example of Forest Zone Biosphere Reserve (the M'passa Biosphere Reserve of Gabon)

101. A typical biosphere reserve located in the humid forest is the M'passa Biosphere Reserve near Makokou in North Eastern Gabon. This reserve was designated as a Biosphere Reserve in the UNESCO MAB programme in 1983. From 1962 a research station had been established at Makokou in the form of a «Biological Mission» by the French National Scientific Research Institute. Makokou was chosen because of its location as a large village hidden away in the dense tropical forest where the low density of human population had little impact on the natural environment. Bellinga is a small outreach station situated in a ferruginous massif with peaks reaching 1,000 meters in a forested environment even less affected by the hand of man than Makokou. During the 1960's many researchers undertook periods of field research of varying duration and frequency at Makokou research station and a specialised scientific journal, "Biologia Gabonica" which formed a principal Forum for the publication of their results until 1972 was founded.

102. The Biological Mission in Gabon was transformed into a laboratory of Primatology and

Equatorial Ecology in 1969 and to this the Government of Gabon allocated an area of 10,000 hectares some 10 km to the South of Makokou at a place called M'passa. A new research station was built after the construction of a 7 km forest road by the Primatology and Equatorial Ecology Research with living quarters, laboratories and animal houses. In 1979 the station became the Research Institute for Tropical Ecology depending largely on the National Scientific and Technological Research Centre of Gabon. The activities of the Centre started to contribute to UNESCO-MAB programme in 1979. It is through the continued efforts of national and international bodies that this research station in tropical forest ecology has been maintained and continues to be one of the best known forest ecosystems in the humid tropics. The town of Makokou is located in the province of Ogooué-Ivindo in North Eastern Gabon slightly to the North of the Equator at about 500 meters altitude.

103. The undulating plateau made up of many hills at Makokou, is covered by dense evergreen humid forests. The Ivindo river, a tributary of the Ogooué, is at this point quite wide but it is punctuated by rapids and waterfalls which make navigation impossible. Makokou is hardly exploited for its forest reserves because of the difficulty of access. Agriculture is of the subsistence type based on shifting cultivation and a few coffee plantations. The climate



is of the equatorial type with four seasons. This area has a persistent cloud cover which produces the lowest temperatures of the year. Mean annual rainfall is in the order of 1,700 mm and the average temperature is 24°C.

104. Access to the research station is regulated, and those wishing to work there need to obtain the permission of the director of the Research Institute for Tropical Ecology. The Station buildings are situated on a plateau which overlooks the Ivindo river and are dispersed over about 10 hectares of secondary vegetation. The Research Institute for Tropical Ecology receives a yearly budget from the Government of Gabon for the upkeep and maintenance of the research station at Makokou another instance of local support of conservation. The laboratories are grouped in the center of the station. A climatized library provides for the conservation of the books and animal specimen. There is a climatized herbarium with a preparing room which contains reference specimen and a catalogue of colored photographs of more than 500 plant species. Around the laboratories are a few animal enclosures set in the understory of the forest. Cages have been constructed for studies of animal behaviour and physiology under captive conditions. Several shelters also exist for the establishment of nurseries, enabling the study of forest tree species. A number of species have been transplanted in a aboretun and in experimental agroforestry plots set up at the edges of the forests.

105. With the creation of the forest reserve on the M'passa plateau, it has been possible to develop more intensive studies in tropical ecology. A series of forest quadrats has been set up using a system of coordinates which are marked at ground level by a network of small paths at 100 m intervals. Along these pathways, trees and climbers are left intact, and only shrubs and low lying plants are cleared. Over a 150 hectare area have been marked out as a function of the needs of the different research workers. Several other forest paths - originally hunting tracks - provide access to the heart of the forest reserve.

106. These so called ecological quadrats were set up to facilitate the sighting and observation of animals within eco-ethological studies. They have also been used in botanical studies on forest phenology and production. Several thousand vertebrates have been marked in the forest using different capture-recapture and radio-tracking systems. Many birds have been marked but so have other groups such as monkeys, rodents, ruminants, bats, etc. Numerous trees have also been marked, and several of these along the

forest tracks and pathways carry specific identification tags, to facilitate quick identification of species.

107. Initial work has necessarily focussed on plant inventory and the description of new species. As of 1987, 71 families had been examined and 29 volumes of the flora of Gabon had been published. For the Makokou region there exist a catalogue of the flora of the flowering plants of North-Eastern Gabon, which has been published in various lists from 1964 to 1980. The number of species in this inventories is 1,233 and an updated listing presently in preparation goes up to 1,500. A comparative analysis of the species richness of stands in the Mpassa reserve shows the predominance of leguminous types just as in the neotropical forests.

108 The structure of the forest has also been studied, with respect to the presence and distribution of animals: analysis of the different strata used by sympatric species of the same group, importance of the density of understory for ground-living animals, importance of climbers for gliding animals, etc. Understanding the mechanism of forest regeneration has involved a variety of studies on germination and seedling ecology which are key developmental stages for a species. The reconstitution of the forest after shifting cultivation has also been examined.

109. On-going research projects at Makokou within the framework of MAB are mainly linked to MAB project Area I, focussed on the ecological effects of increasing human activities on tropical forest ecosystems. The principal underlying objectives of this research effort are to identify the different parameters of the forest ecosystem and thereby to gain an understanding of its functioning but also to gain insights of the changes and perturbations in the system, both in the short and long term and to elaborate and test management approaches for the rational use of the tropical forest environment.

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## Border Areas and Sacred Lands

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110. Border areas are not biosphere reserves in the strict sense of the word but sites of enforced and statutory conservation like biosphere reserves because the land and its resources making up the border is a forbidden zone for cultivation or any other form of land use in most of Africa. These have been identified by the MAB programme for inclusion in its activities in Africa. Use of land and its resources in border areas has been the source of many conflicts in Africa

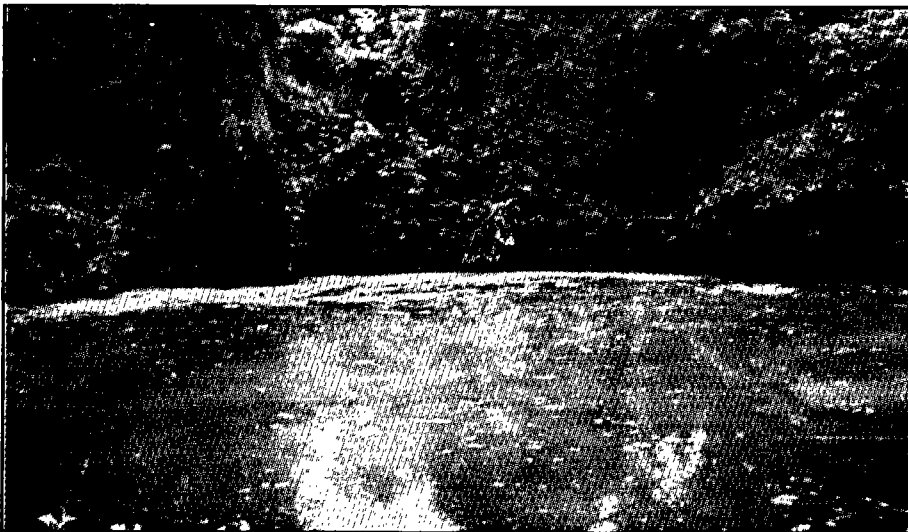
which makes the recommendation for transboundary reserves in the Dakar conference a welcomed resolution as it ensured the continued existence of reserves that were on both sides of the border between two nations. This recommendation also ensured the designation of new biosphere reserves. Border areas can be unique as biosphere reserves because even under normal circumstances border areas are little used for any purpose whatsoever. This non-utilisation of border areas for any purpose (agricultural, mining, etc.) guarantees the conservation of such areas and hence the source of genetic material and biodiversity. In Africa where there are so many geopolitical divisions border areas provide great opportunities for conservation.

related to the population's cultural tradition of respecting various taboos. For example, the Masai in East Africa hardly eat wild-life meat and the Tenda of the Niokolo Koba biosphere reserve in Senegal exploit the resources of the sacred milieu (wood or fauna) only on occasions of ritual and/or religious ceremony.

**BOX 9.**

*Convention on biological Diversity is very clear in its attitude towards the practitioners of traditional land management. Article 10 (c) states, Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.*

112 Bush fallow methods are used during shifting



Convention on Biological Diversity recognize traditionally managed ecosystems like this sacred crocodile pool in the Gambia. This site has about 70 crocodiles traditionally protected for centuries.

cultivation in Africa as a way to preserve land fertility and so, like the sacred bush phenomenon which are privileged areas that are prohibited from exploitation. AFRIMAB is closely looking at it. The fallow period however is limited in contrast to the sacred bush. The sacred bushes are not used at all for any kind of human activity and they therefore represent reservoirs of biological diversity whose conservation is not of any concern to the local population. Traditionally,

111. Like border areas sacred lands (forests, woodlands, rivers, lakes, mountains) are privileged areas where the concept of conservation of nature and cultural heritage fall in harmony. The form of conservation here borders on the utilisation of natural resources in accordance with traditional knowledge and customs. In some African countries the conservation of natural resources is related to the population's social organisation and cultural tradition. In other words, natural resources of the sacred milieu are utilised in accordance with traditions and customs. Many of the laws of tradition regulate individual and/or collective use of land resources and reserves sanctions for transgressions.

nally, local populations use the secret milieu phenomena as a strategy for conservation of the land on which they depend for farming.

## Effects of the Biosphere Reserve Concept

The guiding principles behind the MAB programme will be in perfect agreement with sacred forest idea if limited exploitation of the resources is allowed for the development of the people and their communities. The difference that exists here is that among the tribal populations conservation of natural resources is

113. In many countries of Africa establishment of biosphere reserves are reported to have had positive effects on the life of the people (e.g. Tai forest in Cote d'Ivoire, M'passa in Gabon, etc.). In agricultural regions where majority of the people live by farming biosphere reserves have protected their land from wind and water erosion by the vegetation preserved for this and other purposes. The most striking example of the opposite of this is found in the Western or North Sahel in Africa where biosphere reserves are rare and so land degradation due to erosion is most devastating.

114. The wild life of biosphere reserves also plays an important biological role in the maintenance of surrounding agricultural land: birds control gnawers, insects guarantee pollination, bats control insects and pollinate many fruit trees.

115. Biosphere Reserves have also been used in the maintenance of populations in the rural areas of Africa which are provided with a living through the jobs created in tourism, game ranching, etc. The special German funded BRAAF project in five English speaking African countries set out to achieve an identification of one of several activities capable of providing vocations to people living in respective biosphere reserves are as follows:

- i) In the Bia biosphere reserve of Ghana beekeeping, rice/grinding, economic and ecological impact of Africa's giant snails collecting are undertaken;
- ii) The transition and buffer zones of the Amboseli of Kenya is involved in an evaluation of the impact of tourism through game ranching and an evaluation of the economic and ecological management of the Masai;
- iii) The Omo biosphere reserve of Nigeria's tropical rain-forest has a study of traditional usage, consumption and natural resource selling;
- iv) The Manyara biosphere reserve of Tanzania has bee-keeping, fishing and enhancing camping sites for tourists;
- v) The Queen Elizabeth biosphere reserve of Uganda supports a crafts center at its entrance to produce objects made by women.

116. Thus biosphere reserves are used in helping populations to improve their economic welfare through the use of suitable technologies. These activities when selected by the local populations provide a living during their stay on the reserve and prevents destruction of the resources to be conserved.

117. Thus it appears that each reserve shelters a great number of animal and plant species growing in a natural area and contributing to maintain economic welfare and the genetic resources for national development. These resources are used to meet the needs of neighbouring rural populations. Indeed, in biosphere reserves reservoirs of these resources are preserved to meet the needs of the local populations. It has also been shown that biosphere reserves are useful in the transmission and study of traditional forms of land use and conservation as traditional populations have developed stable systems of resource utilisation of outstanding value for the development of modern resource management.

## Biosphere Reserves Environment after effects of War

118. Indeed one can very well say that Africa as a whole is in turmoil. The last decade has been characterized by severe ethnic wars in several countries, hunger and malnutrition in others resulting to unsurmountable refugee problems and human death. Long term damage to people, animals and land by the effects of World War two conflict is still being felt today in some European and Northern Africa Countries.

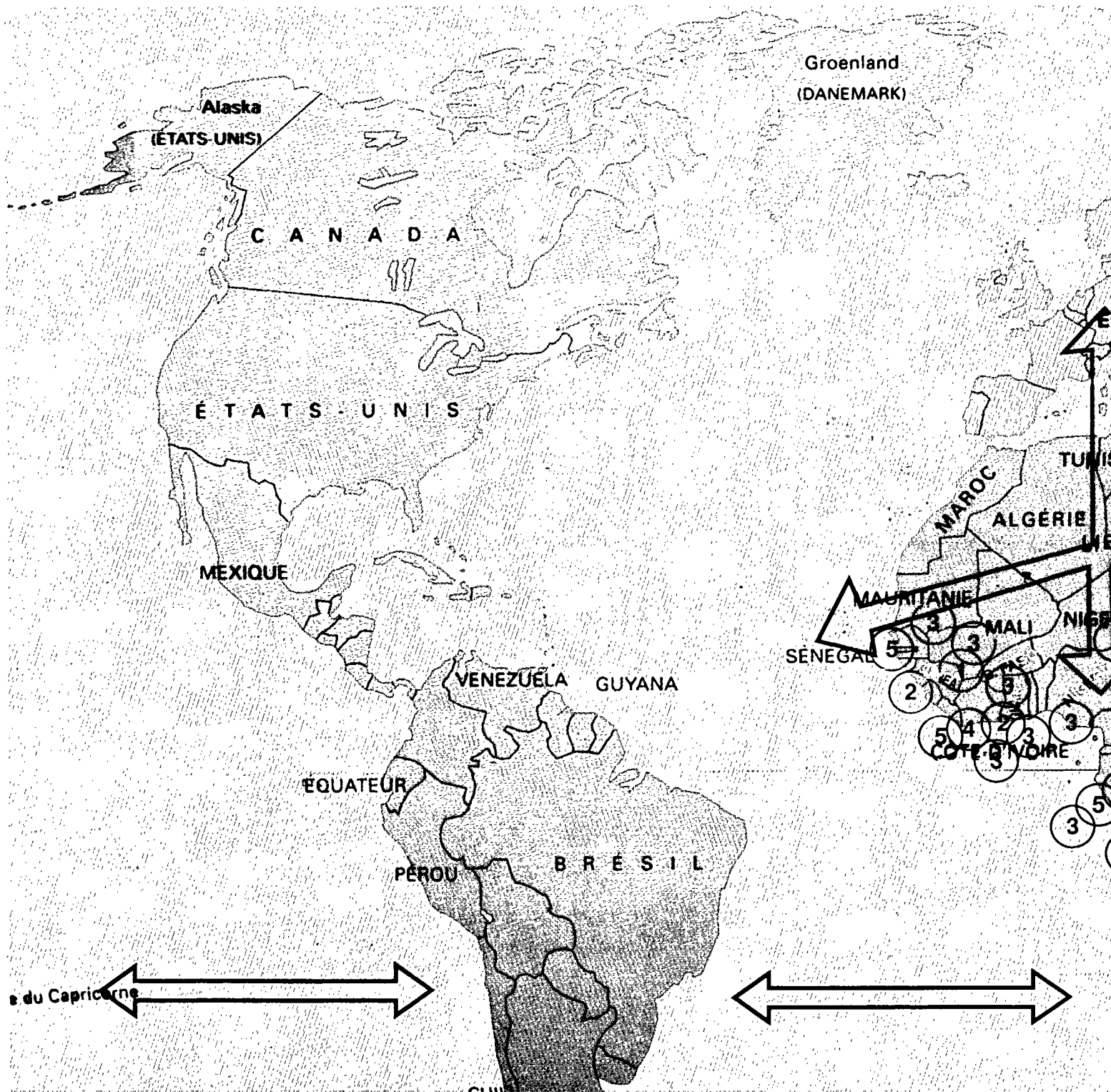
Africa will face similar long-term damage as a result of on-going conflicts. Not only due to physical disturbance to the landscape, but the legacy of unexploded bombs, mines, artillery shells, grenades and bullets continue to maim people long after the cease of the conflict.

The displaced people ravaged by hunger malnutrition and disease have found refuge in Africa forested Biosphere Reserves, for example in Central and in West Africa. The impact of human occupation of these reserves on flora and fauna will take a long time before it is documented. These sites are also important as they constitute stop-over points for migrating birds going between Europe and Africa. Therefore, the value of these managed sites is not only national and regional but also international.

## Integrated Projects

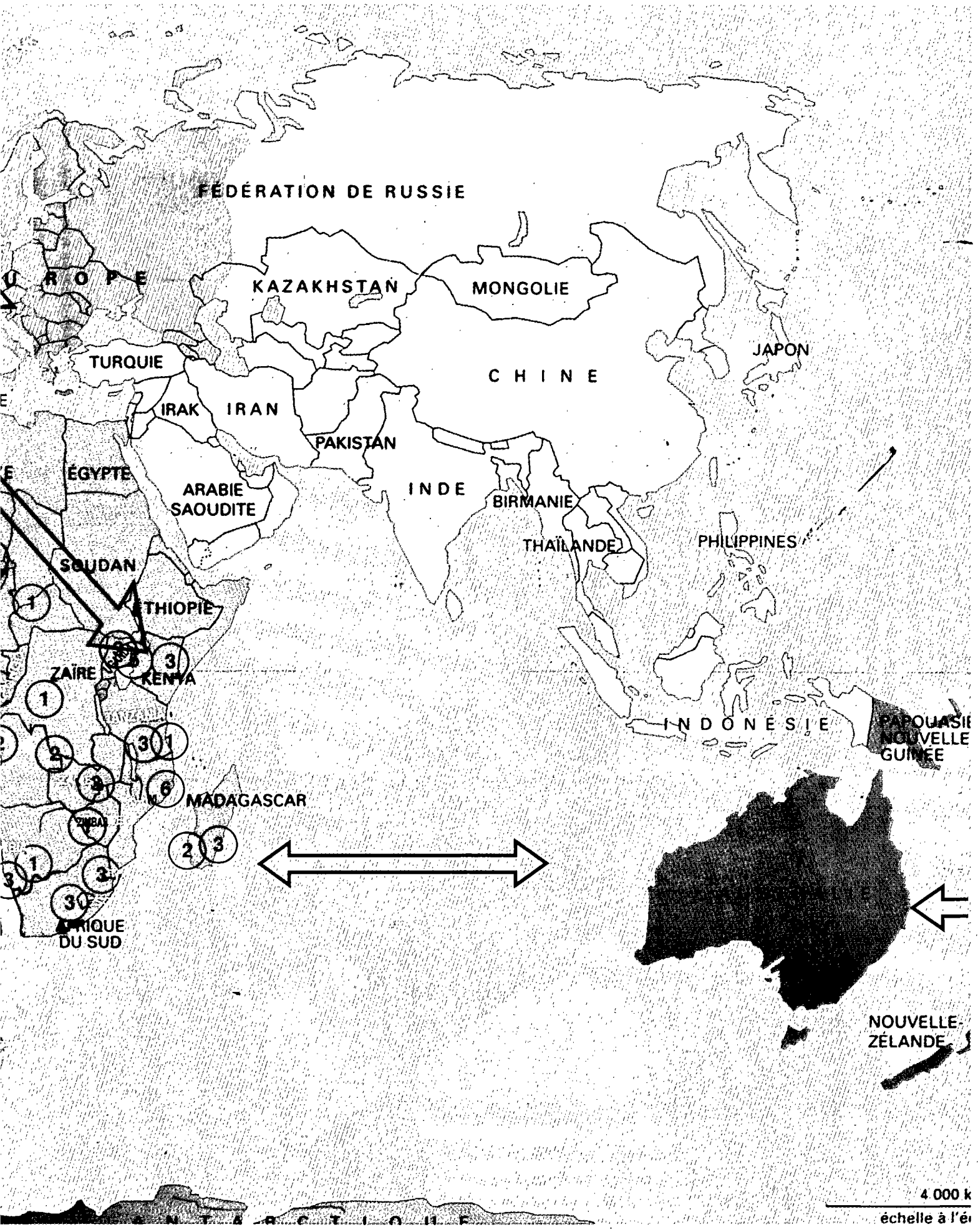
119. Integrated projects constitute the other major areas of activity of the UNESCO MAB programme in Africa. The typical integrated MAB project serves a research function, a training function and a demonstration function including dissemination of information. In most cases however a project is limited to one or the other of these functions. In all cases the projects are located in biosphere reserves or in areas that are to be designated as biosphere reserves. This shows that the integrated projects of the MAB programme have been circumscribed into the relatively new concept of biosphere reserve. The common feature to all MAB projects like the biosphere reserve is that they are all aimed at conservation of land and/or environmental resources linked to the development of local communities.

120. The integrated projects have other characteristics that distinguish them from one another. Some of the projects are pilot while others are at their implementation stage. The projects are also located



- 1 • On-going applied research (Long and limited duration)
- 2 • Beneficially of training on Internet and Geographical Information System (GIS)
- 3 • Beneficially of one or several MAB's Funds-in-trust development projects
- 4 • UNESCO-MAB chair
- 5 • Young MAB Scientist Award
- 6 • Sultan Ghaboos Conservation Award





FÉDÉRATION DE RUSSIE

EUROPE

KAZAKHSTAN

MONGOLIE

JAPON

TURQUIE

CHINE

IRAK

IRAN

PAKISTAN

ÉGYPTE

ARABIE SAOUDITE

INDE

BIRMANIE

THAÏLANDE

PHILIPPINES

SOUDAN

ETHIOPIE

ZAÏRE

KENYA

INDONÉSIE

PAPOUASIE NOUVELLE GUINÉE

MADAGASCAR

AFRIQUE DU SUD

NOUVELLE-ZÉLANDE

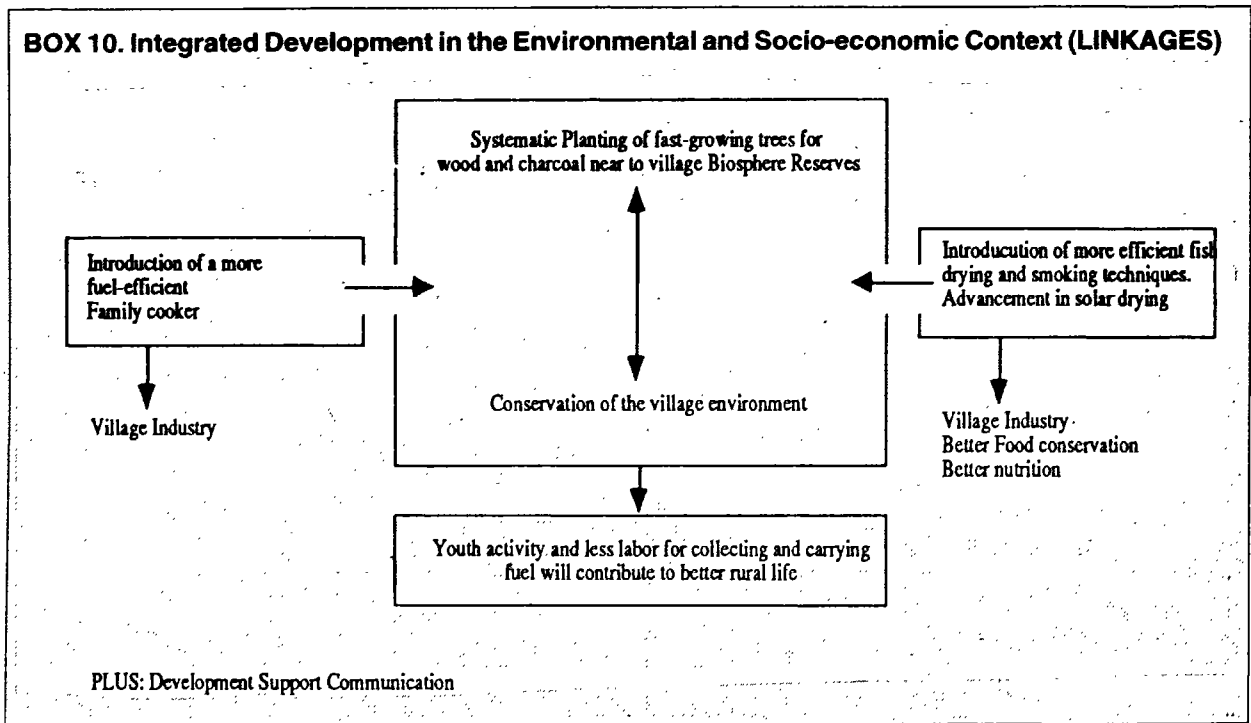
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Table 2: Characteristics of the MAB Integrated Projects

Characteristics/ Biosphere Reserves Integrated Projects	Mountain/H ighland	Coastal/S. Island	Arid/Semi Arid	Forest/ Savanna	Experiment	Pilot	Demonstration	Training	Research
Tassili			X						
Kala			X						
Pendiari			X						
De la Mare				X			X	X	X
Teza	X							X	X
Waza				X					
Benoué				X					
Dja				X					
Bassa Lobaye				X		X			
Bamingui				X					
Odzala				X		X			
Dimonika	X			X			X	X	
Tai				X		X	X	X	
Comoe				X					
Omayed			X						
Wadi Allaqui			X						
M'Passa	X			X		X			
Bia				X				X	
Nimba	X			X		X	X	X	
Massif Ziama				X					
Bolama		X							
Mt Kenya	X			X		X	X		
Mt Kula	X		X						
Malindi Was		X				X			
Marine Kloya		X							
Amboseli			X				X	X	X
Manavava			X					X	X
Boucle de Boade			X				X		
Macchabee		X							
Omo				X		X	X		X
Voloans				X					
Samba Dia				X		X			
Saloum		X							
Niokolo								X	X
Dinda			X					X	
Raadon			X						X
Manyala			X						
Serengeti			X			X	X		X
Djebel Bou			X				X		
Djebel Chambi			X				X		
Ichkene			X				X		
Zamba Zimbrette		X	X				X		
Rwenzori			X	X					
Yamgambi				X		X			X
Luki				X					
Lutira				X					

**BOX 10. Integrated Development in the Environmental and Socio-economic Context (LINKAGES)**



in one of the four types of ecosystems into which Africa's land resources are categorised (Forest/savanna, Arid/semi-arid, Coastal/Small island, and Mountain and highlands). These characteristics distinguish the projects from one another and sometimes determines which function would be served (research, training and administration). The detailed characteristics of each of the projects undertaken in and out of the various biosphere reserves in Africa are as presented in Table 2 below.

121. From the above profiles of the projects it appears they all serve the function of demonstrating conservation which is past of the ultimate goal of the MAB programme in Africa: conservation of Africa's land and environmental resources. However there are a few that are intended more for demonstration purpose more than others. The project on preservation of natural ecosystems in Madagascar is a typical example of a project on demonstration of conservation of natural ecosystem. Activities of this project were carried out in three sites: Mananara, Andasible, Matandi and Ankarafuntika. The main objective of this project was the demonstration of how to achieve integrated preservation of biological diversity. The project mainly undertook to put an end to the degradation of forest ecosystems and preserve the regions natural resources to help local people improve their living conditions in as far as health, education and agricultural production were concerned.

122. The Mayombe project in Congo combines the characteristic of being a forest reserve as well as a mountain/highland ecosystem whose objective was

to make the reserve of Dimonika a fully functional geographic entity for the preservation of biodiversity and integrated development. The project contributed to sustainable development and exploitation of natural resources for the benefit of local populations, encouraging them to increase production while presenting their natural heritage. It undertook intensive training, demonstration programmes and the spread of information to better raise awareness of environmental problems of the people concerned. It is one of the few MAB projects that emphasises increase in production by the local population and at the same time cautioning preservation.

123. Mont Teza in Burundi plays host to another project in a mountain or highland ecosystem which aimed at studying land erosion. This research project provided further scientific knowledge about land erosion in a mountain region.

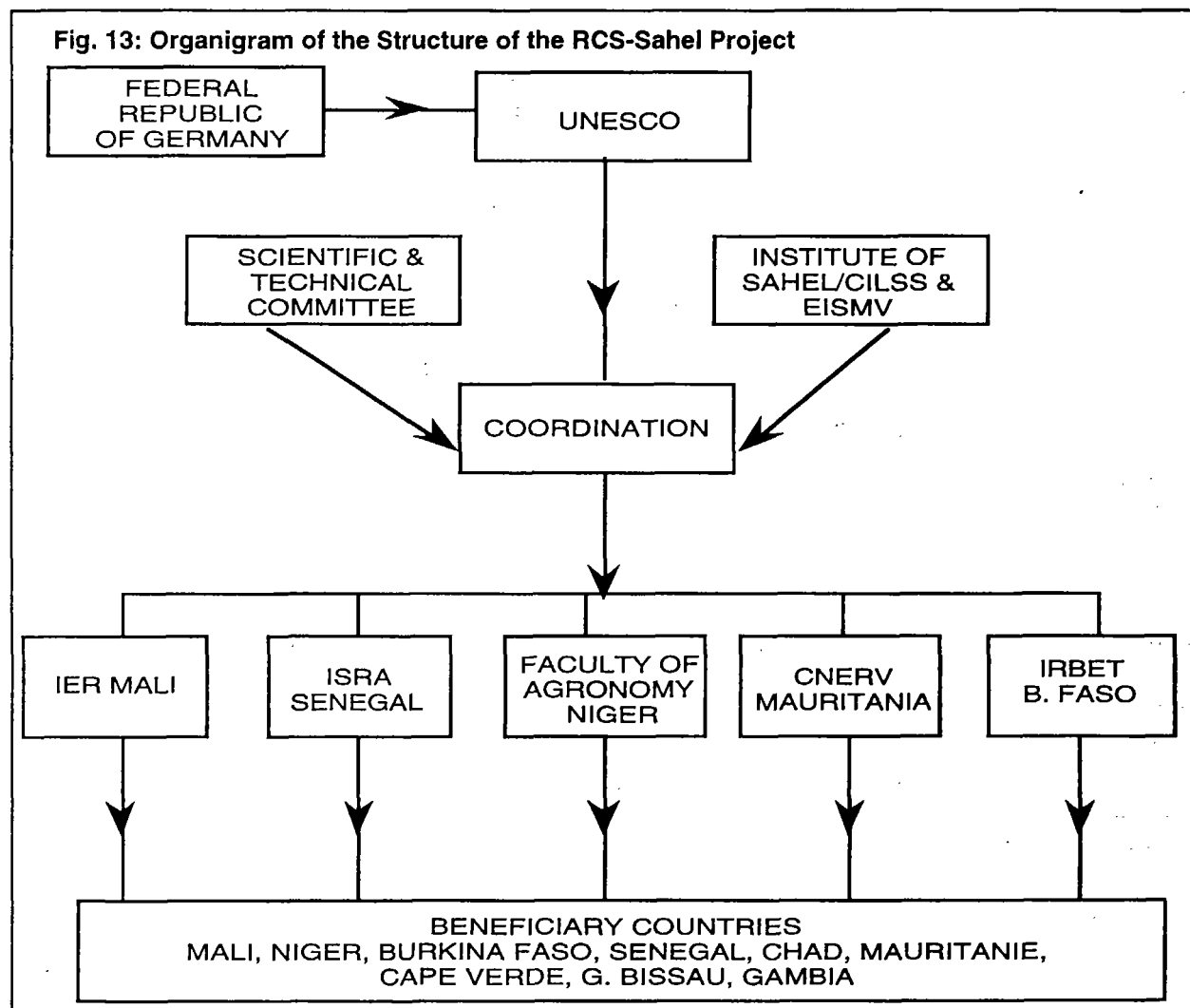
124. The project in Cote d'Ivoire and focussed on the Tai Tropical forest is perhaps one of the most advanced MAB projects in Africa. Tai is West Africa's most extended, densely populated tropical forest and so the project's goal was to match the protection of genetic diversity with the needs of economic development. The project also aimed at extrapolating the obtained results from the Tai region to the South-West of the country. This exercise indicated that a given tropical forest study can bring to light data of considerable importance for overall global studies.

125. Three integrated projects on arid lands (IPAL) within the MAB network of projects in Africa are

found in Kenya, Tunisia and Lesotho. These projects lay emphasis on the functioning of traditional pastoral system in the arid parts of the continent and on the means of improving these systems with a view to promoting the population's conditions of life and guaranteeing an efficient protection of the natural milieu. Apart from the various scientific and technical results obtained about the different components of

the reinforcement of training and demonstration activities in order to develop host institutions capacities for formal research.

127. The other MAB project which runs across several African countries (the typical transboundary activity of biosphere reserves) and multi-functional in scope is the one on the strengthening of scientific



the natural milieu the Kenya project, located in Mont Kulal, came up with a design of development of about half the research area as well as the creation of a research station for arid zones. Like Lesotho the objective of the Kenya research station is to ensure the pursuit of research activities, training and demonstration already launched by the project. The station was also to develop new accompanying researchers to guarantee effective implementation of the development plan or any other development plan for the arid parts of Kenya.

126. The Tunisia project on the other hand, is subjected to global studies and researches with emphasis on deeper scientific knowledge as well as

capacities in the field of Agro-silvo-pastoral Management in the Sahel (RCS-Sahel according to its French acronym). This project is an extension of an earlier project (FAPIS-Formation en Aménagement Pastoral Intégré au Sahel) which had lasted from 1980 to 1989. The project was designed because of the lack, in Sahelian countries, of specialists in the fields of pasture land development. It aimed at an integrated approach to rural development. The details of this project are as given in the summary below.

**The RCS-Sahel. An Example of the Transboundary multi-functional Project**

128. Many countries located in arid and semi-arid

zones, the Sahelian countries (9 member States of CILSS), have been confronted with rapid degradation of their natural resources over the past two or three decades due to the combined effects of growing human pressure and recurrent droughts. This degradation has led to accelerated desertification processes in many cases.

129. Participating in the joint efforts of the international community and of the countries themselves, UNESCO has launched during the past two decades various programmes and projects which address these problems. Among these efforts is the project «Strengthening of Scientific Capacities in the Field of Agro-silvo-pastoral Management in the Sahel» (RCS-Sahel according to its French acronym).

### *Origin and Objectives of the RCS-Sahel Project*

130. The RCS-Sahel project is a follow-up activity of the project FAPIS ((FAPIS-Formation en Aménagement Pastoral Intégré au Sahel) which lasted from 1980 to 1989. However, contrary to the FAPIS Project, which functioned as a centralized project aiming at the training of high-level managers and technical staff, the project RCS-Sahel has been conceived as a decentralized project for promoting interdisciplinary field research. To this end, emphasis is put on the strengthening of national research teams which work on priority topics that have been identified by the countries themselves.

131. A first phase of the project lasted from October 1989 to June 1993 and a second phase has been implemented in 1994 and in 1995. The immediate objectives of the first phase were the following:

- Stimulating the implementation of research programmes with regard to the restoration and the rational management of Sahelian silvo-pastoral ecosystems on the one hand, and improving agro-forestry systems in the Sudano-Sahelian environment on the other;
- Improvement of the functioning of 6 to 7 research stations or experimentation sites which can also serve as focal points for training, demonstration and diffusion of information for programmes targeted at integrated rural development and combating desertification;
- Ensuring the training of scientists and high-level managers who are in charge of implementing such programmes;
- Familiarizing researchers with approaches and methods of applied interdisciplinary research

for the management of natural resources and land-use planning;

- Ensuring the diffusion of the scientific and technical results emanating from work carried out in these programmes to the various categories of end users;
- Strengthening the scientific and technical cooperation among the countries of the Sahelian sub-region in different fields of rural development and for combating drought and desertification.

### **Organization**

132. This project's general organization are indicated in the enclosed organigram:

The organigramme shows all participating partners, the project's coordinating organs, as well as the national organs and the focal points in the field.

It shows in particular that:

- a) The activities of the project cover all nine Member States of CILSS (Burkina Faso, Cape Verde, Chad, Gambia, Guinea-Bissau, Mali, Mauritania, Niger and Senegal), even if the research activities are concentrated in five countries only (Burkina Faso, Mali, Mauritania, Niger and Senegal);
- b) The Institut du Sahel/CILSS and the Ecole Inter-Etats de Sciences et Médecine Vétérinaire in Dakar (EISMV) are closely associated with project activities as regional partners;
- c) All activities are coordinated by a scientific committee which includes the main partners of the project.

### **Activities**

133. The RCS-Sahel project is active in the following three complementary domains:

- Research and testing;
- Training;
- Information diffusion and strengthening of regional cooperation.

134. Research activities are carried out along the following three principal axes:

- a) Management of silvo-pastoral ecosystems in the Sahelian zone;
- b) Improvement of agro-forestry systems in the Sudano-Sahelian zone;
- c) Strengthening of research activities and support to development in two biosphere reserves (the Mare aux Hippopotames in Burkina Faso and the Boucle du Baoulé in Mali).

135. Three types of training activities are carried out in the project:

- a) Individual training of young researchers by providing them with a scientific framework and by offering them the possibility of embarking on internships in other countries;
- b) Group training within the framework of regional courses and seminars during which emphasis is put on methodologies and techniques relevant to the management and land-use of natural resources;
- c) Individual or group study tours to neighbouring countries in order to promote direct information and know-how exchanges.

136. The diffusion of information is handled in particular by the publication of synthesis of documents emanating from project courses and seminars as well as from study trips and field visits.<sup>6</sup>

137. The project's activities are not only supervised by the scientific coordination committee, but also by the director of the Institut du Sahel/CILSS in its function as the regional cooperation organ.

### **Brief summary of the project results**

138. In general, the activities of the first phase of the project (1989 to 1993) were reported according to the initial requirements: distinction between the activities implemented at the national level and those activities implemented at the regional level.

139. Various forms of support were provided to the five national research institutions with a view to helping them develop field activities, to better use the results of their research and to promote new approaches. The five national institutions are: IRBET in Burkina Faso, IER in Mali, CNERV in Mauritania, the Faculty of Agronomy in Niger and ISRA (Department of Forestry Research) in Senegal. Support was provided as follows:

- Provision of equipment: vehicles, laboratory material, field equipment, upgrading of research stations;
- Provision of internship grants: 15 young researchers have benefited from grants (3 from Burkina Faso, 6 from Mali, 1 from Niger, and 5 from Senegal);
- Provision of consultant missions: 20 national consultant missions and 7 international consultant missions have been organized to advise on research activities or to assist in the animation of national or regional seminars;
- Provision of financial resources through yearly

research contracts to ensure the implementation of programmed activities in the five countries concerned.

140. The four other countries (Cape Verde, Chad, Gambia, and Guinea-Bissau) have benefitted from financial support for the organization of national seminars or courses.

141. *Regional level. Training:* At the Regional level, particular attention has been given to the training of researchers and technicians, notably through the organization of courses and seminars on:

- a) Methodological issues:
  - Vegetation study methods;
  - Water-soil-plant-atmosphere relations;
  - Interdisciplinary research approaches and methods.
- b) Ecosystems restoration techniques and attempts to improve production systems:
  - Environmental conservation and natural resources management;
  - Improvement of the fertility of Sahelian soils;
  - Sahelian silvo-pastoral production systems.

142. Six regional training sessions were organized to accomplish this objective. 184 high level scientists benefitted from the training sessions.

143. Field visits were organized on the occasion of each course and seminar with a view to better sensitize participants on the solving of practical problems and to initiate diffusion of research results among rural populations and local technicians.

### **Research coordination**

144. The different courses and seminars mentioned earlier provided the forum for the exchange of information on specific subjects. In fact, each country was asked to present during the course and seminars a summary on the state of research in progress which was dealt with at the course.

145. Moreover, the state of the project's research was reviewed at the annual meetings of the project's scientific coordination committee.

146. In May 1992, a synthesis seminar was organized in Dakar (Senegal) to summarize the silvo-pastoral research efforts carried out in the Sahelian countries. Some 60 participants (researchers, specialists and development experts) from the nine CILSS Member States as well as from other countries took part in this seminar. A synthesis report with

conclusions was published as final report of this seminar. At present, a publication of the essential papers of the seminar is under preparation.

**Information diffusion and strengthening of sub-regional cooperation**

147. Four publications have been produced and widely diffused within and outside the region:

- Approaches and methods in interdisciplinary research: application to the management of natural resources and land use in the Sahel;
- Conservation of the environment and natural resources in the Sahel (with the support of the ACCT);
- Biology and fertility of Sahelian soils (with the support of ABN);
- Water in the soil-plant-atmosphere system (with the support of ORSTOM).

148. Information concerning project activities were regularly published through RESADOC (network of scientific and technical documentation), Sahel-Info and INFOMAB which are information bulletins of the Institute du Sahel and of the programme on Man and the Biosphere (MAB) respectively.

149. The regional dimension of the project has been assured through training activities to which the nine countries of the CILSS are associated, and the holding of periodic meetings of the scientific and technical committee in which the sub-regional institutions are represented. Moreover, numerous study visits were organized to encourage information exchanges among the researchers of the various countries of this sub-region.

150. The project's scientific and technical committee and the Institut du Sahel of CILSS attached a high priority to the exchanges between countries and to the importance of local Institutions to play a coordinating role with regard to national research activities and to provide their results to the relevant Institutions of the sub-region.

**Conclusion**

151. The various national and regional actions contributed to:

- an improvement of approaches and methods: systemic approaches, integrated vision, larger participation of local populations to the conceptualization, implementation and follow-up/evaluation of research-

development programmes...);

- the establishment of interdisciplinary and motivated teams contributing to research, development and application exchanges within Sahelian countries ensured contracts between Sahelian specialists and the scientific community involved in solving problems on the conservation of resources, biodiversity and sustainable development.

152. *Key concepts in the MAB programme in Africa.* There are a number of key concepts characteristic of the MAB programme particularly as it is undertaken in Africa. These require special elucidation with illustrations if the full philosophy of the programme is to be grasped. These include:

**Research**

153. There are many aspects of Natural Resources Management which need further research especially on the savana and marginal lands where many rural Africans live. Interdisciplinary and ecological approach to research as promoted by MAB is needed that encompasses a broad range of system components, including the socioeconomic aspects of human involvement in these ecosystems.

Gaps in the capacities of institutions to undertake research and development in natural resources management vary. Significant support is needed to bridge the gap between researchers and end users of research results. This can be achieved through improving capacities of institutions to use appropriate participatory approaches that effectively involve the ultimate beneficiaries - the local communities.

Gaps in the tools available to link research development and policy such as methods or equipment



Field training of biosphere reserves site managers gives first hand knowledge on eco-developmental problems (Senegal 1989)

to reliably monitor change in the sustainability of natural ecosystems are lacking.

Gaps in the information base of researchers and of site managers in case of Biosphere Reserves. Despite the fact that there are areas in sustainable natural resources management which require significant basic, strategic, and adaptive research, there are many well developed technologies and improved practices and only require adaptation and implementation by local communities around biosphere reserves and by site managers. The challenge is to assist the community and managers in gaining access to the wealth of data and information that exists. Such efforts are already underway in Amboseli Biosphere Reserve (Kenya) and also more is expected in the future following the Regional Training Course for site managers in the use of Internet and the Geographical Information System (GIS) held from February 24 - March 7, 1997, in Dakar, Senegal.

### **1. Human Resource Development and Sensitisation**

154. Training is one of three key elements of the MAB programme. As such, training of all kinds of personnel has been undertaken in most of the activities of the programme in Africa including seminars, workshops, study visits and attachments to the integrated projects. Indeed, training included all MAB field projects.

155. The emphasis on training in the MAB programme is because western education in Africa generally failed to foster knowledge or understanding about the environment, about the interrelationship between the human species and other species or about the complexity of ecosystems. Traditional or indigenous African education kept the sacred bush phenomenon may be as a way of conservation of the resources most required by them but this has never seen the light of day in the school curriculum.

156. Often, planners, managers and decision-makers, though equipped with a certain level of knowledge, they lack the ability to interpret and apply knowledge for natural resource management in the field. The IPAL project in Kenya, Tunisia and Lesotho and the RCS-Sahel in West Africa are responses to this situation.

157. Africa is still faced with the problem of brain drain necessitating continued training at the higher levels and on the job. Scientists lack opportunities to share experiences on resources management and

advance training. It was in this regard that a new scheme, the MAB Young Scientists Award was introduced so that younger scientists, especially from the developing world can undertake advanced work on relevant and needed aspects of Conservation and sustainable development. The programme has benefitted several generations of African students since its inception. The Young Scientists Award scheme usually takes the form of advanced courses in developed countries by students from the South. The advantage in this scheme is that before the student embarks on training a niche would have already been identified in the field of natural resource conservation and development. One of the areas in which a lot of interest has been shown in this scheme is information dissemination including computers and internet as applied to the MAB programme. Many students under the Young Scientist Award scheme are benefitting from support to undertake courses in this area.

158. The other forms of training provided on the MAB programme is what is called in-situ training which includes courses in developing countries while at the same time making inputs into the workings of MAB. This has recently gained a lot of preference from young people involved with the MAB programme.

### **2. Ecosystem Conservation and Regeneration**

159. The phenomenon of regeneration is a conservation strategy in which the MAB programme has been involved in Africa. Regeneration ensures the retention of species in a particular ecosystem or their spread to far away places. It maintains the composition of a particular ecosystem by ensuring that the various elements (plants and animals) continue to exist in their normal location by various reproductive processes including their normal life histories and growth increments. Ayensu (1981) equates regeneration to maintenance of these life histories and growth increments, and that good management of ecosystems like tropical forests and savannas would ensure regeneration capabilities of tropical trees. He refers to the augmenting of the timber needs of local communities in tropical forest ecosystems by fast growing tree plantations to allow for regeneration of natural forests over a 20-30 year period as attempts at conservation.

160. The MAB programme through the establishment of the Omo biosphere reserve in South Western Nigeria has influenced the conservation of the tropi



cal rain forest in that country. The forest itself has been subjected to two forms of artificial regeneration methods:

- i) enrichment planting which involves planting tree seedlings and samplings under partially opened forests which are only slightly altered while the micro climate and soil cover remain virtually the same;
- ii) plantation establishment either directly or through agro-silvo-cultural techniques where a conscious effort is made to improve on the productivity of the land as much as possible. This brings about drastic changes in the species composition and structure of the forest as the method would involve felling of trees, site clearance and burning which brings about some changes in the various components of the ecosystem.

161. These methods of regeneration have been used as approaches to conservation but as Nwoboshi (1979), in a paper recorded as part of the proceedings of the MAB organised workshop on the Nigerian Rain Forest ecosystem, states:

The available quantitative data... indicate that as in the natural forest ecosystem, data on biogeochemical cycles in man-made forest ecosystems are still very incomplete. This makes accurate assessment of the changes brought about by conversion to various plantation ecosystems difficult.

162. In addition to the artificial regeneration methods there are the natural modes of regeneration in the various ecosystems of the biosphere reserves. In the M'passa biosphere reserve of Gabon the variability in the size of tree gaps formed in a haphazard manner in the forest brings with it a mosaic structure, with clumps of mature forest side-by-side with others at different stages of regeneration. Studies in the M'passa biosphere reserve show that measurements of tree growth at fixed intervals during a seven year period revealed large variation between and among species as well as the particular siting of each individual within the forest mosaic. Understanding the mechanism of forest regeneration has involved a variety of studies by the MAB programme on germination and seedling ecology which are key developmental stages for a species. The reconstruction of the forests after shifting cultivation has also been examined.

163. The amount of work done on regeneration of flora appears to be far ahead of similar attempts on the fauna of biosphere reserves under the management of AFRIMAB just as very few coastal and small

island biosphere reserves have been investigated on the African continent. Inland fisheries projects have had new fish species introduced in ponds and policies have been formulated for fishing methods that preserve stocks but studies of marine biosphere reserves have been very limited.

164. Work on afforestation in arid and semi-arid parts of Africa are in progress as in the case of IPALAC (International Programme for Arid Land Crops) with which AFRIMAB is associated through UNESCO-Paris. The work of this programme however is, strictly speaking, not regeneration as it is not a replacement but an introduction of new plants to create an entirely new ecosystem. The plant species used in this project come from breeding programmes that endows them with special characteristics to withstand arid land conditions.

165. Traditional practices of shifting cultivation and laying a farm land fallow for several years ensures regeneration but the population pressure on Africa's farm land of today and large-scale animal husbandry may never allow this age-old condition to prevail. If it does efforts must be made by intergovernmental and non-governmental organisations concerned with conservation to adopt these natural methods or else a thorough investigation of an ecosystem may be required to ensure adaptability of improved plant species to soil types and their physico-chemical conditions before artificial replacements can be undertaken to bring back the original composition of ecosystems.

### **3. Biodiversity and Sustainable Development**

166. The concept of biodiversity is another of the key concept of MAB that has been frequently used in this report without providing a clearer picture of what it is even though the MAB programme has been involved in protecting and promoting it in all of its activities. This section provides a clarification of the concept and the involvement of the MAB programme with it.

167. Biodiversity simply evokes profusion of life as illustrated by the more than 1.5 million known animal, plant and microbial species globally and the several millions which are still unknown. It implies intra-species diversity reflecting the unique genetic characteristics of each individual. So the concept of biological diversity is not a simple description of the diversity of life but opens up a pandora's box of concerns and stakes as demonstrated by the Conven-

tion on biodiversity signed in Rio de Janeiro in 1992. There are concerns because biodiversity is threatened by human activities and stakes because the concept represents an unequally distributed heritage and wealth. Indeed, biodiversity is particularly rich and abundant in the tropics, mainly the countries of the South, but are coveted by transnational firms belonging mainly to the industrialised nations of the North. Thus, the concern for biodiversity is not simply with the diversity of living things but also with their utilisation and conservation, in other words, the challenges that human societies face in seeking to reconcile development with the safeguarding of their biological heritage.

168. The ultimate source of biological diversity resides in the variability inscribed in the genetic heritage of organisms. The traits and performance of living things (their phenotype) is coded first of all in their genetic structure (genotype) and then with interactions with the environment. All genetic diversity, which brings about biodiversity, is inscribed in the DNA molecules transmitted by the parent or parents. New variation can only come from a mutation, the chemical alteration of a gene or chromosomal accident. Genetic diversity observed in nature results from the accumulation of these mutations which are filtered by natural selection and conserved. Thus, the richness of beings and forms, behaviour and life cycles that one observes in nature is the result of a complex and long process of biochemical changes and chance selections based on physical conditions.

169. Biodiversity is the concern of the world today because it is being threatened - species and their varieties are disappearing at an unprecedented rate (1,000 per 400 days) - partly because conservation measures are often too costly but also because of the lack of knowledge of what we have and what we can do in the biosphere to conserve it. Extinction of living organisms is the most important biological damage of our time for it is totally irreversible. Thus, extinction of species may be regrettably taken less seriously (Wilson 1992) especially in developing parts of the world like Africa because diversity is a potential source of immense material wealth in the form of food, medicine and amenities. It is truly a precious heritage which we must learn to conserve even though our knowledge of it is scanty and insufficient.

For instance, the importance of biodiversity for the functioning of ecosystems and of the biosphere (present preoccupation of the MAB programme) is still largely unknown (Barbault, 1995) beyond that of particular functions of certain species in major processes like nitrogen fixation.



Protection of the habitat is important for continued survival of these resources. Amboseli Biosphere Reserve, Kenya.

170. At present, the emphasis in biological diversity is shifting from the species to the system level including conservation and sustainable development with the participation of major inter-governmental (UNEP, UNESCO-MAB programme) and non-governmental organisations (IUCN, ICSU, etc.). This new interest in biodiversity results from the increasing concern for the preservation of the biosphere: researchers, politicians and ordinary people becoming more conscious of the importance of understanding how the biosphere functions before pretending to manage it.

171. One of the known objectives for conservation work is the recognition of the multiplicity of known species that may be identified if they are preserved for a long time so that their uses and functions can be articulated. Of the millions of plant and animal species believed to exist in the forests, grasslands, rivers and lakes of the African continent only a few hundreds have been domesticated and brought into agriculture for the supply of human needs. Among plants only about 150 species are known to have been commercially cultivated and only about 20 of these are known to provide the cereals, legumes, root crops, oil crops, and sweeteners form the bulk of human food.

172. Ironically, for a continent like Africa the majority of agricultural crops are introduced plants.

Indigenous plants of equal or superior potential have simply never been explored or even considered for the production of food stuff. Many more plants that may yield food and other products remain in the wild and could be lost without the intervention of conservation. These are some of the areas of expected outcomes from the research function of the MAB programme in Africa. Unfortunately not enough work is being done in these areas by the MAB programme.

173. It has not been impossible to estimate the number of species that are lost before their potential value as sources of food or medicine can be explored. Exploration and research are needed to develop unknown species for various purposes as was the case, many years ago, of the common mould penicillium before the discovery of its antibiotic properties in 1929 or the Soya Bean in recent times. To a reasonable extent diversity of biological resources in Africa is being tapped as part of the integrated approach to conservation adopted by the MAB programme. Projects in the MAB programme are aimed at achieving this objective. In the Tai Forest reserve in Cote d'Ivoire, the M'passa biosphere reserve in Gabon, and the Omo rain forest reserve in Western Nigeria are found a lot of activities in this area of exploring biological diversity although the major constraint in this field of ecological studies in Africa is the availability of adequately trained and appropriately qualified scientists to undertake these responsibilities. There is no limit as to the availability of the natural resources to be studied in the wild. The number of species of flowering plants of M'passa biosphere reserve in South Eastern Gabon standing at 1,500 (catalogued) is only a small fraction of what is available in that reserve. Many other species found in the region have an extensive distribution within that forest block of Central Africa including the Congo basin. The Tai forest in Cote d'Ivoire is another extensive resource and the project has been aimed at combining conservation of genetic diversity with the needs of economic development. Highlands, mountains, costal areas, and islands around Africa are particularly endowed with biological diversity. The Mangrove forests of coastal areas are the homes

of rich biological resources which should provide the materials for studies.

174. In addition to their importance as potential providers of new products, wild species, particularly relatives of cultivated or domesticated species, provide the gene pool for improvement of stocks by breeding. The importance of this is better appreciated when it is realised that at least one third of the recent spectacular increases in crop yield is accounted for by breeding, involving crossing with wild relatives to increase hardiness of cultivated varieties. Thus, it is on selection and breeding that we have our last hopes for obtaining the resistant varieties to combat the increasing menace of pests, drought and desertification on the African continent.

175. In this connection, the most recent programme with which the UNESCO-MAB programme is collaborating is the International Programme for Arid Land Crops (IPALAC) referred to earlier. The aim of this programme is to promote the use of plant species that are adapted to semi-arid lands for rural development in the World's dry lands. In Africa, Mali, Burkina Faso and Senegal are the countries where the programme is being introduced by inter-governmental and non-governmental organisations including the UNESCO-MAB programme. The project is working on the use of arid land plants as crops or component of farming systems and the species used are either introduced or domesticated through a research and development programme based in the wild. In these projects an innovation in soil and water conservation is introduced. Diguette, a French language term for either earthen ridges or lines of stones that are erected as part of indigenous soil and water conservation techniques in West and Central Africa, had been improved by the introduction of a living fence of prickly pear cactus to protect the ridge from damage by uncontrolled grazing of animals. The cactus is also to provide mulch in order to improve the infiltration of rain water to the soil.

176. In Burkina Faso (the Omer Introduction and Evaluation site) tree species that have demonstrated their value for honey production have been tried and

**BOX 11. The Desertification Convention**

*The focus of the Desertification Convention is to bring international action and resources to bear on the problem of desertification. The convention establishes mechanisms for monitoring and assessment, information dissemination, research and technology development, and drought relief, as well as public participation, awareness, and education on desertification. UNESCO is working closely with the Convention Secretariat and the Conference of Parties to bring its experience to assist in the implementation of the convention.*

shown to be giving positive results using the prickly pear cactus ridge. Thus biological diversity work is currently the concern of many in Africa especially in areas where the land has been severely degraded.

### **MAB'S CONTRIBUTION TO THE DESERTIFICATION CONTROL PROGRAMME FOR THE SAHEL AND SOUTHERN AFRICA**

177. Desertification is a very serious problem in the African continent. In the early 1980's 473 million hectares of productive dryland in Sudano-Sahelian Africa was classified as desertified. Because of this, desertification became one of the targets of the UNESCO-MAB programme as shown by the over 75% of the land area covered by biosphere reserves in Africa belonging to arid and semi-arid lands. The IPAL projects in Tunisia, Kenya and Lesotho together with the project on Strengthening Scientific capacities in the field of Agro-silvo-pastoral Management in the Sahel located in 9 countries in West Africa are all geared towards combating desertification.

178. Recognition of the depletion of natural resources, including land, on the African continent, happened a long time ago, even before the launching of the MAB programme. The depletion of land resources in Southern Africa had been observed since 1937 by the director of the South African Museum travelling through Botswana and the Southern part of Zimbabwe where evidence of land degradation caused by over-grazing and over-cropping were found. But interest in this observation and the taking of action on the problem came about only in the early 1980's after feasibility studies had been conducted under the auspices of UNEP and UNESCO which culminated in a project to provide training programmes on desertification control in SADC countries. The MAB programme of UNESCO had made an earlier input into training for desertification control in a major project on research, training and demonstration applied to integrated management of arid and semi-arid regions established by the General Conference at its 21st session. Implementation of the UNEP-MAB Integrated Project on Arid Lands (IPAL) was intensified, and a significant contribution made at the United Nations' Conference on Desertification held in Nairobi in August-September 1977. Inputs included six case studies designed to present a world-wide cross-section of desertification processes.

179. In recent times (1994), the background to a major regional course organised by the UNESCO-MAB programme in collaboration with UNEP in Zimbabwe was, amongst other things, the depletion of renewable resources and the concerns of governments in Southern Africa and elsewhere, for the development of rational resource management strategies that will lead to the control of desertification. The Southern Africa Regional Desertification Control training course was thus one of such involvement by UNESCO which emanated from the realisation of the extent and complexity of environmental problems by governments in the SADC region.

180. After a UNDP/UNEP inter-agency meeting on desertification and protection of the environment in Africa UNEP found a partner in UNESCO for the organisation of this regional training programme on techniques pertaining to desertification control for Southern Africa. This programme was ultimately conducted in 1994 and geared towards reinforcing specialist knowledge in desertification control for top resource managers concerned with desertification problems in SADC countries. The training also promoted research and information dissemination and exchange by SADC members.

181. This training course surprisingly came up with a number of conclusions that are significant to understanding the gravity of the problem and eventual control of desertification including:

- i) Desertification is a widespread feature in Southern Africa. It differs in degree between countries but there is undeniable evidence of land degradation caused by a combination of drought and inappropriate land management practices. This form of land degradation as stated before may be irreversible;
- ii) The degradation which is widespread causes severe reduction in the living standards of both rural and urban populations and urgent attention is needed to restore the productivity of both range and cropland in order to enhance the living standards of inhabitants of the arid and semi-arid lands.
- iii) Although drought is undoubtedly a factor in the increasing land degradation it is not the only one and failures in animal husbandry and land use planning and management make a significant contribution to the problem;
- iv) Within the arid and semi-arid land areas of Southern Africa the problems of range-land degradation were obvious despite some contrary views and there was agreement that managerial inputs were necessary.

- v) There are, within SADC countries, many initiatives of value in the control of desertification. These need to be more widely disseminated since desertification is unlikely to be clearly constrained by limiting knowledge of strategies discovered to single countries. There are no geographical boundaries to the problem either internationally or nationally.

182. Indeed, in Africa the problems of desertification are no longer restricted to the extreme poles of the continent, but is now a reality in the tropical region as well due to deforestation, over-exploitation of agricultural lands, acidification of once irrigable lands, over-grazing of rangeland and burning of forests. The effects of dryland degradation and desertification are particularly important in the sahelian zone as well as the southern Africa Kalahari region and have caused enormous losses of land and livestock resources, substantial human migrations and even a sizeable loss of human lives.

183. Another recent activity on desertification in which UNESCO was involved was the workshop on Impact on natural resources ownership pattern, tenure and access on land degradation and desertification by IDRC, Dakar-Senegal. This workshop suggested, among other things, that the important elements or principles to consider in formulating reforms designed to encourage sustainable use of natural resources and avoid degradation and desertification should include harmony with local community and full and sincere involvement and participation of local populations. Present in this suggestion is the strategy of the MAB programme which is the continued involvement of local populations in conservation programmes so that exploitation of Africa's natural resources are carried out responsibly. It was brought out in this workshop that ignorance of land tenure laws by the local people lead to methods of exploitation that are contradictory to conservation principles thereby making their actions to lead to land degradation including desertification.

184. The local people in areas prone to desertification - the Sahel (arid and semi-arid areas) and the Kalahari in Southern Africa - are disadvantaged by their inability to gain access to information even on maps. In consequence and especially in the Maghreb region, land occupied by poor people are the most degraded and subject to desertification. In Southern Africa (Zambia, South Africa, Namibia, Kenya) poor marginal areas are left for the local community whose overstocking/exploitation lead to land degradation and desertification.

The establishment of MAB pilot projects in these areas (e.g. IPAL, or the RCS-Sahel) has helped the situation by ensuring that the interest of the local community members are also looked after. Thus, in concluding that the security of tenure is one of the many incentives to combat desertification and land degradation the workshop agreed that local arrangements on land tenure merit protection if they support sustainable resources management.

185. Another activity in which the UNESCO-MAB programme participated was the Pan-African Conference held in Ouagadougou in 1994 on the implementation of the Convention of the United Nations to Combat Desertification. This conference had as one of its objectives adoption of «guidelines for the elaboration of the regional action programme to combat desertification. The conference provided an opportunity to assess the value of actions undertaken by partners of the international community including MAB and the following were some causal factors in desert encroachment based on the IPAL project at the Mont Kulal biosphere reserve in Northern Kenya:

- i) traditional land tenure/communal ownership of land;
- ii) increased sedentization of nomads;
- iii) increase livestock herds,
- iv) tree and shrub destruction;
- v) expending human population increase adult survival;
- vi) increase run-off of water;
- vii) soil erosion.

186. Thus, it appears from the foregoing that a lot of efforts have been made towards the control and sometimes reversal of desertification in Africa and the MAB programme of UNESCO has played no mean part. MAB has played a very significant role in this process through the integrated projects that were conducting research and training for the management of land resources that were prone to degradation that may lead to desertification.

187. On the whole it is reassuring that all forms of land degradation are the concern of the MAB programme in Africa. The efforts made are very extensive (Creation of Biosphere Reserves, Integrated Projects and training programmes to increase the human resource base and information dissemination). African governments must however consider the topic of conservation of Africa's land and environmental resources as very important and make respectable provisions in national budget estimates so that endogenous programmes will be undertaken to solve Africa's land problems.

## INNOVATIONS AND FUTURE PROSPECTS

188 Conservation of natural resources, especially the biological diversity of Africa, is a long-standing traditional practice by Africans albeit to small extents and may be unconsciously. This fact of the African tradition has been gradually unfolding itself as part of the activities of the UNESCO-MAB programme on the continent. In many countries of Africa traditional practices of the local communities have been discovered as effective strategies for conservation of the existing natural resources. They have been identified also as innovative strategies for conservation by the UNESCO-MAB programme which is concerned about natural resource and environmental degradation around the world.

in Accra, Ghana, 9-15 March, on the theme "Biodiversity conservation: Modern Concepts and Traditional Knowledge" with the aim of identifying some of the modern and traditional strategies for conservation and sustainable development. Some of the traditional strategies discovered earlier had been seen to be closely linked to the people living within and around protected areas. In particular, the spiritual attachment of these people to the land and its resources that were to be conserved were high. This is the Sacred Grove phenomenon which arose out of taboos and the traditional beliefs and practices of the local communities that had implicit conservation objectives.

### Sacred Groves: Tradition turned innovation

190. In many African communities taboos are used to protect the habitat (flora and fauna) from irresponsible exploitation. Individuals, families or whole communities are forbidden from exploitation

Objectives of biodiversity management must incorporate the concerns and aspirations of stakeholders including local communities. Equitable sharing of local benefits is important component of a strategy to conserve biodiversity (Custodians of Yoff Sacred island in Senegal)



189. The provisions of the convention on Biological Diversity placed a special emphasis on conservation. By these provisions the sustainability of biological diversity became global imperatives which led African countries to organise a regional seminar under the auspices of the UNESCO-MAB programme

of particular plant or animal species and where this taboo is respected the species will be found in much higher density and larger in size. Taboos regulate man's exploitation and relationship with his environment. In other cases, the plant or animal may only be considered as sacred and therefore protected

from exploitation. Rare trees are considered sacred and are not felled or trapped for medicines or food without elaborate rituals. Sometimes a whole area is forbidden from use for any purpose. Such an area is the sacred or fetish Grove.

191. Africa's rich ecosystems are indirectly and unknowingly protected in these ways through traditional spiritual beliefs and practices which form the foundation of traditional ecological knowledge and environmental protection. In traditional Ghanaian culture, for instance, the earth is held sacred and personified as "Mother Earth", the sustainer of life, and worshipped. It is said to rest one day a week from human disturbances when it is purified from any defilement. Many lakes, lagoons, rivers, etc are also worshipped as Gods and protected from human disturbances for specific periods of time extending to years during which time the land and its natural resources are conserved.

192. It is within this context that the phenomenon of Sacred Grove emerged in the UNESCO-MAB African programme as a potential conservation strategy. Sacred Groves are considered as Groves for ancestral spirits which are not entered by ordinary citizens and the "gods present there" are protected from disturbance by an embargo placed on hunting, farming or other forms of activities for a period of time every year or for several years. Where sacred

groves are to be cultivated, a very seldom occurrence, the farmer has to offer prayers before cultivation and celebrates harvest festivals. Sacred Groves can be forest woodlands, water bodies, river courses, streams and ponds, coastal zones including sea shores, estuaries and mountains side. They are regarded as the abode of the Gods. Thus, the African's relationship with nature clad in religion and reverence for it has helped him to develop a body of knowledge which eventually makes him the caretaker of his environment. To enhance biodiversity in these ways the African has developed body of laws and taboos to regulate his relationship with the environment. In some cases these taboos or traditional laws have been converted into official by-laws to make them more effective. Important uses of lands have been refused because a Sacred Grove was of a significant socio-economic and cultural importance to the locals.

193 For biodiversity conservation these groves house large numbers of plant and animal species. For taboos to prevent the exploitation of these is a strategy towards conservation although in many instances such taboos have not been very effective because of population pressure and the corresponding demand for farm land. Thus, abundant traditional ecological knowledge exists which constitute the unintentional efforts of local people to prevent the extinction of species and to protect the environment from degradation. Integrating these traditional conserva-

**BOX 12.**

An international workshop organized by the International Development Research Centre (IDRC) in Cairo, Egypt from January 3-5, 1994 on «Indigenous Knowledge and Desertification» recommended that:

«Indigenous Knowledge as it relates to desertification processes, comprises a wide range of accumulated local experience about natural resource use and management techniques in both agricultural and pastoral systems, institutional and organizational arrangements as well as beliefs and values. All these dimensions need to be duly weighted and included in applying indigenous knowledge to development decisions and interventions at micro as well as macro levels.

Indigenous knowledge can be enhanced with the infusion of modern scientific knowledge. The challenge is to evolve the right mixes between IK and modern knowledge. This will require the creation of an enabling environment at national and international levels.

(i) Government officials should duly take into account, in the development and implementation of policies, indigenous knowledge as well as the experience and

developmental perspectives of local populations;

- (ii) Government officials should also take all the necessary measures to protect and preserve and use indigenous knowledge by creating an enabling environment, including the support of focal local institutions and the development of awareness programs. Sufficient funds should be made available for that purpose. Channels should be created to enable representative local institutions themselves to promote the importance of their local knowledge and insist that their knowledge is relevant despite processes undermining it.
- (iii) Given the importance of combining traditional and modern knowledge systems, research should be carried on how adaptations and innovations are being done by local communities and outside agents; to analyze these processes, and contribute to the development of appropriate hybrid knowledge systems and enabling environment.
- (iv) It is imperative that mechanisms be found for the effective involvement of local representative institutions in

higher level decision-making processes. To facilitate such resource use and management is a necessary condition. Equity and democratic principles should be applied in the empowerment of local representative institutions.

- (v) In designing research and local level interventions, cultural, ethical, spiritual and institutional aspects of indigenous knowledge systems should be given full consideration.
- (vi) Recognizing the fundamental ecological, social, economic and cultural roles of traditional pastoral and agro-pastoral production systems, it is important and urgent that public authorities create suitable conditions and provide sufficient support to the local populations for their continued viability.
- (vii) Indigenous knowledge and its use in local contexts should be documented by the local communities for their own use, access and control. Data bases should be created at local, national and international levels with a clear view toward further use and development of that knowledge.

tion practices with modern scientific strategies would enhance sustainable utilisation of natural resources.

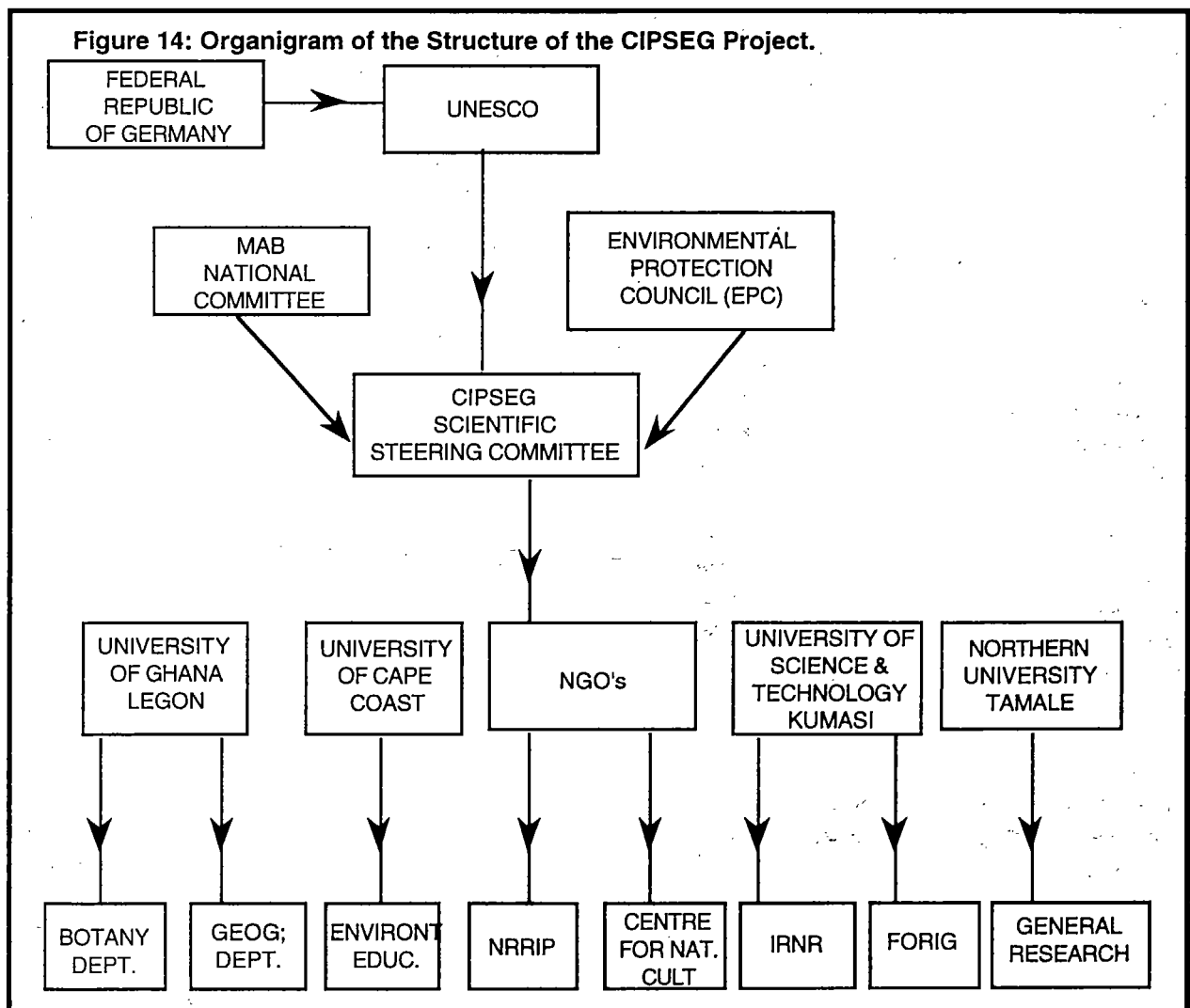
194. In most of Africa, particularly in the Guinea Savanna, Sacred Groves still stand out distinctly as relicts of each particular ecosystem and are rich in biological diversity. The knowledge and skill developed in the use and conservation of these biological resources by the African through hundreds of years of adaptation to and manipulation of their land (the flora and fauna) constitute an invaluable resource. The laws and taboos against the exploitation of sacred groves are enshrined in stories, folk lores, beliefs and a host of other cultural practices. However, as a result of urbanisation and modern religious beliefs and practices many of these groves with their rich biological diversity have been experiencing extreme stress from human and other forms of degradation.

195. Modernisation had substantially eroded a lot

of knowledge from the culture of the people including the traditional methods of conservation of biological resources. However, the biosphere reserve concept of the MAB programme, which is consistent with the identified traditional mechanism for protecting sacred groves and their adjacent environs is now being adopted to promote the concern for land and environment degradation.

196. A MAB project set up specifically with this objective of adopting sacred groves as conservation sites (the innovation) is the Cooperative Integrated Project on Savanna Ecosystems in Ghana (CIPSEG). This project has helped the consolidation and expansion of 3 Sacred Groves, the biodiversity they contain and the restoration of the degraded adjoining areas, to suit the diverse ecological and socio-cultural needs of the people in the local community. The summary of the profile of the CIPSEG project is as presented below.

Figure 14: Organigram of the Structure of the CIPSEG Project.





**“Cooperative Integrated Project  
on Savanna Ecosystems in  
Ghana (CIPSEG)”**  
(An example of a tradition turned Innovation)

197. The “Cooperative Integrated Project on Savanna Ecosystems in Ghana (CIPSEG)” is a project of the new type of generation of projects embedded in the overall integrated research and development philosophy of UNESCO’s Programme on Man and the Biosphere (MAB) which :

- (a) contributes to the strengthening of national research institutions in Ghana by drawing on the expertise of local scientists in applying modern ecological research on different environments;
- (b) is based on traditional cultural values for environmental conservation; and
- (c) explores ways of environmentally sound development.

198. In other words the CIPSEG Project strives to promote sustainable development that is compatible with the populations technical capacities and conforming with local traditions and customs, while remaining open to scientific progress. The rationale for this project is the serious environmental degradation in the savanna areas of Western Africa, and in particular in northern Ghana. Environmental degradation poses a serious threat to the biological diversity as well as to the economic development potential of this bioclimatic zone. In many parts of the country, the natural vegetation has been seriously affected by bush fires, agricultural cultivation, overgrazing, firewood cutting and even urban and village sprawl.

199. However, a few relict climatic vegetation patches still exist as “fetish or sacred groves” which have been protected and conserved due to traditional religious beliefs over the centuries. Village communities in the project area in northern Ghana themselves have been actively engaged in protecting their sacred environments acting as custodians and wardens at the same time and thus, deliberately though unconsciously, contributing to environmental conservation at large. Using such traditional forms of environmental conservation is important today in a world facing environmental degradation and the sacred groves may well become beacons needed for the restoration of degraded savanna environments. Cultural values may be more powerful agents for protecting the environment than legally designated areas such as national parks or nature reserves.

200. The scientific study of these sacred groves in terms of plant species composition and ecological functioning can provide important answers to the question of how the Guinea type savanna areas in Western Africa may have looked like before human pressure on the savanna grew too strong. The project’s goals are to develop a scientific knowledge base on the relict fetish groves ecosystems with a view to helping in the restoration of the adjacent and degraded savanna areas by using native plant species from the sacred groves’ gene-pools, and to formulate sound management guide-lines for development interventions aiming at the environmental conservation of the area at large. Interdisciplinary research teams study the soil conditions and plant physiology of the sacred groves, as well as the existing resource use/land use practices and the cultural values and religious beliefs which have led to the protection of these few undisturbed natural ecosystems.

201. Figure 14 shows the Ghanaian research institutions participating in the project. The Botany Department of the University of Ghana in Legon is carrying out an in-depth plant inventory of the three sacred groves that have been selected for the project. The Geography Department of the same university is looking into the overall land use systems of the three districts in which the sacred groves are located with a view to elaborate environmentally sound development and management plans. The University of Science and Technology in Kumasi with its Institute of Renewable Natural Resources (IRNR) and its Forestry Research Institute of Ghana (FORIG) are concerned with assessing the area’s soil, climatic and socio-economic conditions which are needed as baseline factors for overall development interventions. Scientists of these two universities are actively engaged in carrying out modern ecological and applied research and several graduate students are using the project’s facilities for preparing their Master’s and PH.D degrees.

202. Apart from Ecological research, the project also attaches great importance to the socio-cultural dimensions of the sacred groves. The Centre for National Culture has already undertaken in-depth studies of the traditional beliefs which have led to the protection of the sacred groves as well as their functions for ceremonial purposes performed by the fetish priests. At the same time, studies also focus on traditional resource use by village communities such as tree planting, ownership of tree and forestry products and marketing thereof. These studies are important for the restoration of degraded savanna environments in order to meet the specific needs of

village communities without violating cultural values. Gender issues with regard to resource use is being addressed by the Tamale based Northern Region Rural Integrated Programme (NORRIP) since the different roles of women and men in restoration and development activities need to be fully understood for any kind of intervention activities.

203. The project teams work in very close collaboration with the chiefs, elders and village communities and, of course, the fetish priests/priestesses who are the custodians of the sacred groves. The three chiefs in charge of the Malshegu, Tolon and Yiwogu sacred groves have spontaneously offered several acres of land for the project which will be used for environmental research, afforestation and other development purposes. Regular workshops are held for the village communities such as on the prevention and control of bushfires and adequate tree planting techniques for which the Environmental Protection Council (EPC) of Ghana is preparing specific training material. So far, at least 150 farmers have been trained already. The replanting of the degraded savanna environments with indigenous species from the sacred groves as well as with cash crops such as mangoes combines restoration activities of the savanna with income generation for the local communities.

204. A "UNESCO-CIPSEG Centre" has been built in the vicinity of one of the sacred grove which comprises two field laboratories, a meeting room and three small offices. The UNESCO-CIPSEG Centre was built by making use of voluntary manpower from one of the project's participating village communities for two reasons :

- (a) to convey the idea that the local people are building "their" Centre for the enhanced protection of "their" sacred groves, and
- (b) the training provided and the know-how gained by building the Centre can be used for other community based construction activities even beyond the duration of the CIPSEG project. In December 1993, the UNESCO-CIPSEG Centre was officially dedicated by the Honourable Minister of the Northern Region in the presence of the UNDP Resident Representative to Ghana, representatives from the German Government which is funding the project through a funds-in-trust agreement with UNESCO, UNESCO representatives and the Malshegu village community. The dedication ceremony of this field research centre gave rise to a traditional "durbar" which best embodied the spirit of the CIPSEG project:

coupling science with culture. The project, indeed, reflects the overall mandates and fields of competence of UNESCO : the project has a scientific thrust (environmental research and protection); it respects and uses the traditional cultural values for enhanced environmental protection and environmental sustainability from the local level; it strengthens environmental education and training of specialists at all levels (with children and women as specific target groups), and it provides for the communication of all project findings to other areas similarly suffering from environmental degradation.

205. From this profile the use of sacred groves as a potential conservation strategy holds great promise in Africa even though the published results of the CIPSEG project are yet to support this claim. The undisputed fact, however, is that the inhabitants of the project area have protected these few vegetation patches as fetish or sacred groves which show all the signs of having been conserved as useful land areas and the biological diversity present on them.

### **Conservation of Biological Diversity**

206. The African has and uses farming systems and farm tools which have helped him to conserve biodiversity. The introduction of market economy in recent times in Africa through cash cropping however unleashed an unprecedented assault on the environment and land resources. The change in the farming system and tools degraded the environment and biodiversity in Sub-saharan Africa. And imposition of legislation to enhance biodiversity conservation from this state is likely to worsen the predicament of the people as such a legislation tends to draw the attention of the unpredictable public to the phenomenon (biodiversity conservation) with unfavourable consequences.

207. In the forest areas, clearing and burning has led to loss of biological resources as a result of overharvesting or unjustified destruction of plants and animals. And the deliberate and immediate substitution of biodiversity so lost -- by uniformity of crops, trees and livestock through development projects and introduction of exotic species - contribute to the loss of biological resources.

208. The activities of the MAB programme in Africa have been regaining the biological resources lost in

the ways described above because one of the main concepts that has been pursued by this programme in recent times is biodiversity conservation. The implementation of the convention on biological diversity conservation has continued to be a major activity of the MAB programme in Africa involving the giving of advice to member states on the scientific, social, cultural, ethical and educational aspects of the convention in cooperation with the Agency for cultural and technical Cooperation (ACCT). Following the conclusions of the Conference of international experts on Biosphere Reserves (Seville 1995) basic research and monitoring of biological diversity on land and coastal regions have been promoted in cooperation with the Intergovernmental Oceanographic Commission (IOC), in connection with the programme on environment and development in coastal regions, and small islands especially within the framework of the joint UNESCO-ICSU programme "Diversitas". It is expected that recourse will be made in this research programme to use the network of biosphere reserves in African and elsewhere and coastal marine stations. Specific attention will be paid to the key role of biodiversity in soils and aquatic sediments and to recording and using ecological knowledge.

209. Diversitas is one programme in which UNESCO has collaborated with non-governmental organisations through the MAB programme to research into biodiversity in other parts of the world. In 1995, the programme was entering a new phase of organisation and activity, incorporating new sponsoring agencies, enlarging its administrative capacity and initiating a number of new activities designed to expand and complement the research efforts already under way. An international programme of Biodiversity Science was made available to those taking part in biological diversity's subsidiary body on Scientific, Technical and Technological advice. With Africa being one of the major sources of biological diversity, the diversitas programme is already gaining grounds in some countries through collaborative research efforts between the South and the North.

210. In the preamble to the convention on Biological diversity attention is drawn to the general lack of information and knowledge regarding biological diversity in the developing countries including Africa and the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures. At the international level, the diversitas programme was set up to respond to this

need with the aim of promoting collaborative scientific research and catalysing knowledge about biological diversity including its origin, composition, functioning, maintenance and conservation. As of 1995 five major programme elements representing the core of the diversitas research effort had been earmarked :

- i) origin, maintenance and loss of biodiversity;
- ii) ecosystem functioning of biodiversity;
- iii) inventorying, classification and inter-relationship of biodiversity;
- iv) assessment and monitoring of biodiversity;
- v) conservation, restoration and sustainable use of biodiversity.

211. All these areas of research effort by the diversitas programme have been considered urgent in Africa. In a similar way the four cross-cutting research themes of the diversitas programme:

- a) The human dimension of biodiversity
- b) Soil and sediment biodiversity
- c) Marine biodiversity
- d) Microbial diversity

have been most relevant in the African situation. Studies of the Gabonese, Nigerian and Ivorian tropical rain forests as part of the network of biosphere reserves have given startling revelations of the biodiversity of African forests.

212. The planning of the diversitas initiative has stimulated a variety of works, from reflective seminars and research planning workshops to setting up of research and conservation projects. The programme has also encouraged improved international coordination of research and training for research. Moreover, the in-depth work of teams of specialists including Africans mobilised through the scientific committee of Diversitas has enabled substantive and diversified inputs to be made to sections of the Global Biodiversity Assessment, the balance sheet on biodiversity sponsored by the UNEP.

213. Biodiversity conservation includes the multiplicity of ways of reproduction of the plant and animal species that are usually found in an ecosystem including asexual methods. In addition to all the conventionally known methods of reproduction is the traditional tropical phytopractices (Halle 1993) that are reported to be adding to biodiversity in Africa. These are traditional practices that are used to conserve plant natural resources and therefore biodiversity conservation. Some of the practices can be used in forest regeneration. They are treatments given to plants to improve, propagate or preserve plant growth. Included are a range of manipulation

techniques which are applied to individuals or groups of plants in improving quality and quantity of the products obtained from the plants. Some of these techniques are:

- a) tying a nut in the trunk of a young mango tree which acts as a traumatism that induces flowering and fruiting.
- b) using banana stems to encourage tuber growth. This involves driving a section of hollow banana stem containing the bud of a yam tuber into the ground to increase the growth of the yam tuber. As the banana stem decomposes, a rich and humid environment develops that is easily penetrated by the growing tubers
- c) pole cuttings are used to multiply trees throughout the rural community of tropical Africa. Placed vertically in the soil, the cutting with the store of water and other reserves that the pole contains takes roots and rapidly develops into a fast growing tree without being impeded by adventitious vegetation.

214. Many tropical trees can be multiplied by this technique of poles or macro-cuttings including the Africa Europhobia species used as firewood which can be replaced in this way or the wild plum tree of West Africa used for fencing. Many fruit trees of the Gabonese tropical forest, timber species (including teak), bamboo (or bambacopsis species) and cashew are propagated in this way. These are ideal for use in rapid reforestation and have attracted the interest of forestry and oil companies. The techniques contribute to conservation of biological resources. In some cases they provide a complementary approach to genetic techniques for improving biological performance. The techniques of phytopractices are traditional methods involving indigenous knowledge which like the sacred groves phenomenon could be adopted in the future as scientific techniques arising out of African tradition for ease of adoption. These are some of the other activities in biodiversity conservation to be undertaken after the extent of Africa's biodiversity has been established by inventorying all of the African biosphere.

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## Combating Desertification

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215. It appears that the greatest challenge to Africa in the 21st Century in the field of conservation is to control the encroachment of deserts (Sahara as well as the Kalahari in Southern Africa) on the sahel as well as the tropical forests. The immediate aim

should be to halt the movement of deserts to the coast but a long term goal should be reversing the successes already achieved by encroachment to the extent that lands gained by deserts can be rehabilitated.

216. Taking advantage of the experiences gained from two decades of MAB research related to major ecosystem types and the synthesis made of these researches a new series of activities of the MAB programme have been initiated in Africa in areas such as rehabilitation of degraded areas. This class of activities took account of the socio-economic environment which is kept in mind in exploring and addressing problems of combating desertification and investigating and solving arid land management problems. Scientific and technical inputs have been made into the implementation of the convention on desertification in particular. One such input is the programme on arid and semi-arid land management.

217. This project is located in selected member states of UNESCO in sub-saharan Africa and the objective is to contribute to the combating of desertification and improvement of agricultural productivity in arid and semi arid lands through the application of appropriate management techniques and the transfer of germplasm of multi purpose plant species. The project is conducted by the International programme for Arid Land Crops (IPALAC) with funds from UNESCO, UNEP, FAO and the Finnish Coalition for Environment and Development while the training and research activities are carried out under the coordination of the Institute of Agriculture and Applied Biology of the Ben Gurion University in Israel.

The tasks of the project comprise :

- i) advisory mission to participating member states on Research and Development requirements for the appropriate management of their arid lands with UNESCO, FAO, UNEP and IPALAC participating;
- ii) national workshops on arid land management;
- iii) transfer and exchange of germplasm of multi-purpose trees, shrubs, forage, tubers, fruits and nuts, medicinal species, salt-and drought-tolerant plants that would be introduced to combat desertification.

218. The outputs of the project are expected to be designs of a number of Research and Development (R&D) plans and advanced training of scientists and R and D personnel.

219. The semi-arid and arid countries participating in this project are Burkina Faso, Mali and Senegal

where the need for agricultural productivity is urgent. The major aspects of the project includes identification of human and physical factors related to desert development, strategies for plant introduction, gene bank and germplasm management and selection and breeding techniques for desert crops.

220. The background to the project is that in 1956 UNESCO made a grant to the Israeli government to help fund the Negev Institute for arid zone research, and among the Institutes's first projects was the establishment of a site (Omer site) for the introduction and evaluation of tree species for afforestation in semi-arid zones. In 1995, UNESCO supported IPALAC based at the site of the successor to the Negev Institute with another grant for a follow-up study at the Omer site including collection and sorting of seeds that had done well on desert soil over the 40 year period. A project to evaluate the potential of *balanites aegyptiaca*, a highly drought tolerant, multi-purpose tree was undertaken at the IPALAC Centre in Israel. Because of the success of the earlier trials of this plant to improve Africa's harshest dry regions a wide range of potential projects and sites have been established including the development of dry land fruit orchards, biodiversity education for school children, simple drip irrigation system, etc. Also, identified are a number of plant species that seem to merit further scientific investigation.

221. The 4 year project on combating desertification will also be geared towards improving agricultural productivity in arid and semi-arid regions. Training and research activities will be continued on the application of appropriate management techniques and the transfer of germ-plasm of multipurpose plant species having the potential to adapt to arid conditions and thus generate additional revenue. The more such plant materials are discovered that are drought-and salt-tolerant the better the chances for reversing desert encroachment in Africa. In Ghana, today, farmers at the Bia Biosphere Reserve are advised in a similar way to use sustainable land-use packages like the cultivation of sun-tolerant tree crops like oilpalm instead of shade-loving tree crops like cocoa with a view to attaining a continuous blend of such farms with the natural forest vegetation of the reserve.

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## People and the MAB Programme

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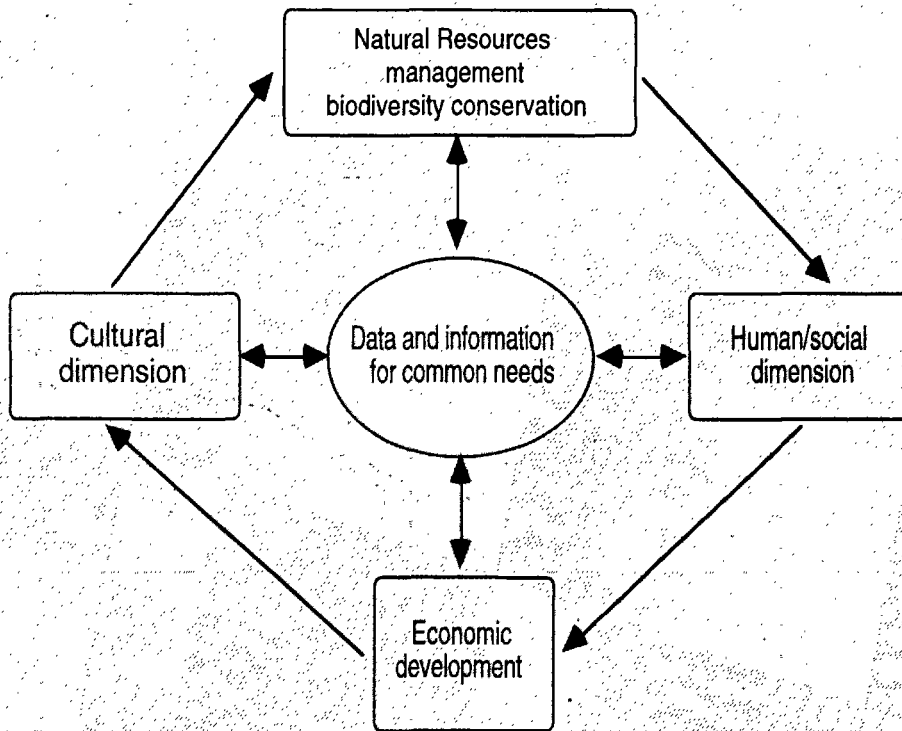
222. One important area where innovations have been very effective in the MAB programme in Africa

is that of the influence of people associated with the programme on the programme. Some people in the programme have benefitted from or had an impact on the implementation of the programme.

223. For instance, the new approach to protected area management has been to integrate the needs of the local people with the object of natural resources conservation. In this connection some African countries allowed local communities living around national parks and protected areas to have access to those areas for economic activities, the principle on which the biosphere reserves operate. This is the case with the Bia National Park of Ghana where the African Giant Snail (*Achantina achantina*) is collected during peak season on a trial basis with the objective of improving the relations between the management of the park and communities living around it, impressing upon the communities the positive contribution that the park can make towards the improvement of their socio-economic well-being if well protected. This approach was testing the impact of the controlled harvesting on the population of snails in subsequent three year cycles and encouraging the local communities to farm snails outside the park for their protein requirements as well as their economic well-being. This exercise improved the protein requirements of the communities and provided a temporary solution as well as improvement of the economic well-being of the local community but also brought the wild-life park management closer to the community.

224. Thus, one of the new ideas of the MAB programme in Africa is that of exploring strategies to ensure harmony and mutual benefit between biosphere reserves and their neighbouring urban and peri-urban systems and their people. The people factor, people living within and around protected areas, the communities that shape the cultural landscape, confronts scientists with soft issues, many of which are very uncomfortable. Included among these issues is the spiritual attachment of people to the landscape referred to earlier under the sub-lead sacred groves. It is for this reason that effective implementation of policies for the conservation of biodiversity requires an understanding of local cultural perceptions. It has been shown that the success of conservation efforts will depend less upon the production of learned documents than upon the direct integration of scientific and technical information with local cultural perception. The biosphere model has encouraged this interaction in Africa as shown by the Sacred Grove project in Ghana. Unfortunately, however, there are no real guidelines for scientists or

**BOX 13. MAB Africa needs for:**



land acquisition and tenure system in Africa creates a lot of disenchantment and so buffer zone development may best be achieved by negotiations with the farmers.

226. One of the objectives for the establishment of national parks and biosphere reserves was to make the people staying in and around the reserve to live harmoniously with the natural environment and obtain lasting and continuous benefit from the conservation and sustainable use of the biology diversity

local communities to facilitate the exchange. Large elements of the exchange process may depend upon local conditions but there is the need to provide general advice for the inexperienced. The biosphere reserve model which has emerged is the closest approximation of what is expected. The broad goals of the biosphere reserve concept promote a holistic approach to landscape management fostering the conservation of natural and cultural diversity.

225. Another recent involvement of local people with the MAB programme is through the development of the buffer zones of biosphere reserves. This is another situation in which a conservation strategy benefits from the influence of inhabitants residing around a protected area. Buffer zone development is reportedly best achieved in Africa through consultations with the local people who own the land because they have lived and depended on the biological resources contained therein. Over the years they have developed several time-tested strategies for sustainable utilization of their biological resources. The strategies evolved would have been based on traditional religious beliefs and taboos as well as annual festivals which the people looked up to in anticipation. Of late and as a result of western education, culture and fads, the fear and reverence to these taboos that had hitherto ensured the conservation and sustainable use of resources have either been diminishing or lost completely. Furthermore, the

therein through biologically sound and economically efficient practices or strategies. One of the resources that should be managed economically and efficiently for this to happen is water. If water which is the engine of sustenance of the reserve is not well managed as it is the case in Africa today, many of the biodiversity will perish. The natural forest when preserved uses water very efficiently and complements water in sustaining organisms in biodiversity conservation. The forest and water complement each other in sustaining the biological species in biodiversity conservation. The degradation of forest resources in Africa has become a concern for this purpose.

227. As a result of all the above regards, conservation is defined as the management of human use of the biosphere so that it will yield the greatest sustainable benefit to present generation while maintaining its potential to the needs of future generations. The implication of this definition is that conservation involves preservation, maintenance, sustainable utilisation, restoration and enhancement of the environment. Traditional communities in rural societies as in most of Africa consider conservation as a matter of survival. But conservation in these societies must go hand in hand with environmental education where the purposes of conservation are clarified so that it is not considered as yet another development project that keeps the people less

developed than before. The form of education required in Africa for this purpose must belong to both the formal and non-formal realm because a large proportion of the continent's people are still illiterate.

228. The final category of people of the MAB programme considered from the point of view of their effect on MAB are those that implement the programme itself - the biosphere reserve planners and managers. It is interesting to note that the Young Scientist Programme and all of the activities of the MAB programme have always included a training component. In spite of this, most administrators of biosphere reserves and national parks in Africa are sometimes less than high school graduates which makes the work of the reserve less efficient. The Young Scientist award scheme must be made to take on board planners and managers of biosphere reserves and national parks to improve on their administrative duties and not to make them all into ecologists.

### Gender and the environment: the role MAB

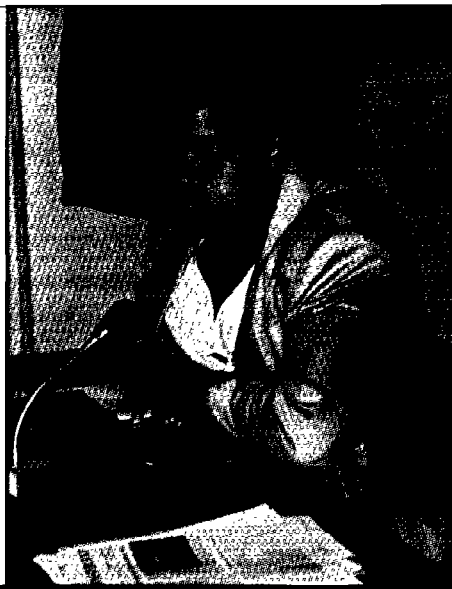
229. Unlike in many other agencies, the gender issue has not been treated as a separate entity within the MAB activities in Africa. However gender issues have been addressed and women participation well articulated in such projects as CIPSEG, Mananara North Project in Madagascar, FAPIS; IPAL etc.

UNESCO Dakar office organized from October 1996 a regional seminar titled Regional Conference for Forging Cooperation on Africa's Biosphere Reserves for Biodiversity Conservation and Sustainable Development in Dakar, Senegal. This meeting well attended by several African countries recommended on the importance of involving women in developmental projects.

Linking gender relations and environment is now an important focus of development research, policy and practice. But there is no consensus as to how gender-environment relations should be characterised. Much current thinking in policy circles suggests there is a special relationship between women and the environment. This is said to derive from women's current role as users and managers of natural resources; as collectors of fuel wood, drawers of water, and food producers, with some ecofeminist work also emphasizing how women are harmoniously linked with nature.

**BOX 14.** «... gender relations shape patterns of environmental use and management with tangible ecological effects, making gender analysis indispensable for understanding environmental history.»  
*Melissa Leach and Cathy Green (1994)*

**"Educate one woman, you educate a nation"**  
Women represent 52% of African population and ensure up to 70 to 80% of grain production. However women suffer most in the continent: one every three adult women cannot read or write and 250000 die each year in birth. Regardless of these handicaps, women of the continent are on the move. Today they are heads of businesses in public and private sector and in international commerce etc. Rural development initiative should not neglect the important role of women.



### Information Technologies in the MAB Programme Communication of finds and transfer of scientific knowledge

230. The usefulness of information and information technologies to the UNESCO-MAB programme cannot be over-emphasized. The three functions of research, training and demonstration require information at all times for effectiveness and efficiency. In the African continent the need for improved information technology is great because of the low infrastructural development of many parts of the continent. The poor transportation system throughout the continent makes it essential to have other ways of being in contact. Unfortunately, the other ways of maintaining contact (telephones, electronic transmission devices like internet and E. Mail) usually also depend on an efficient transportation system and electrical power supply. Africa is as yet to provide these basic infrastructural amenities in member states of UNESCO before embarking on an efficient adoption of the innovations in the information technology.



Tourism and non-consumptive uses of bioresources can provide opportunities for general population income from single resources. The importance he foresees applying some benefits for the communities

231. An internet based UNESCO-MABnet has been developed since 1995 in order to improve MAB's information service and strengthen its networking capacity. In 1996, the UNESCO-MAB net covered 112 MAB national committees, the list of MAB publications, contacts and activities of 328 biosphere reserves in 82 countries. It also covered Biosphere reserve bulletins and information on collaborative programmes such as Diversitas. In all these the participation of African member states has been considerably handicapped by the unavailability or irregular supply of basic infrastructural facilities, like telephone and electricity, that are required for the smooth running of the devices that make the information flow possible. The UNESCO-MAB net even has linkages to other internet services and information clearing houses. The regional thematic MAB networks are also being developed. An AFRI net has been set up but all these are reportedly being used by the urban or peri-urban areas on the African continent, and unfortunately most of the activities of the MAB programme in Africa are located away from these areas.

232. One feasible approach presently experimented upon in Africa for Africa, in the field of information technology for the MAB programme, is the use of popular theatre for communicating research findings on soil conservation and resource management to rural communities in East Africa as part of the tropical soil Biology and Fertility (TSBF) initiative. This approach appears feasible because it fits into the present infrastructural development in some African countries and must be encouraged to be used side by side with the electronic media in places wherever it

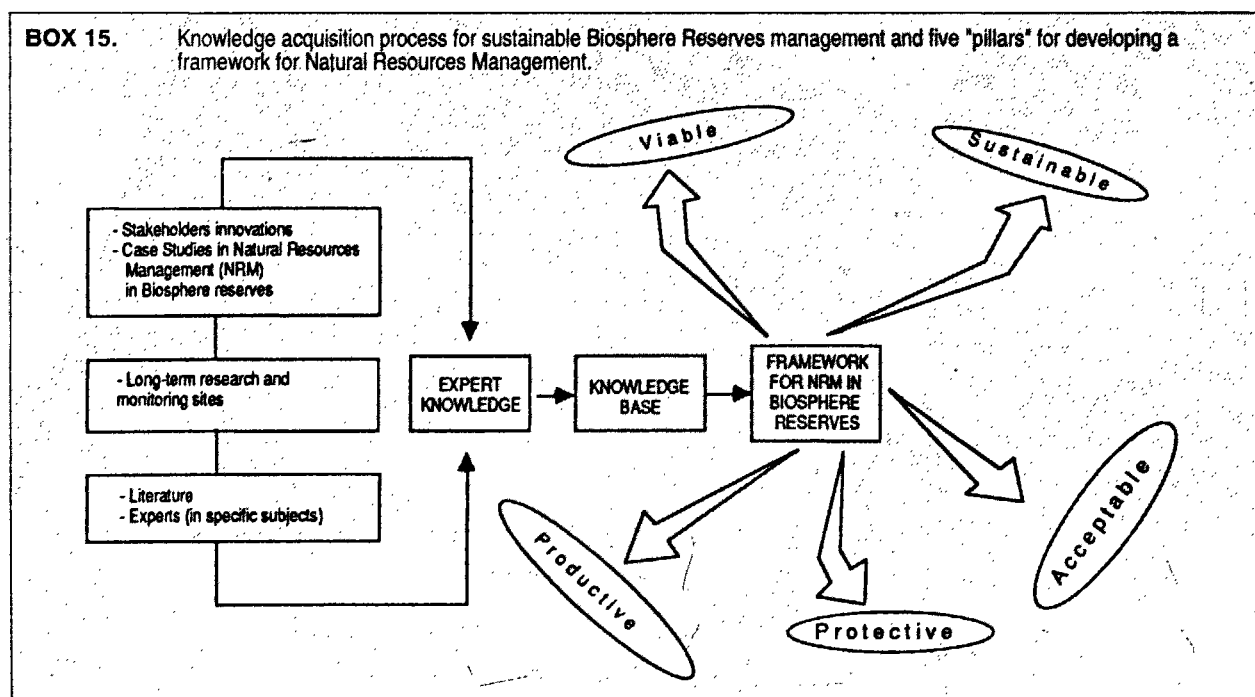
is appropriate to do so to ensure effective cooperation.

## Benchmarks and Indicators

233. The future of Biosphere Reserves in Africa should include establishing minimum "indicators" to measure the implementation of the Seville Strategy. The indicators should be adapted to problems of implementing the Strategy and should also be representative of the ecological zones in which Biosphere Reserves are situated, taking into account national, subregional and regional factors, particularly local socio-economic conditions. The indicators should be simple and readily usable by the parties concerned.

Benchmarks on the other hand are to be used to develop correlations between various parameters and to provide a baseline for monitoring at the local, national and regional levels. There are a few data bases on Biosphere Reserves degradation, and those available contain insufficient data from which benchmarks could be developed for measuring future trends.

However it is fortunate to note that in Africa, MAB does already have on site test sites and laboratories in key Biosphere reserves where benchmark would be carried out by multidisciplinary teams. These sites already provide essential interactions among scientists, economists, farmers etc. The Biosphere Reserve questionnaire developed by the Division of Ecological Sciences of UNESCO, Paris is an excellent initiative in this direction. Countries should however be sensitized to understand the usefulness of such exercise.





234. In spite of the above limitations in Africa, the Seville Conference (1995) gave a new impetus to the validity of the Biosphere Reserve concept of the MAB programme which was to mobilise cooperation at national, regional and international levels. Consequently, a considerable investment was made to develop the UNESCO-MAB net to improve communication within the world network and for the preparation of promotional materials on biosphere reserves (the folding map, the Seville Strategy Framework) for wide dissemination. Some African countries will benefit from such developments and investment but many more will be marginalised because of the absence of the infrastructural facilities that should make the use of these facilities feasible as most of today's information super-highway is based on the principles of telegraphic and telephonic transmission.

235. Facilities have been provided for electronic networking using internet to exchange information and data on MAB research and biological diversity. In addition to exchange of diskettes and CD-ROMs, information has fortunately continued to be communicated to researchers and decision makers in Africa through selective publications and other forms of multi-media channels of information flow. This should be developed and used to cope with the variety of contexts that the African continent will provide with limited extents to which recent development in information technology can be applied.

236. Other areas of information technology development for the MAB programme that might affect MAB's programme activities in Africa are the strengthening of cooperation by means of the Global Terrestrial Observing Systems (GTOS) in connection

with relevant UNESCO activities. The objective of this new system is to promote and facilitate information exchanges at the global and regional levels for selected monitoring of sites making use of the biosphere reserve networks. There are also the "Observatoire du Sahara et du Sahel" (OSS) within the framework of implementing the convention on combating desertification as an urgent measure in Africa and the Biosphere Reserve Integrated Monitoring System (BRIMS) as an environmental research and monitoring effort.

The Geographic Information Systems (GIS) and Environment Information systems (EIS) have also been providing linkages in the Biosphere Network. The case of Amboseli in Kenya can be cited as a success story.

237. With these developments South-South Cooperation in the humid tropics and North-South Cooperation in the area of higher learning have been possible with several African countries and the clearing house activities have been strengthened by providing training on the use of data bases and introducing information technologies for the management of biosphere reserves in Africa. Building human and institutional capacity through training, information, technology transfer and networking has been an integral part of the MAB programme and some attention has been given to strengthening the links between African institutions and those of the North to develop inter disciplinary education and training activities which combine ecology, social science and technology. The emphasis on ecology in this cooperation is most desirable because in the case of Africa man power shortage in this area as, pointed out before, is still very acute and the MAB programmes are reportedly facing serious difficulties in the continent as a result of this defect.



Training in Internet and in the use of Geographic Information System link site managers from Africa with other continents and assist them collect, interpret and manage their field data for site management.

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## MODALITIES OF EXTERNAL ASSISTANCE

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238. The key to success in internationally conducted programmes like the UNESCO-MAB programme is cooperation among participating units. And the elements that form the basis of such cooperation include exchanges of information on strategies adopted and results or products obtained; participation in common activities like seminars, workshops, conferences, research and training courses; and exchange of visits between personnel collaborating in the conduct of similar activities (research, demonstration projects) across the units. In this case of the UNESCO-MAB programme the basic units of activities are the biosphere reserves and the networks that had been formed. Since Seville 1995, the two-pronged approach (biosphere reserves and integrated projects) of the programme had ceased to exist by the provisions in the Statutory Framework and the Seville Strategy. Also, Seville 1995 adopted networking at the regional, inter-regional and thematic levels as the major strategy for cooperation. The statutory Framework was designed as a model legal instrument for this strategy and since the concept of integrated projects had been circumscribed by the concept of biosphere reserves cooperation in the MAB programme had been reduced to networking among biosphere reserves at the thematic, regional, inter-regional and world levels.

239. Networks represent new mechanisms for exchange of knowledge and information as well as a way of increasing the impact of successful approaches, such as, the concept of biosphere reserve. Networking is a new way of learning from one another and multiplying the impact of approaches that work. In networks peer-peer transfer promotes a kind of technical cooperation as opposed to technical assistance that leads to appropriate adaptation, new problem-solving approaches and longer term relationship between innovations.

240. One important principle to guide networking is the identification of a few key persons who will form the nucleus of the network and who will work with commitment and dedication to further the objectives of the network. Networks should avoid duplication as the resources for very many programmes that are subjected to networking are limited and it is believed that more can be achieved through putting the resources together and collaborating with other institutions and organisations which are doing similar work. It was with these principles that the activities of the MAB programme in Africa were judged and considered to be amenable to networking at the different levels stated above. These different levels already had the convention on Biological Diversity, Convention on Combating Desertification and other agreements awaiting them as areas of activity. Biosphere reserves following these thematic programmes cooperated on the basis of the shared programme. They exchanged information, personnel and data.

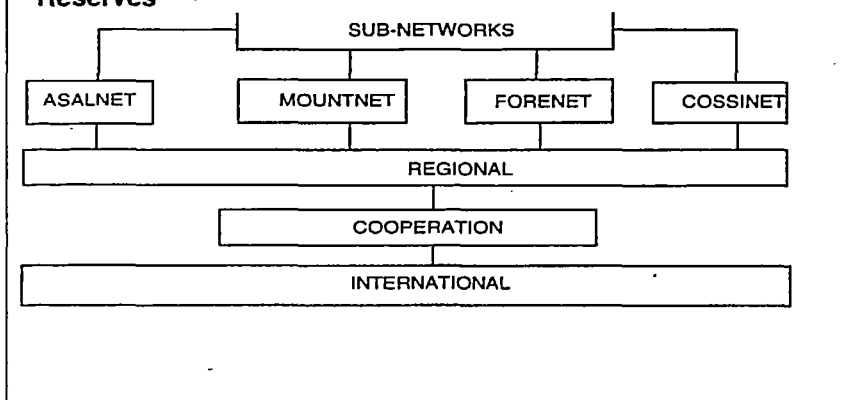
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### The State of Cooperation in the MAB Programme in Africa.

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241. The first major activity within the MAB programme in Africa that centred on cooperation by networking was the Dakar Regional Conference for forging cooperation in Africa's Biosphere Reserves for Biodiversity Conservation and sustainable Development. Before this, there had been a loose network of pilot projects world-wide. It was at this conference that an African Network of Biosphere Reserves (RESAREB - the French Acronym) was founded principally to encourage cooperation between different reserves. The network was to provide each reserve with basic principles for long-term conservation of natural resources in the continent in accordance with the statutes of the world

**Fig 13. Representation of the African Network of Biosphere Reserves**



network of biosphere reserves (the Seville Statutory Framework). The representation of this African network as conceived at the conference is as reproduced in figure 13 below.

242. These four sub-networks conceived at the Dakar Conference were not by countries or geographic regions of the African continent but by reserve types. The arrangement constituted a unique framework in the comparative study of biosphere reserve and ecological problems, in setting up common projects relating to each sub-network, in evaluating priority problems peculiar to biosphere reserve types and in facilitating exchange between biosphere reserves and the countries in which they are located. The arrangement was considered to be the ideal framework for international cooperation as exchanges and other forms of cooperation took place between the biogeographical networks of the same ecological zone. For instance, the 9 Sahelian countries in which the RCS-Sahel and IPALAC projects are conducted have had exchanges of information, training facilities and sharing of research results. In the case of the IPALAC programme the involvement of the State of Israel ensured that through networks relationships are established between countries with different economic and scientific development levels within the same sub-network.

243. The combined efforts of the Southern African countries involved in combating desertification is another example of intra-regional cooperation. The extent of cooperation between Western and African countries in the conduct of common projects like desertification control or combating deforestation is low although some financial support is obtained from these countries in solving the unique conservation problem of Africa. These countries participate in studies of complex African problems of conservation using Western institutions, experts and

equipment. The contribution of the Federal Republic of Germany to African programmes on conservation is noteworthy in this respect in the same way that other inter-governmental organisations (UNDP, UNEP, FAO) can be commended for the substantial contribution they have made to the UNESCO-MAB programme.

### **Objectives of the African Network of Biosphere Reserves (AFRIMAB)**

244. The main goal for setting up the African Network of Biosphere Reserves (AFRIMAB) was to enhance cooperation as expressed in the following specific objectives of the organisation:

- 1) to promote cooperation between MAB activities in Africa and related activities in other parts of the world.
- 2) To promote and develop compatible African strategies, policies, data banks and skills required for human activities as they relate to the environment and natural resources.
- 3) To attract the attention of donors to African professionals.
- 4) To strengthen cooperation between biosphere reserves in Africa, the sub-regions and the reinforcement of the scientific, technical and financial links with other MAB networks.
- 5) To develop a framework for the exchange of information and experiences amongst the various reserves.

245. These objectives of the network were intended to strengthen national facilities and institutions in Africa through regional programmes and activities and to spread the benefits of these activities to all interested parties in participating countries. Through the network, agencies of sustainable development, in particular, the local communities, were made to be involved in conservation activities. The existence of many and varied ecosystems in Africa justified the founding of the network to enhance flow of knowledge on how to manage these ecosystems. The rationale for the establishment of the African networks of MAB was also to increase the continent's participation in regional and international cooperation through biosphere reserves. One important principle that was

needed to guide such networking was the identification and use of existing institutions and facilities rather than build new ones.

### Intra-African Regional Cooperation

246. The AFRIMAB network was a framework for information exchange among the various biosphere reserves in Africa and between reserves located elsewhere in similar ecosystems. It enhanced MAB's regional cooperation. The biosphere reserves acted as the motor of the network together with a well defined programme of activities. The network had a working group of regional experts or facilitators (focal points for the four bio-geographical zones) to guide AFRIMAB and the regional biosphere reserve network in collaboration with the national committees for MAB and the regional offices for UNESCO in Africa. The national committee at the country level, by promoting new programmes of biosphere reserves which had the potential to attract funds from donors as a result of their intrinsic development and conservation value, acted as an agency for cooperation as it brought the donor and the initiating institutions together. In many cases where such cooperation was attained, the National MAB Committee became the multi-sectoral steering committee together with the representative of the donors and the NGO, research centre or university. The case in point is that of the CIPSEG project in Ghana where the University of Ghana, Legon and the University of Science Technology, Kumasi with the assistance of the Ghanaian National MAB Committee initiated the CIPSEG project around the Sacred Grove phenomenon and has now associated appropriate departments of the two Universities - Legon and Science and Technology in Kumasi to conduct researches and other developmental activities. The steering committee of this project thus has scientists from the Universities involved in the project together with the National MAB Committee. Thus, the MAB National Committee and the Biosphere Reserves represent the privilege tools for management of biological resources in the MAB programme.

247. The above scenario is the level of cooperation that is very common in Africa at the moment. Cooperation has increasingly become an important aspect of good management of protected areas in Africa. The cooperation within and between biosphere reserves does not only serve as a master integrator of the other function of MAB but also provides the moral force behind the biosphere reserve concept.

248. The network concept strengthens the leaders, the groups (including the local populations) who evolve the positive approaches and find the sources of support to multiply these approaches. With their counterparts in corresponding biosphere reserves, each of these focal points acts as a transfer agent putting successful approaches into the hands of policy makers for implementation. The AFRIMAB network provided integration within regional development programmes. It was also an invaluable tool for cooperation because it facilitated better dissemination of scientific information, experiences and skills within the sub-network on the management of biological resources for sustainable development. AFRIMAB exchanged information and data on African countries related to human activities and biosphere reserves through the AFRINET series and Biosphere Reserve Update which are publications of the UNESCO office in Dakar.

249. The simplest but perhaps the most effective level of cooperation that has been identified through networking is that between planners and managers of biosphere reserves (NGO's, National Park Managers, etc) on the one hand and the local community people on the other. A few cases of this, already cited are the Bia National Park (biosphere reserve) in Ghana, the Amboseli biosphere reserve in Kenya and the Tassili in Algeria. The cooperation between the local community people and biosphere reserve managers has been found to be very crucial for the successful cooperation between one biosphere reserve and another.

250. Operation of transborder biosphere reserves constitute another form of cooperation discovered by networking that is common in Africa. With the many States on the continent sharing borders on a continuing land mass, there are many ecological systems that extend beyond the border of one State into the other. The conservation of biodiversity in this land mass or degradation of one form or another (desertification, deforestation) is done together by certain States sharing the ecological system in common. To do so requires a lot of cooperation between the States. In the case of combating desertification in the Sahel in the North African region several countries in the regional network (Burkina Faso, Côte d'Ivoire, Gambia, Mali, Niger, Senegal, etc) have cooperated in conducting the same project. Similarly, countries in the East and Southern African regional network (Kenya, Tanzania, Lesotho, South Africa, Botswana, Namibia) have cooperated in conducting projects on combating the spread of the Kalahar and other deserts. The IPAL project in Kenya and Lesotho and the

training courses organised by MAB for SADC countries are cases in point. Strictly speaking, some of these projects are not transborder conservation projects conducted across these countries but they are cases of cooperation among states sharing common problems. The training courses, in particular, are organised to provide human resources that work towards eradicating common problems of land degradation facing countries in the same regional network.

251. The other group of agencies that bring about cooperation among African countries facing land and environmental degradation and seeking solutions to them includes training courses, workshops, conferences, seminars and researches. African institutions and centres of excellence which provide courses in conservation and related fields and that are made use of by the MAB programme contribute significantly to cooperation between States through the information transferred during the courses offered and by the movement of persons between countries. By sharing information during these courses, students or participants from different countries use the knowledge gained on their return to undertake conservation and sustainable development programmes. They even continue to share experiences and skills gained in the field on their return and exchange ideas on the programmes they conduct in their different countries through subsequent seminars, workshops and conferences to which they are invited.

252. Research is one of the main activities of the MAB programme and this is usually conducted by institutions or non-governmental organisations. Individuals involved in similar research projects in different countries cooperate by sharing results for comparability, techniques and methodologies. The methodology used by one researcher may be replicated in a similar problem situation elsewhere and results compared to accept or refute earlier findings and corresponding explanations. Cooperation at this level is not necessarily intimate but takes place through published documents which are consulted. The cooperation can be international but within themes that are of common interest. The research project can be a complete repetition of an earlier study where the situations or problems are exactly the same but the results are not applicable at a particular point in time.

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### International Cooperation

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253. Cooperation at the international level in the area of conservation is of two types. There is the

South-South Cooperation which is largely a collaborative problem-solving one where two or more nations having a common conservation problem collaborate to find a solution to that problem by working together. In most cases the resources used are through international loan schemes through inter-governmental and non-governmental organisations. Except for the funding aspect, this approach of South-South Cooperation is preferred by both the recipient and donor organisations of present day Africa because of the resulting empowerment of the South through the expertise they acquire by providing a solution to an endogenous problem. Work in the Omo biosphere reserve in Nigeria is the closest example of South-South Cooperation. The second type of cooperation is the North-South Cooperation which brings on board knowledge and technology transfer. In many cases where a conservation problem in the South is of interest to countries in the North knowledge and technology transfer become the essential aspect of the involvement of the countries of the North. Learning about the problem and the solution arrived at suddenly become attractive to funds from the donor community in the form of equipment and technical assistance. The Tai tropical forest biosphere reserve in Côte d'Ivoire represents a North-South Cooperation.

254. Several efforts have been made at ensuring international cooperation of the above two types. The well documented of these two types of international cooperation is the North-South one. Cooperation through inter-agencies is also very well documented. UNESCO and Conservation International (an NGO), for instance, launched a joint project to equip and organise training of 25 biosphere reserves in developing countries, including those of Africa, to build up their capacities to access internet based information sources including MABnet. In cooperation with the World Bank's Global Environment Facility (GEF) project UNESCO provided training to biosphere reserve personnel in internet communication and data based development. A joint initiative of the World-Wide Fund for Nature, UNESCO and the Royal Botanic Gardens in Kew, UK, launched two regional cooperation projects on conservation problems supported by Funds-in-trust with UNESCO.

255. There are also several instances of inter-agency cooperation involving the UNESCO-MAB programme, and the principal inter-governmental agencies involved here are FAO, UNEP and UNDP. The non-governmental agencies with which the MAB programme has cooperated on many projects in

Africa include the World Conservation Association (IUCN), the World Scientific Union (ICSU) and the International Development Research Centre of Canada (IDRC). The MAB programme has also had close cooperation with the "Observatoire du Sahara et du Sahel (OSS)" within the framework of implementing the convention on combating desertification as regards urgent measures in Africa.

256. All of the above instances are efforts at the international level at ensuring cooperation with the UNESCO-MAB programme in Africa. In all of these cases UNESCO has initiated, coordinated and made financial contributions on behalf of the MAB programme including activities in the African continent. To this extent, the UNESCO-MAB programme has been considered a coordinating centre for land and environmental resource conservation including responsible utilisation for sustainable development.

257. Knowingly or unknowingly UNESCO is also engaged in putting into place complimentary process to projects' approach for appropriate actions. Though fairly new to be evaluated «process-oriented approach» has been highly successful for such projects as CIPSEG and is indeed promising for future projects in Africa, particularly those projects with rural development as the goal.

**BOX 16. Process-oriented approach**

*Flexibility and participation are two of the key element of the process oriented approach. The starting point is real involvement of the part of all relevant and interested parties in the identification planning, implementation and management on activities.*

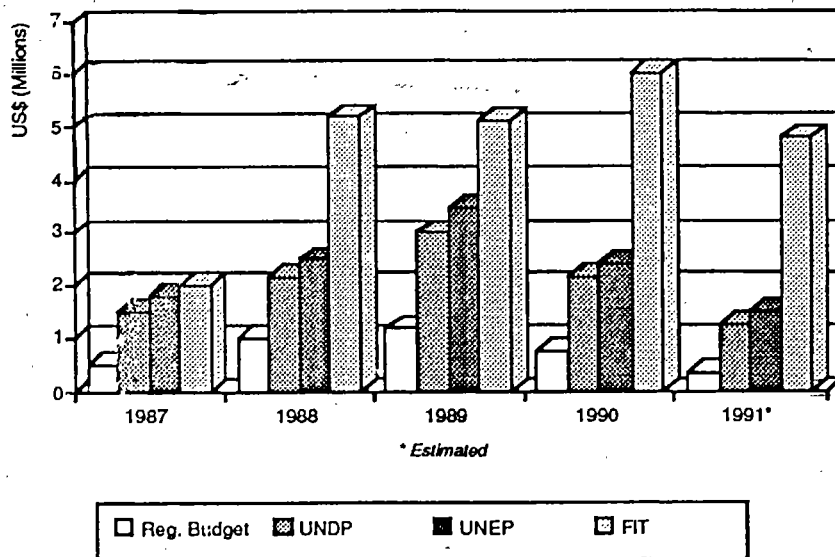
*Essentially, what the process oriented approach means for an aid activity is that the specific objective, the amount of aid and the date on which it will be determined in advance. The objective is determined by those involved, not before the process starts but while it is under way. The people involved also determine the priorities and each step to be taken, not in a planned fashion in advance but again, while the process is underway. The donor selects the counterpart, the counterpart selects an objective... The principal obligations which the donor assumes are to enter into a relationship for a long period to support part of the process, providing the recipients also make a significant contribution in the form of ideas, attention, manpower and financial resources. In general with the process-oriented approach, aid will take longer to get off the ground, will not involve excessively large sums of money, because it is in line with what people themselves, rather than those with power over them, can handle (Netherlands 95: p 76-77).*

**Funding of the MAB Programme in Africa**

258. The sources of financial support for the UNESCO-MAB programme in Africa falls into two categories: the regular budget of UNESCO and the extra-budgetary sources made up of contributions from other inter-governmental and non-governmental organisations and funds held in trust by UNESCO. Some countries of the North also give to specific projects of the MAB programme in named-countries

for supporting various activities. The budgetary and extra-budgetary resources for MAB world-wide for the five-year period 1987-1991 inclusive is as shown in the chart below:

259. In general the contribution from the UNESCO Regular programme has often represented a little less than 20% of the total funds available to the Central MAB programme. This is to say, each dollar from



Source: Ecology chronicle 1991

UNESCO has been matched by more than five dollars from extra-budgetary resources. And on top of this are the funds invested directly in countries participating in MAB, on a national or bilateral basis. In particular extra-budgetary support have been made to activities in African countries such as :

- 1) Reinforcement of Agro-silvo-pastoral capacities in sahalian countries (support provided by the Federal Republic of Germany Ministry of Economic Cooperation).
- 2) Tunkana Resources Evaluation and Monitoring Unit in Northern Kenya (support provided by Norway).
- 3) Integrated Project on Arid Lands (IPAL) in Lesotho (support provided by the Federal Republic of Germany Ministry of Economic Cooperation).
- 4) Tassili N' Ajjer in the Central Sahara of Algeria (support provided by UNDP).
- 5) Sustainable Development research and heightening environmental awareness of tropical forests (support provided by the Federal Republic of Germany Ministry of Economic Cooperation).
- 6) Integrated Pilot Projects for sustained development and conservation of tropical forest ecosystem in Monts Nimba (Guinea), Mayombe (Congo), Mananara Nord (Madagascar) (support provided by UNDP).

- 7) Savana research in Côte d'Ivoire (support provided by UNDP).

260. These extra-budgetary support to UNESCO for MAB related activities has been the principal explanation for the increase in the overall funding of MAB from \$ 6.2 millions per year in 1990. Of particular note is the steep increase in funds-in-trust (FIT) made available to MAB (over \$ 3 millions in 1990 which was triple that of 1987). UNDP funding had increased slightly on the global scale but still stood at \$ 1 million in 1990. UNEP also provided continuing though relatively low level support to joint activities with MAB.

261. These increases in extra-budgetary funds and the reportedly static regular programme resources may have been responsible for the significant decrease of UNESCO provide funds from 50% in 1987 to 14% in 1990. The extra-budgetary resources are by their very nature targetted to specific activities, often on a named-country basis. The UNESCO Regular programme support of the MAB programme has implications for the future funding of advisory committees, cooperative studies, communications and publications.

262. In the African continent support for the MAB programme activities have been obtained from both



'Research is vital be it: exploration, inventory and taxonomic to discover new organisms, the characteristics and patterns of variation; or ecological studies to ascertain the processes that sustain ecological services; or monitoring to determine the changing status of biodiversity and its components'.

the UNESCO Regular programme and extra-budgetary sources including funds-in-trust, the associate expert programme (in the case of technical assistance) and other inter-governmental organisations. UNDP and UNEP have been the major regular contributors to MAB.

263. For a long time (1973-1983)\* UNEP and MAB conducted joint projects after the former had been founded at the United Nations Conference on the Human Environment in Stockholm. The integrated joint projects that were conducted by the two programmes gave promising results including the definition and testing of conceptual approaches. The promising results also included data from studies of tropical forests, human settlements, arid lands and mountain ecosystems. During these days, institutional constraints were identified by the two programmes during the testing of the integrated approach. In some cases this approach could not be applied due to lack of expertise in the national counterparts. Another usefulness of the collaborative UNEP/MAB integrated ecological approach to the study of ecosystem was the promotion and dissemination of improved environmental management practices.

264. During the period under review when UNEP and MAB were conducting the joint projects the financial resources of the two programmes were so closely linked that only raw data on the resources of these programmes can give the amount separately. It is thus not possible to do an independent analysis for these early years. Information on the allocation made to these two programmes was given in a lump sum without breakdown between UNEP and MAB. In addition, contributions to the MAB programme which were lumped together were made by UNDP and Funds-in-Trust even in these early years of the programmes' existence. In the case of UNEP contributions to the MAB programme activities were in the form of activities in which the two programme collaborated. After 1983 the collaboration continued but at a much slower pace and with separated budgets.

265. In 1984, the MAB programme started independently mobilizing its own resources from a number of agencies to provide support for specific activities; one of these sources of support was: the United Nations Sudano Sahelian Office (UNSO) which funded Pilot Projects on research, training and demonstration in arid and semi-arid zones in the North and Southern African region. Research, training and additional support also continued to come from the Funds-in-Trust and Associate Experts pro-

gramme as well as UNDP and UNEP. The Funds-in-Trust and Associate Experts programmes contributed to the execution of the pilot projects in the arid and semi-arid zones, the CIPSEG project in Ghana and work on arid lands in Burundi. The UNDP in collaboration with the UNSO contributed to organisation of training programmes in pastoral ecology for Sahelian region and established the CILSS institute together with the respective countries. UNDP also supported Algeria for setting up the National Centre for research in arid zones. UNEP, on the other hand, supported the activities of the integrated project on arid lands in Kenya, Tunisia and Lesotho while at the same time providing funds to the biosphere reserves for their collaborative project. UNEP also provided support to pilot projects for integrated management of coastal zones.

266. The UNDP and UNEP provided the most regular support to the MAB programme as these collaborated extensively in the activities of the biosphere reserves.



## CONCLUSIONS AND RECOMMENDATIONS

267. The conclusions and recommendations listed below are as categorised under major areas of activities of the UNESCO-MAB Programme in Africa:

### Ecosystems at Risk

268. Comparatively, more arid and semi-arid lands are presently designated as biosphere reserves in Africa probably because these appear to be areas that need land improvement most in the North in the Sahara and in the South in the Kalahari and other small patches of desert land. While it is true that large desertified land masses need improvement it must also be borne in mind that forest and savanna land areas are also fast becoming desert. Combating desertification by designation of large biosphere reserves must be extended to the other vegetational zones where designation of biosphere reserves have either not been undertaken as a conservation strategy or have only been done on a small scale.

269. Land degradation has resulted from human settlement in coastal and highland areas. The effects of concentration of human settlements and the resulting economic activities and resource mobilization seem to be exceeding the capacity of natural systems and amenities in these areas. A lot of work is required to be carried out on this phenomenon so as to provide a stable co-existence between humans in urban areas which are now considered as ecosystems. The principle of conservation with rational utilization of existing resources on which the biosphere concept is based must be used for the preservation of these areas

### Innovations

270. The main aim for halting the different forms of

land degradation by the UNESCO-MAB programme is to contain the agricultural and other resource potentials of Africa's land mass without disturbing existing stable states (equilibria) of the different ecosystems. The different approaches, including the biosphere reserve and sacred grove concepts, are in this regard innovations in the history of conservation work that must be nurtured. This nurturing must start by increased participation of Africa's nations in the adoption of these concepts.

271. Traditional forms of conservation and development must be studied and encouraged to be used as the cue to the MAB programme in Africa. Sustainable exploitation had for a long time been practised in traditional Africa and have been seen to work as strategies for conservation and rational utilisation of land resources.

272. It appears that the greatest attraction to the MAB programme in Africa is the freedom of the local community people to live on their land carrying out traditional practices of farming and other methods of exploitation within the limits of their cultural beliefs and practices while conservation activities are going on. Even where designated land areas or resources are identified for conservation purposes the status quo must be kept with respect to the interaction between the local community and the land they live on or an appropriate replacement is made for the many restrictions imposed. Orchestration of any designation assigned to a land area or resource contained there in must be avoided. The traditional practice of laws regulating individual or collective use of land resources can be a good way of ensuring these conservation practices other than strategies unknown to the local people.

273. Traditional conservation strategies like shifting cultivation, fallow periods and sacred groves are to

be maintained as innovative practices of conservation to satisfy local community people who have kept these methods over the years but also to ensure effectiveness. By identifying and encouraging these traditional methods as against the agricultural practices resulting from market economy Africa's land degradation can be gradually halted. These traditional methods are the ways of keeping traditional societies adhering to conservation.

274. The utilisation of land resources leading to serious problems of degradation like fuelwood harvesting which can be avoided by suitable replacement methods is already under serious consideration in most threatened parts of Africa. The use of gas as a replacement of fuelwood is gaining popularity in many arid and semi-arid regions of Africa. A special promotional campaign is required for this practice even in the humid tropical forest areas which are threatened by desertification.

### Dissemination of Information

275. While making efforts to institute advanced information technologies in the MAB programme, especially for linking the biosphere reserves, it is advisable in the immediate future to strengthen the African network.

276. The biosphere reserve approach to conservation with sustainable development is potentially productive but requires guidelines either for scientists or local communities to facilitate the exchange of ideas between them for the success of the global garden. These guidelines must be prepared and made available for public consumption.

277. The use of Popular Theatre in disseminating information on the activities of the MAB Programme in Africa appears to be a plausible proposition especially in areas where there are problems of infrastructural deficiencies for the use of today's information super-high way. Even where the information super high-way can be used it is not yet possible to get it to everybody. Certainly the internet based MABnet will for sometime be limited to a few regions of the world. The use of Popular Theatre and other ways of disseminating information to deprived or disadvantaged groups or areas must be investigated and adopted.

278. Sub-networks of AFRIMAB are based on biogeographical divisions for conducting the different activities of the MAB programme using similar

ecosystems. It is however desirable to consider geo-political divisions of the continent for purposes of networking to encourage better exchange of information as well as competition between network. Some of the geo-political divisions are along lines which will augur well for better exchange of information. It is already not possible to have all documents translated into the various official languages used in Africa.

### Cooperation

279. Many more African nations are to be encouraged to have biosphere reserves to benefit from their membership of the UNESCO. They should identify more biosphere reserves, world heritage/Ramsar sites and sacred groves as a means of halting the deterioration of the African land mass through indiscriminate and irresponsible exploitation. In this respect it will be appropriate if the activities and progress of the MAB programme (the number of biosphere reserves designated, the areas covered, type of ecosystem are frequently reported to these nations.

280. Land areas allocated to Biosphere reserves in some Member States of the MAB Programme are very limited presumably because of the limitations imposed on exploitation of the natural resources available to peasant farmers and others. It appears the principle of non-deprivation of rational land use in the MAB programme requires intensive campaign to motivate Member States to designate more land areas as biosphere reserves especially in the humid tropical forests, coastal and small island areas and mountain and highland ecosystems.

281. The new Member States joining the MAB programme must be made to be involved in the many interesting activities that had been undertaken by the programme when these Member were out. For instance, the 14 themes or project areas that were originally undertaken must be the first activities of the new Member States even though these have been officially terminated by the older members.

282. Relations must be established between countries of different economic and scientific development levels with sub-networks and within Western countries to allow them benefit from available experiences and techniques in the specialised institutions of the more advanced countries.

283. Contacts between planners and managers of biosphere reserves and similar institutions must be facilitated through direct participation in research and training activities within sub-networks of the same ecological zones and through technical seminars and exchange of information by means of the Biosphere Reserve Update.

284. The keen interest of intergovernmental and non-governmental organizations and the local community in problems of land and environmental degradation in Africa is resulting from the extent and speed at which the continents' land area is deteriorating. It is a fact that if the present forms of degradation of Africa's land mass are not halted by different conservation strategies including those that ensure responsible utilisation the rich resources of Africa will be lost. Since there are some organisations which are still not involved in saving the continent from collapse a public promotion for these others to participate is absolutely necessary.

285. The basic and perhaps the most important type of cooperation is at the level of the local community people who use the resources that are conserved. It is when cooperation at this level has been attained that others amongst biosphere reserves at national, regional and international can succeed. The concept of buffer zone development through the involvement of local community people and impact on the economic activities of the people living in a biosphere reserve are a few of the cases that have been shown to be effective.

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## Research

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286. In the present state of the Africa continent where a lot still needs to be known about the flora and fauna of Africa's land resources and even the distribution of ecosystems (mountain and high lands, coastal and small islands, arid and semi-arid, savanna, lakes, rivers, lagoons, estuaries, etc.) there is need to prepare a continent-wide inventory of these resources for identification of possible sites for the location of different types of biosphere reserves.

287. Many of the agricultural crops of Africa are introduced plants. One of the major areas of research for the MAB programme should be continuous inventorying of many of the plants in the wild and investigations carried out as to their uses to man. It has been impossible to estimate the number of species that are lost before their potential values as sources of food or medicine are known. Exploration and

researches are needed to develop these unknown species for various purposes including food, medicine, construction and shelter.

288. As a result of the inadequate participation of African nations in the UNESCO-MAB programme and similar relevant inter-continental programmes intended to save planet Earth from destruction less research-based information is available on the state-of-the-art in respect of the deteriorating conditions on the planet especially trends that seem to have been in existence over the years. In this regard it will be appropriate that the increased participation that may result from the recommendations in this report be used to initiate more continent-wide research activities on trends in the deteriorating conditions of the continent. This could be achieved through trans-national studies of phenomena affecting the continent.

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## Funding of MAB

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289. Information gathering, synthesis work and publication and dissemination of research results on MAB is limited by funding. Other necessary activities of MAB have been constrained by funding. Participation of Africa Member States must be encouraged to fund conservation activities in their countries. It will be unlikely for countries of the north to continue funding conservation activities in Africa if contributions are not forthcoming from countries that are seriously affected by land degradation problems.

290. A significant change in the last few years in donor assisted integrated pilot projects of MAB in Africa concern the management for projects results. There has been more emphasis on management for results which suggests that though results are important, what is emphasized is working to strengthen management skills and capacities to work more effectively and efficiently. Therefore here, the support is not so much in terms of achieving particular and more traditional and tangible development objectives but in terms of enhancing the capacity of recipients to manage and implement development for themselves «unaided». Being the case MAB activities are linked to institutions that are likely to undertake the responsibilities of a particular project once the extra budgetary financial support is terminated, or local mechanisms are put in place during the course of project duration that easily assimilate the functioning of the project.

291. Many projects of the MAB programme are

funded by other nations notably the Federal Republic of Germany. While these sources should be appreciated African Government must see their responsibility in funding conservation activities as the development of each country and the continent as a whole depends on the preservation of its natural heritage.

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### **Pilot Projects**

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292. The existence of integrated pilot projects within the MAB scheme of work alongside or within biosphere reserves is an exceptionally good idea for conducting research and training in topics that are relevant to the main objective of MAB, which is, conservation of sustainable development including rational utilisation of resources. However, whereas some projects have emphasised the role played by local community people to enhance achievement of the conservation objective a few are probably so concerned with the original MAB objective that the local communities who ensure sustained achievement of this objective are ignored. It is perhaps advisable that the issue of the local communities peoples' involvement in the execution of pilot projects be taken very seriously. Community participation in biosphere reserves and pilot project implementation should be considered as one of the main elements of the MAB programme in the same way research, training and demonstration are.

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### **Addressing Regional Environmental Challenges**

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293. A key challenge for the future will be to ensure that the rapidly growing portfolio of environmental projects continues to perform well in Africa. High percentage of ecological projects addressing environmental problems financed under the Funds in Trust arrangements with UNESCO are in Africa, and the portfolio is expected to increase in future. This represents a highly important contribution of the financing needs identified at the Rio «Earth Summit» in 1992. Countries will require help to effectively implement these projects.

294. Integrated pilot projects in the name of, or that run across several countries, like the RCS-Sahel project intended for nine countries but actually conducted or concentrated in five or the IPALAC project in three countries but intended to cover the arid lands, must ensure that activities of the project are visible in countries or entire climatic and

vegetational zones originally intended to be covered. Where the research or training activities are not conducted in a particular country the results of the research or personnel trained in the name of that country should be visible in the areas covered or intended to be covered. Conservation problems are practical ones and so any input in solving them must be shown in concrete terms.

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### **Training**

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295. Training of players in the MAB programme cannot be over-emphasized (Biosphere Reserve Planners and Managers) in Africa as these are required for effective implementation of the programme. At the moment most of the administrators of the programme on the field are less than qualified. It is alleged that many of them are less than high school graduates. The MAB Young Scientist Award Scheme or a more appropriate scheme must be used to upgrade these people for more efficiency and effectiveness in the performance of the tasks assigned to them.

296. Training is a key area in the MAB programme and education has been mentioned in this regard in various places where field activities of the programme are conducted. And educated public in land and environmental conservation is required if conservation attempts presently made are to be successful. There is, of course, a strong case in incorporating environmental education into school programmes at the different levels. Some universities in Africa now have faculties of environmental sciences and the teaching of science at every level in the continent is receiving an environmental bias. However, a large segment of the African society in all African countries is ignored in all these endeavours. That segment is the illiterate community which averages about 50 % of Africa's population. The influence of this groups on conservation has been noted. Thus, a way is to be found where the various efforts made at the formal education level are extended to the adult illiterate community. The point has been made somewhere in this report that human contribution to land degradation is largely by the poor and disadvantaged as a result of the desperate need to survive. With conservation infused into adult education alternative sources of survival or rational methods of exploitation of renewable natural resources can be discovered and used. Already traditional African practices have been adopted as innovations in conservation for sustainable development which means that a strong foundation already exists to be built upon.

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