Government of the Republic of Sudan
Ministry of Environment and Physical Development
The Higher Council for Environment and Natural Resources
(HCENR)

Third National Report on the Implementation of The Convention on Biological Diversity

Khartoum, Sudan
2006

TABLE OF CONTENTS

Preface

Sudan is party to the CBD since October 1995 after ratification of the Convention. It has been meeting its obligations towards national reporting by being able to submit the First and Second Reports in the years 2000 and 2003 respectively. Sudan has also benefited from the umbrella project that is designed to assist a number of countries in the preparation of their Third National Reports on Biodiversity in order to meet their national reporting requirements under the Convention on Biological Diversity (CBD).

The expedited assistance has helped Sudan very much in achieving the timeliness and quality of reporting as called for under Decision VII/25 of the CBD at its Seventh Conference of Parties.

I am indebted to the Global Environment Facility (GEF) and its agency the United Nations Development Programme (UNDP) for their assistance and financial support of the Government of Sudan during the Biodiversity Enabling Activities and Add-on Phases. Building functional capacity and infrastructure to support the implementation of biodiversty national strategies and plans is a demanding task. We therefore, will do our level best to implement the biodiversity action plans. Nevertheless, we wish that the help and cooperation of GEF and UNDP to continue.

Dr. Ahmed Babikir Nahar
Minister of Environment and Physical Development
The Republic Of Sudan

ACKNOWLEDGEMENTS

The successful preparation of the Third National Report on the Implementation of the CBD is a result of the commitment and hard work of many individuals and institutions. We thank the H. E. the Minister of Environment and Physical Development, Dr. Ahmed Babikir Nahar for his follow up of the Report and his auspices of the National Consultation Workshop.

We wish to express our gratitude to the coordinator of the report preparation Dr. Ahmed S. El Wakeel, Ex-Coordinator, Biodiversity Project. Our thanks extend to his colleagues, the Task Force members, Professor Yousif Babikir Abu Gederi, Dr. Nadir Mohamed Awad and Dr. El Tahir Ibrahim Mohamed whose inputs constitute the core of the report. We are grateful to all heads and representatives of government sectors, ministries and institutions who attended and/or contributed with useful information in the national consultation workshop held to review the report.

We are particularly thankful to all the stakeholders, civil society and NGOs representatives who have contributed with ideas and thoughts. Thanks are also due to HCENR staff for their role in organizing the workshop. Finally, thanks are to the media that made good coverage to the workshop deliberations.

Dr. Saad El Din Ibrahim Izz El Din
Secretary General,
Higher Council for Environment and Natural Resources (HCENR)

ABBREVIATIONS AND ACRONYMS

ABS	**Access to Genetic Resources and Benefit Sharing**
ARC	**Agricultural Research Corporation**
ARRC	**Animal Resources Research Corporation**
CBD	**Convention on Biological Diversity**
CBO	**Community Based Organization**
CHM	**Clearing House Mechanism**
CITES	**Convention on International Trade in Endangered Species of Wild Flora and Fauna**
COP	**Conference of the Parties**
DNA	**Deoxyribonucleic Acid**
EAPGREN	**Eastern Africa Plant Genetic Resources Network**
FNC	**Forests National Corporation**
GEF	**Global Environment Facility**
GIS	**Geographical Information System**
GPS	**Global Positioning System**
IUCN	**World Conservation Union**
HCENR	**Higher Council for Environment and Natural Resources**
1ES	**Institute of Environmental Studies**
MAPRI	**Medicinal and Aromatic Plants Research Institute**
NBG	**National Botanic Garden**
NBSAP	**National Biodiversity Strategy and Action Plan**
NCR	**National Center for Research**
NTEAP	**Nile Transboundary Environmental Action Project**
PGRU	**Plant Genetic Resources Unit**
RPA	**Range and Pasture Administration**
SECS	**Sudanese Environment Conservation Society**
UNDP	**United Nations Development Programme**
UNEP	**United Nations Environment Programme**
UNFCCC	**United Nations Framework on Climate Change**
WCGA	**Wildlife Conservation General Administration**
WRC	**Wildlife Research Center**
WSSD	**World Summit on Sustainable Development**

Executive Summary

Sudan is a large country with an area of 2.5 million square kilometers and is bordered by nine African States. These are Egypt, Eritrea, Ethiopia, Kenya, Uganda, Congo, Central African Republic, Chad and Libya. Additionally, the Sudan has over seven hundred kilometers along the Red Sea Coast. Ecologically, the country is diversified. Environmentally, the country ranges from desert in the north to semi-humid savanna and humid sub-tropical woodlands in the south. This wide range of variation is a result of climatic factors, particularly rainfall, together with soil variation leading to diversity in vegetation cover. In general, a gradual succession occurs from desert scrub in the north to low rainfall savannas in the south.

Agriculture is the mainstay of the national economy with about 80% of the people engaged in crop production and animal husbandry. The principal food crops are sorghum and millet while the cash crops are cotton, sesame, groundnuts and Gum Arabic. Livestock which is estimated to be over 100 million, composed of cattle, sheep, goats and camels, are kept under both nomadic and sedentary traditional conditions. Such a large number of livestock has resulted in overgrazing of rangelands which triggered the process of desertification. Nomads move with their herds from north to south according to the rainy season. In many cases conflicts may arise with sedentary cultivators as a result of competition over meager natural resources.

Sudan has singed CBD in June 1992 and ratified in October 1995. Hence, Sudan became obliged to develop its National Biodiversity Strategy and Action Plan (NBSAP) which was completed May 2000 and endorsed by the Council of Ministers. Two Enabling activities were undertaken through GEF/UNDP assistance to the government of Sudan. The first enabling activity (EA) aimed at developing the NBSAP while the second EA was to assess the necessary capacity needed to implement the NBSAP. The said strategy outlined many issues related to biodiversity status in the Sudan. The strategy identified a number of challenges that affect biodiversity conservation and ecosystems. The NBSAP represents a major effort built on wide consultation and participatory process however still it has not been without gaps and these were later identified. The implementation process of the NBSAP is constrained by many factors but progress has been made in some sectors and some activities were achieved.

In accordance with Articles 26 of the CBD, Sudan has submitted the First National Report (August 2000) and the Second National Report (October 2003) to CBD.

This report "Third National on the Implementation of the Convention on Biological Diversity, CBD" attempts to briefly in eight major sections highlight the current situation of biodiversity in Sudan. This is meant to analyze and synthesize measures undertaken, evaluate up-to-date progress made towards conservation of biodiversity and implementation of CBD in Sudan since the inception of biodiversity as enabling activities.

The first section gives a background on the status of biodiversity components and ecosystems in the country. It also explained the developments and achievements during the two-phased Enabling Activities in addition to identifying the gaps and constraints that encountered the processes. A SWOT analysis is performed on the undertakings. The second section illustrates the progress that took place in implementing the biodiversity strategy in some sectors or components. The third

section acknowledges the constraints that are assumed to have slowed down or have completely hampered execution of some activities. The fourth section describes the links and connection with some of the core international and regional conventions and treaties to which Sudan is party or member. The fifth section explains how would the new Comprehensive Peace Agreement (CPA) which is recently launched between North and South Sudan might positively change and enhance implementation of biodiversity strategies and action plans. The sixth section brings out to the surface some of the important themes that have been inadequately or have not altogether been considered even though they can be ranked as priorities. The seventh section associates effective implementation of biodiversity management and conservation in the country with meeting several capacity building requirements. The requirements are diverse and variable but mainly include institutional, logistical, legislative and financial arrangements. It is suggested that these needs can be covered through efforts at the national, regional or international levels. The eights section furthers the call for capacity building adding other areas that need input and qualify for support. The final section, the ninth one summarizes the major recommendations that can help in the process of implementation.

There is increasing awareness among stakeholders about environmental issues in general and particularly in biodiversity in the country. Conducive atmosphere has been created after the emergence of the Comprehensive Peace Agreement (CPA) for environmental concerns to rank as high priority. The time is ripe now for better and serious consideration for appropriate plans of action to be implemented. Actions on biodiversity implementation plans should not be an exception.

1. BACKGROUND

Sudan is a big country with an area of 2.5 million square kilometers (250 million hectares). It extends from desert in the north with dry hot climate, to the African Sahel zone in the center with both poor and dense savanna, up to the equatorial region in the south where heavy rains and dense plant cover prevail. Potentially arable land in Sudan is estimated at 87.8 million hectares with variable rainfall levels ranging from 50 mm to 1500 mm. Data on land use show that only 21% (18 million hectares) of the total potential arable land.

Natural range and pastures cover 90.3 million hectares, while forest and woodland occupy 26.9 million hectares. Livestock numbers are estimated at 134.3 heads. Records indicate the presence of 3132 species of flowering plants, 409 of which are endemic. There are 265 species of wildlife mammals seven of which are endemic. Bird species amount to 938, while freshwater fish species are 106. Reptiles are estimated at 80 species, six of which are endemic. There are also three endemic amphibian species.

Sudan is endowed with a wide range of ecosystems and species diversity. The ecological zones extend over a wide range from the desert in the extreme north to the rain forests deep in the south. This is in addition to the freshwater and marine and coastal environments.

Conservation of biodiversity is vital in a country like Sudan, where ecosystems are fragile and the renewable natural resources are endangered through over-exploitation. These ecosystems are deteriorating rapidly due to multiple interacting factors mostly socio-economic changes which result in excessive grazing, felling, soil erosion, desertification, over-hunting, land degradation and declining biological diversity. There is evidence that many aquatic and terrestrial species have either disappeared or are subject to severe threats resulting from the destruction of their habitats.

Limitation of legislation and law enforcement efforts which call for protection of biodiversity have led to improper utilization and misuse of natural resources and adversely affected the biota both at sea and land. Lack of clear policy and strategy for the conservation and management of resources has led to unsustainable use of resources and irreversible loss of biota.

Following the signature in 9 June 1992 and ratification of the Convention on Biological Diversity (CBD) in October 1995, the Government of Sudan has requested the assistance of the GEF and UNDP to meet its initial obligation to the Convention through the development of a National Biodiversity Strategy and Action Plan (NBSAP). Signifying its commitment to participate in the conservation and management of the world biological and natural resources, Sudan has also signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD).

As a first step in meeting its obligations, the Government of Sudan in accordance with Article 6a of the CBD, has undertaken a participatory process for development of the NBSAP. In response to the list of challenges facing biodiversity and sustainable development, Sudan outlined a number of issues and identified those which affect biodiversity conservation and ecosystems. Besides, there are opportunities for better management if there are appropriate structures and political will. Accordingly, the (NBSAP) suggested several actions and means of implementation including among others:

(a) Creation of conducive atmosphere through strengthening national institutions and integration of biodiversity policies in the national decision-making process, marketing incentives and strengthened synergies and collaboration,
(b) Expansion in establishment of biosphere reserves (in-situ and ex-situ conservation),
(c) Policies and actions to ensure sustainable use of biodiversity, and
(d) Supporting and updating institutions involved in genetic resources.

In accordance with Articles 26 of the CBD, Sudan has submitted the First and Second National Reports. This Third National Report is meant to highlight, analyze and synthesize measures undertaken, evaluate up-to-date progress made towards conservation of biodiversity and implementation of CBD in Sudan since the developing of the NBSAP.

1.1. Status of Biodiversity in Sudan

Data collected and/or information gathered on biodiversity had most of the time been site-specific, local and at the particular institutional levels. The recent biodiversity countrywide assessment undertaken by the NBSAP Project even though not very comprehensive, it constituted a benchmark and base of information for the different ecosystems, habitats and species. The effort made was to update the information on the different biodiversity components but future monitoring and filling of the gaps in knowledge is imperative. The status of main Sudan biodiversity components are briefly described below.

1.1.1. Agrobiodiversity in Sudan

Crop Plants

Through centuries Sudanese farmers have been developing and conserving diversified varieties of crops like sorghum that are well adapted to the conditions where they evolved. Diversified local genetic resources are known in Sudan for both field and horticultural crops including cereals, oil crops, grain legumes, fiber crops, vegetables and fruits. A list and areas grown by major crops from these categories are shown in table 1 below: The table shows the diversity of crops grown and reflects that the areas cultivated with these crops are either stable or increasing which indicates that these crops are conserved.

Table 1. Areas of major crops in Sudan in 2002 and 2003

Crop	**Area harvested (ha)**	
	2002	**2003**
Wheat	115,500	150,000
Rice	4,762	4,800
Maize	80,000	80,000
Millet	2,437,000	2,570,000
Sorghum	5,003,000	7,081,000
Potatoes	2,100	2,100
Sweet potatoes	650	650
Cassava	5,900	6,000
Yams	57,000	57,000
Sugarcane	63,480	65,000
Dry beans	13,000	15,000
Dry broad	58,000	

beans		58,000
Chickpea	12,600	12,600
Groundnut	1,350,200	1,900,000
Castor bean	2,000	2,000
Sunflower	12,600	28,000
Sesame	1,174,320	850,000
Cotton	144,480	180,000
Tomatoes	51,240	52,000
Pumpkins and squashes	3,900	3,900
Cucumbers	6,700	6,700
Eggplant	11,670	12,000
Chilies and peppers	740	740
Onion	8,600	8,600
Garlic	1,100	1,100
Banana	2,300	2,300
Oranges	2,450	2,450
Lemons and limes	5,200	5,200
Grapefruit and pomelo	4,600	4,600
Watermelon	5,100	5,100
Cantaloupe and other melons	1,150	1,200
Mangoes	9,500	9,500
Dates	35,000	35,000

B. Farm animal genetic resources in Sudan

Sudan possesses an immense and diversified wealth of domesticated livestock species, which include cattle, sheep, goats and camels. There are different types and breeds of livestock, the majority of which is raised within tribal groups and often carries the names of the tribe or locality. Other domesticated local types of animals include horses, donkeys, pigs and poultry. They range from 20 breeds of cattle to one breed in Guinea fowl, Muscovy duck and pigeon as shown in Table 2 below.

Table 2. Breeds of animals in Sudan

Species	**Number of breeds**	**Names of breeds**
Ass	5	Dongolawi, Etabi, Rifawi, Sudanese Pack, Toposa
Cattle	20	Baggara, Beja, Butana, Dinka, Dinka Aliab, Habani, Ingessana, Kenana, Mongalla, Murle, Nilotic, North Sudan Zebu, Nuba Mountain, Nuer, Red Bororo, Shilluk, South Sudan Hill Zebu, Sudanese Fulani, Toposa, White Nile
Chicken	3	Betwil Baladi (Small Baladi), Large Sudanese Baladi, Sudanese Bare Neck Baladi
Dromedary	5	Albishari, Anafi, Arabi, Rashaidi, Red Sea Hills
Goat	11	Anglo-Nubian, Ingessana, Nilotic, Saneen, Southern Sudan, Sudanese Desret, Sudanese Nubian, Swiss Bred, Toggenberg, Toposa, Yei
Guinea fowl	1	Sudanese Guineafowl
Horse	5	Dongola, Sudan Country-Bred, Tawleed, West African Dongola, Western Sudan Pony

Muscovy duck	1	Sudanese Muscovy Duck
Pigeon	1	Sudanese Pigeon
Sheep	17	Ashgur, Beja, Dubasi, Fallata, Fung, Mongalla, Murle, Nilotic, Nuba Maned, Nuba Mountain Dwarf, South Sudanese, Sudan Desert, Toposa, Uda, Watish, Western Baggara, Zaghawa

C. Medicinal and Aromatic Plants

The list of plant species that are used for medicinal purposes or used as spices includes more than 90 species found in different indigenous sources in Sudan. Among those only 13 species are cultivated while the rest are wild such as *Solenestemma argel, Cassia acutifolia, Cymbopogon sp* and *Citrullus colocynthis*. Roselle (*Hibiscus sabdariffa*) is a highly important cultivated medicinal and beverage crop grown in Sudan. It is produced mainly on the sand dunes of western Sudan. The type of roselle produced in the country belongs to the botanical variety *sabdariffa.* It is believed to have originated in West Africa and from there it has been introduced to western Sudan. Kordofan region is the main area of production of this crop and more specifically in North Kordofan state. Cultivated varieties are mixtures of different strains. Several local strains can be identified on the basis of calyx shape and color and other plant characteristics. Sudan is the most important roselle producer in Africa with annual area fluctuating between 11,000 ha and 57,000 ha depending on the amount of rainfall and prices. Smallholder farmers traditionally grow roselle in plots ranging from under 0.25 ha to 2 ha, but some growers have areas of up to 20 ha. Sudanese roselle is viewed as of superior quality. Recent collection missions to Kordofan and Blue Nile states between 2003 and 2005 have resulted in the collection of 88 accessions with different plant and calyx characters.

1.1.2. Freshwater (Inland) Ecosystems

i. Lotic Aquatic Environment

This comprises the White Nile, Blue Nile, Sobat, Atbara and main Nile together with the Swampy sudd where running currents of water are experienced.

ii. Lentic Aquatic Environment:

This comprises inland lakes such as Kundi, Keilak, Merri Barra, Jebel Marra crater lakes, Malaha Lake, Lake Amadi as well as a number of water depressions made to store water during the rainy season locally known as (Fulas).

iii. Benthic Environment:
This includes the Dams and Canals in irrigated schemes such as the Gezira, Managil, New Halfa, El Suki, N.W Sennar, El Guneid, Kenana, Hagar Assalaya and Rahad.

a. Aquatic Fauna
a-1. Microfauna:
These are more dominant in southern Sudan; composed of zooplanktons which are extremely poor.

- Fish Fauna:
There are least 45 genera and 300 species in the whole River Nile. But in Sudan there are 29 genera and 123 species. In the White Nile there are 24 families 52 genera and 106 species. Favorable conditions are in the south and it is under fished.

b. Aquatic Flora:
b-1. Macrophytes:
There are four major life forms of those being emergent, floating-leafed, and submerged. The wetlands of southern Sudan where macrophytes are the major components are a very important complex of ecosystem. They have economic, cultural and historic importance.

b-2. Microphytes:
Unlike the macrophytes, they support a rich community in quantity and diversity of desminds (algae). A rich phytoplankton community is also present.

1.1.3. Marine Ecosystem and coastal habitats:
The Red Sea is an important international water body which generally comprises the most unique coastal and marine environments. It is one of the most important repositories of biodiversity in the world. It is famous for its high biological diversity and well-developed habitats and living and non-living resources. All the (coral reefs, sea grass, algal beds and mangroves) coastal and marine species depend ultimately on habitats for existence. Of the inter-tidal habitats, coastal vegetation is particularly conspicuous and also ecologically important. In the sub-tidal zone, different types of corals and reefs extend along much of the coast in many offshore areas around islands. Sea grasses are distributed unevenly with varying degrees of occurrence. Out of the eleven species eight sea grass species have been reported so far in the Sudanese Red Sea.

i. Mangroves and Halophytes
Mangroves are the main vegetation that constitutes a characteristic feature. Mangrove forests and native halophytes merit serious attention on account of dangers that threaten this unique ecosystem. Optimal habitats conditions permit the development of various aggregations of Avicennia marina. Mangroves have breeding roots, thus muddy substrates carry pure stand of mangroves lagoons; inland bays and hard hummocks of calcareous deposits are encountered interrupting the meandering coral pattern of indigenous halophytic stands.

ii. Marine Living Resource

- Turtles

Of the five species known, the Green Turtle, Chelonia mydas and the Hawksbill turtle, Eretmochelys imbricata occur in abundance in the Sudanese coast (3,500 individuals) and the main threats to these come from continuous oil spills, loss of habitat and physical development actions and collections.

- Marine Mammals

The Dugong dugong (sirenia) and several species of dolphins and whales (Cetacea) occur regularly.

- Fishes

More than 450 common reef associated species are now recognized. Most of those reef fishes have been reported where coral communities are well developed. The damsel fish species are considered to be the most important in the reef community structure and of greatest commercial importance, and an indication of endemism. There is a general trend of decreasing species richness with decreasing latitude among parrot fishes and sturgeon fishes, a replacement trend amongst the wrasses and groupers, and an increase in diversity and abundance of snappers and emperors.

- Seabirds

Seabirds constitute a key feature of the Sudanese Red Sea coast. Several of those have been seen in several coastal and offshore islands. Other migrants are observed in autumn and winter. Marine birds as carivones may have local influence on the food chain especially where large seasonal colonies nest.

- Prawns

There are 8 shrimp species but the bulk is made of only those species namely Paneus semiculatus, p. latisulcatus, Metapaneus monocercus.

- Oysters

Wild mother of pearl oyster, Pinctada margarittfera are found along the whole Sudanese Red Sea coast.

- Coral reefs

There are 3 types of reefs–fringing barrier and Atoll. The latter (Sanganeb) has already been declared as a marine park of international heritage. There are 32 marine species.

- Trochus

Trochus dentatus is also found along the Sudanese Red Sea coastal shallow water with concentration at Suakin and Dongonab.

- Sea cucumber

Six species are found along the whole Sudanese Red Sea coast.

- **Sharks**

Shark production is estimated at 10% of the total fish catch. The importance of this potential lies in shark fins.

- **Lobster**

This is found in negligible amount and no data are available.

Fisheries and Critical Evaluation

In addition to 250 species of finfish inhabiting the Sudanese Red Sea coast yielding a potential of 10,000 tons/year, and over 100 species whose potential production is approaching 100,000 tons/year in the Nile system there are other conventional fishing areas. Of those are several thousand kilometers of irrigation canals and over 1775 large and small water impoundments particularly in the savanna belt. This wealth could have developed and contributed substantially to the national economy, had it not been for the effects arising from problems and constraints that need to be addressed and resolved. These constraints are outlined in the following:

1) Lack of strategy and plan of action for fisheries development and integrated coastal management.
2) Rather poor and irregular monitoring and research activities, which handicapped proper planning and institutional backstopping.
3) Insufficient infrastructure and institutional capacities.
4) Poor organization of fishers and their low socioeconomic status which has limited their potential influence and effective participation in the development process.
5) Weak co-operation and coordination between the concerned research and administration authorities.
6) The remoteness of the fishing areas from the fishing landing sites and markets coupled with rudimentary insufficient facilities for fish handling and presentation have their negative impacts on fish quality.
7) Extension, training and public awareness programs are rather lacking or poorly attended to.
8) Inadequate access of fisheries research and management proposals to regional and international for abroad training that limited their experience.
9) Limited skilled manpower.
10) Insufficient credit schemes for fishermen communities and small scale investors.
11) Insufficient foreign technical assistance and financial support from donors and relevant institutions and agencies.
12) Civil war disturbances that jeopardize fisheries development programs in some parts of the country.

1.1.4. Wildlife Ecosystem

Wildlife ecosystem in Sudan is composed of biosphere reserves, national Parks, game reserves and sanctuaries. The wide variety of ecosystems and vegetation types in the Sudan are reflected in its fauna. It has always been mentioned that Sudan has 224 species and subspecies of mammals. In 1983 it was reported that there were 52 major wildlife species in northern Sudan while in 1991 a list of 83 was produced. Major species were distributed in 19 protected areas all over the Sudan. There are no recent wildlife surveys for the whole Sudan and only limited information exists on amphibians and reptiles. These include snakes, lizards, crocodiles, pythons and boas. Many surveys had been recently conducted by the Wildlife Research Center (during the 1980's-2000's), but were limited to specific areas such as northern and eastern Sudan states, Kassala state , Dinder National Park, Radom National Park, Jebel El Dair proposed bioshpere reserve, Sabaloga game reserve and others. All reports of such surveys showed that many types have not been seen and numbers of major species had decreased. The surveys of 2002-2004, in Dinder National Park showed that 27 mammals and partial summer lists of 115 birds 14 snakes and scorpions , and 108 species of insect and 26 fish species are recorded. About 49 common tree species and shrubs (of which eight endangered) and 195 common herbaceous plants are identified.

1.1.5. Insect Life

European missionaries and tourists had initiated the collection of Sudanese insects early in the 19th and 20th Century. There are about 500,000 insect species distributed all over the Sudan. However, no monitoring of insect number of species has been going on for a long time.

1.2. Biodiversity Enabling Activities

Lack of awareness about the importance of biodiversity and eventually being short of planning in addition to inadequate institutional mechanisms for integrated biodiversity management, have aggravated the situation of biodiversity in Sudan. The ultimate result was unsustainable use of biological resources, degradation of many aquatic, marine and terrestrial ecosystems putting under threat important species of flora and fauna and their habitats. The historic Convention on Biological Diversity (CBD) with its financial tools made it possible for countries like Sudan to pay utmost attention to its biodiversity and take the opportunity to save it.

1.2.1. Phase One: National Biodiversity Strategy and Action Plan (NBSAP)

Project Partners: UNDP, IUCN-EARO and HCENR

Following the ratification of the CBD in October 1995, the Government of the Republic of Sudan received GEF support (through its implementing agency UNDP) for the development of NBSAP. GEF has also approved a request of the Government of Sudan on Clearing House Mechanism (CHM). Implementation of this initial enabling activity in meeting its obligation under the convention was through a project that was implemented under the umbrella of the Higher Council for Environment and Natural Resources (HCENR) with the technical support of the World Conservation Union, Eastern Africa Regional Office (IUCN-EARO).

The project started in early 1999 as a unit within HCENR. The unit was intended to be transformed into a permanent biodiversity coordination unit as part of HCENR. The project established a steering committee that had been providing policy guidance to the project implementation. Following the completion of the project, the committee was also hoped to be restructured to a permanent National Biodiversity Committee to continue providing policy guidance and advice to

the Government of Sudan on biodiversity management and conservation issues including implementation of CBD and related conventions.

Major achievements and Gaps during Phase One

- **Biodiversity Assessment**

Through a participatory process a countrywide biodiversity assessment was undertaken during the project's second quarter. Biodiversity components assessed included:

- Agrobiodiversity;
- Freshwater (inland) ecosystem;
- Forest Ecosystem;
- Insect Life;
- Marine and Coastal Habitats;
- Rangelands Ecosystem;
- Wildlife Ecosystem;
- Biotechnology and Biosafety.

In addition to cross-cutting issues such as:

- Biodiversity Economics;
- Legal and Institutional policy frameworks.

Fifty national experts from academic and research institution carried out the assessment. 14 individual assessment reports were produced.

- **Preparation of "Sudan Country Study on Biological Diversity" publication**

This publication constituted a comprehensive document on the status of biodiversity in the country. It was compiled from the 14 reports produced by the sectoral and regional assessments undertaken. In addition to the data presented, the document has included analyses and synthesis of the prevailing situation in relation to conservation and management of biodiversity in the country.

- **National Biodiversity Strategy and Action Plan (NBSAP)**

Development of NBSAP was undertaken by a Task Force of seven national experts but it has involved meticulous consultations among a great number of stakeholders including representatives of the civil society at both federal and state levels. Besides its demonstration of the state of affairs in biodiversity, the NBSAP has identified the need for strengthening of organizational set up for conservation and management of biological resources as important activity that needs immediate attention for implementation. The Final National Biodiversity Workshop that took place in April 2000 provided a participatory and useful forum in confirming the findings of biodiversity assessment reports and in identifying priority areas for actions including scientific and management capacity building. The NBSAP was finalized mid May 2000. The NBSAP has been approved in August 2001 by the Council of Ministers. The plan envisages future sustainable development plans to take into consideration the conservation of the natural environment and its constituent biological, ethnic and cultural diversity. The NBSAP is presented in two parts: Part I which encompasses the strategy and, Part II which highlights basic background information and the synthesis of the results of biodiversity assessment, specially conducted for the purpose of developing the strategy. In Part I the strategy aspire to attain a number of set objectives. The latter

are based on several guiding principles which emanate from current political, socio-economic and constitutional happenings. The objectives cover aspects pertaining to biodiversity such as conservation, promotion of awareness, creation of enabling environment for and effecting sustainable utilization, complying with and benefiting from regional and other conventions/agreements to which Sudan is party, together with essential legislative actions. A number of opportunities conducive to the realization of the strategy and possible impediment constraints are enumerated. Twelve projects are proposed to achieve the objectives of the strategy. Funding for the projects is envisaged from Sudan Government with substantial contribution from the donor, development partners and international community. An implementation modality and a time frame together with monitoring and evaluation schedules are proposed at the end of the strategy.
Part II of the NBSAP document is made up of two chapters on background and a synthesis of the results of biodiversity assessment, status and trends, threats and necessary actions to biodiversity.
The strategy stresses on the need for building a critical mass that can contribute essentially to the safe and equitable application of biotechnology with emphasis on development and conservation of biodiversity.

- **Awareness Program**

Ten national and state-based awareness, training and consultation workshops were held during the life span of this enabling activity. These workshops helped in widening the circle of involvement and participation of the stakeholders. The attendance and participation of these workshops was intensive and noteworthy.

- **Major Documents and Reports produced**

In addition to the above mentioned principal publications, the following documents were produced:

- First National Country Report to the CBD/COP.
- Proceedings of 10 workshops during this phase of the project.
- Seven Biodiversity Series (booklets) were published.

1.2.2. Phase Two: Assessment of Capacity Needs and Country Specific Priorities in Biodiversity Management and Conservation Project in Sudan

Project partners: UNDP, HCENR and MIC

The NBSAP team and IUCN-EARO technical advisors prepared proposal identifying priority areas for further capacity needs assessment and development of plans for capacity enhancement to support implementation of NBSAP. The aim of this proposal was also to seek additional funding to enable the government of Sudan to assess its current capacity and future capacity building needs in bridging the capacity gaps in the above areas. The proposal included the following priorities:

- Implementation of conservation activities of representative ecosystem and species, including adequate coordination, planning for integration of biodiversity action plan at sectoral and state levels;

- Further awareness raising on NBSAP proposals and their integration into sectors at federal and state levels;
- Taxonomy including assessment and monitoring;
- Biosafety;
- Mechanisms for access to genetic resources, benefit sharing and promoting the use of and safeguarding traditional knowledge;
- Biodiversity economics and incentive measures for biodiversity management and conservation;
- Data management for CHM.

The selected priorities were also confirmed and approved during the Tripartite Review (TPR) meeting held joining project partners in June 2000. The proposal was submitted to the GEF for financing.

A GEF/UNDP 10 months-Add-On Project on biodiversity had been approved and initiated in October 2002 to support the government of Sudan in assessing its national capacity building needs and specific priorities in biodiversity management and conservation. The ultimate goal of the add-on project was to assess the needs for implementing the National Biodiversity Strategy and Action Plan. The following assessments for implementing the NBSAP were financed in the Add-On Project:

- National capacities in implementation of general measures of *in-situ* and *ex-situ* conservation and sustainable use, including national plans, strategies and legislation;

- National capacity building in biodiversity monitoring programs including taxonomy;

- National capacity building needs related to managing access to genetic resources and benefit sharing.

The assessments were undertaken by three working groups each was formed of ten national experts from universities, research institutions and government departments representing different sectors.
The assessments identified lack of appropriate and adequate skills, inappropriate infrastructure, and inadequate institutional and legal framework for biodiversity conservation and especially for the management of the emerging issues.
The Add-on Project held four national consultation workshops three on the above issues, and one for the endorsement of the recommendations. Three comprehensive documents covering the three above mentioned assessments were produced.
Biosafety was handled later in a separate project that aimed at developing a National Biosafety Framework (NBF). This project was financed by GEF through its agency the United Nations Environment Programme (UNEP). Sudan acceded to the Cartagena Biosafety Protocol and developed the NBF.

1.3. Gaps identified in the NBSAP

Although Sudan is rich in its diversity of ecosystems, habitats, species and genetic resources, yet no coordinated comprehensive surveys or assessments have been carried out before the biodiversity enabling activities. Most surveys and studies on biodiversity components used to be sectoral, fragmented and were tailored for limited academic or research and scientific purposes.
Despite the fact that the NBSAP presents a major effort built on wide consultation and participatory processes, the strategy has had some gaps of which can be summarized in the following:

- The biodiversity assessments did not cover the southern part of the country due to inaccessibility of that part because of the civil war that was waging on those areas. This was unfortunate because the southern part of the country is relatively the biodiversity-richest part of the country. Most significant is the largest swampy wetland area of the "sudd" which harbors diverse flora and fauna. In addition, in the deep south of Sudan there are dense forests and a great number of wildlife species. All the assessments for the southern region were carried out as desk work.
- Most of the emphasis was put solely on conservation aspects while issues of sustainable use and benefit sharing were given little attention. More plausible was seeing biodiversity protection and conservation in environmentally sustainable development context.
- Poverty has not been addressed in the NBSAP and/or linked to biodiversity even though biodiversity and poverty are intricately interconnected. The degradation of ecosystem services is one of the principal factors that cause poverty.
- Similarly, there was no emphasizing of the fact that association between food security and other goods and services provided by the ecosystems and biodiversity components is all important.
- Equally, there was no clear mention of synergies between biodiversity, climate change and desertification.
- No clear vision or explanation of how to mainstream the NBSAP into other national strategies and plans.

These gaps could possibly be attributed to the fact that at the time of preparing the NBSAP in Sudan some of the above mentioned issues did not emerge globally. Furthermore, there were no agreed upon contents or standard format to follow in preparing NBSAPs, at least, not within the region. In addition, NBSAP documents were not adequately exchanged between countries of the region.

1.4. Analysis of the situation of Biodiversity Implementation

1.4.1. Strengths

- Awareness of the value and importance of biodiversity has been generally growing rapidly and in particular among academicians, university level students and professionals.
- Involvement of many national experts in the different stages and processes of the biodiversity enabling activities will assist in the process of monitoring and evaluation of biodiversity in the country.

- Experts from different subject matter specialists are available in the country.

1.4.2. Weaknesses

- Lack of consistency and continuity of data collection and information gathering in consequence to lack of monitoring.
- Dominance of conventional and sectoral vision in some institutions a factor that hampers the adoption of integrated approaches to data collection.
- Lack of standard quantitative and mechanistic biodiversity data collection and monitoring systems among institutions and sectors of similar mandate.
- Inadequate coordination and communication and therefore lack of exchange of biodiversity information between relevant institutions or departments.

1.4.3. Opportunities

- ✓ Facilities and helping equipment such as computers, websites and GIS tools are becoming increasingly available in many relevant institutions.
- ✓ Increased regional and global initiatives on biodiversity components and the associated technical and financial assistance being made ready for interested countries.
- ✓ The launching of the Comprehensive Peace Agreement between northern and southern Sudan. This will hopefully pave the road for carrying out up-to-date assessments of biodiversity ecosystems in areas that once were battle fields.

1.4.4. Threats

- The rapid transformation of the economy of the country into open market economy and liberalization.
- Oil and mining activities are dominating the government's policies and priority activities.

2. PROGRESS MADE SINCE THE NBSAP DEVELOPMENT

Relatively greater progress made in biodiversity issues was in the area of awareness. Many sectors have recognized the concept of biodiversity and the approach has changed to that of a more holistic one. Plans and schemes to combat desertification and deal with climate change matters started considering synergies with biodiversity.

The government has been giving more attention to and following up on biodiversity subjects both at regional and international levels. This is reflected in attendance and participation, through representatives, in international meetings related to biodiversity such as COPs, SBSTTAs and regional forums. However, practical and tangible progress has been made in conserving biodiversity components and ecosystems mentioned below:

2.1. Agrobiodiversity and Genetic Resources including medicinal plants

The agricultural sector contributes to about 46% of the GDP and employs about 75% of the labor force. Different industries are dependent on the agricultural sector including spinning and textile, sugar production, vegetable oils, wheat milling, canning among many others contributing to about 8% of the GDP. The agrarian plant component contributes with about 24.9%, while the livestock component contributes with about 20.7% of the GDP. This makes the agricultural sector critical

for improving food security and alleviating poverty in the country. It is important to realize such agricultural activity in Sudan is based to a great extent on the indigenous heritage of plant and animal species and types, which form an important component of the country's wealth of biodiversity.

2.1.1. Conservation efforts for agrodiversity

Some activities have been taking place in Sudan to conserve the agrobiodiversity components against the real threats of loss and extinction. Magnitude and achievements of such activities vary due to factors such as existing policies and capacities.

2.1.2. Conservation of plant agrobiodiversity

The Plant Genetic Resources (PGR) Unit in the Agricultural Research Corporation (ARC) is playing a significant role in the conservation of the local diversity of the cultivated plants in Sudan. It was established early in 1985 as a unit within the Horticultural Research Section for the conservation of the local genetic resources of horticultural crops. The mandate of the unit has been expanded since 1995 to cover the genetic resources of all crops. Since then the PGR Unit/ARC has been active in collecting and ex-situ conserving the genetic resources of different crop plants. The seed bank of the unit keeps at present more than 8000 accessions from different crop species. Efforts for collection and conservation of germplasm has been boosted significantly since 2003 by the support made available to the country from the Eastern Africa Plant Genetic Resources Network (EAPGREN) of which Sudan is one of the founding members. This was due to financing made available for collection tours and procurement of a vehicle and conservation equipment.

2.1.3. Plant germplasm collected since 2003

Ten collection trips were organized and executed between 2003 and 2005 by the PGR Unit/ARC covering the following locations in the country:

i. Parts of West Kordofan state in western Sudan in 2003 for collecting watermelon germplasm.

ii. Parts of North Kordofan state in western Sudan during 2003 for a multi-species collection mission.

iii. Kassala state in eastern Sudan during 2004 for collecting banana germplasm.

iv. Gezira state in central Sudan during 2004 for collecting banana germplasm.

v. Eastern parts of Nuba Mountains in South Kordofan state during 2004 for a multi-species collection mission (before 2004 these were civil strife areas).

vi. Western parts of Nuba Mountains (Kadugli area) in South Kordofan state during 2005 for a multi-species mission (before 2005 these were civil strife areas).

vii. Northern state in northern Sudan during 2005 for a multi-species mission.

viii. Gash Delta area in Kassala state in eastern Sudan during 2005 for collecting sorghum germplasm.

ix. Sinnar and Blue Nile states in central Sudan for collecting banana germplasm.

x. Blue Nile state during 2005 for a multi-species mission.

A total of 2484 accessions from more than 36 crops were collected during these missions. The largest number of accessions was collected from sorghum (792 accessions) followed by banana (362 accessions), cowpea (171 accessions) and sesame (146 accessions). Among the top ten crops of highest numbers of accessions collected were also maize, watermelon, pearl millet, okra, roselle, faba bean, and groundnut.

2.1.4. Conservation facilities for plant crop genetic resources

The PGR program in the ARC is at present executed through a PGR Unit, which is run by a number of specialized technical staff. The unit is equipped with facilities for a seed bank in the ARC, which is used for the preservation of the collected seed samples. Storage capacity of the seed bank at present is of 300 cubic feet in 15 deep freeze chests. Five of such deep freezers in addition to other gene bank equipment have been acquired recently during 2004 and 2005 through funds made available by EAPGREN.

According to the NBSAP, the present PGR Unit is considered a nucleus for a national plant genetic resources program under the umbrella of the ARC. It is perceived as a centrally coordinated program with a central gene bank facility to which five regional units in different geographical regions are to be affiliated. The central gene bank is to be responsible for the base collection of the germplasm under conservation, while the regional units are to be equipped with small gene bank units for the conservation of the active collections for those accessions collected from within the different regions. Some specialized laboratories are envisaged to be attached to the central gene bank such as an in-vitro culture facility and a molecular biology laboratory. A national documentation system will be established and administered from the center. Multiplication, regeneration, characterization and preliminary evaluation will be the responsibility of the regional units. Some evaluation programs could be conducted in the center. Access to the germplasm will be under the responsibility of the center. Establishment of in-situ conservation activities will be a shared responsibility between the center and the regional units.

Having such a plan, initiatives have been taken by the PGR Unit/ARC that enabled the establishment of two PGR facilities in eastern and western regions of Sudan in 2003 and 2005 respectively. A field gene bank has been established in Kassala state of eastern Sudan for the conservation of banana genetic resources. Total number of banana accessions planted in this field gene bank has reached 402 accessions since then. A new regional seed bank is being at present established in El Obeid in western Sudan for the conservation of an active collection of the crop genetic resources collected from western Sudan, particularly, Kordofan and Darfur regions. Equipment including two deep freeze chests, air-conditioners, a computer and a stand-bye generator have already been provided and installed within El Obeid Agricultural Research Station.

2.1.5. Conservation of medicinal plants

The medicinal and Aromatic Plants Research Institute (MAPRI) of the National Centre for Research (NCR) is exerting efforts for collecting, conserving, studying and documenting the indigenous medicinal and aromatic plants in Sudan. In this regard, there are on-going relevant activities for the last few years to attain the following objectives:

- Protection of Sudanese medicinal and aromatic plants from extinction through agricultural research leading to plantation, conservation and production of certified seeds.
- Development of new varieties of Sudanese plants of high quality for production and competitiveness in world-wide markets.
- Identification of new Sudanese plants, which may be used as natural pesticides.

However, a number of accessions from medicinal and aromatic plants such as roselle, fenugreek and black cumin, have been collected and conserved in the PGR Unit seed bank following the collection tours to North Kordofan, South Kordofan and Northern states between 2003 and 2005.

2.1.6. Conservation of animal genetic resources

A number of research stations have been established soon after the independence of the country in 1956 in the various regions to study, preserve and improve native breeds of livestock in Sudan. At present a number of such stations are under the Animal Resources Research Corporation (ARRC). These stations are mandated for the characterization of local breeds towards increasing production efficiency through applied research in breeding, nutrition and husbandry system. These stations are the following:

- Um Binain Research Station in central Sudan, for working on Kenana cattle breeds.
- Atbara Research Station, in eastern Sudan, for working on Butana cattle breed.
- Ghazala Gawazat Research Station, in Western Sudan, for working on Baggara cattle breed.
- El Huda Research Station, in central Sudan, for working on the sheep breeds.
- El Shukkaba Station, in central Sudan, for working on dairy cross breeds and fodder production.

The National Artificial Insemination Center in Sudan is, as well, interested in the conservation and utilization of the local animal breeds. In this regard, several projects have been proposed for implementation by this centre since 2003. These projects include:

- *Ex-situ* conservation of animal genetic resources (Animal Gene bank).
- Classification of indigenous animal breeds.
- Conservation of indigenous breeds of Sudanese chicken.
- Conservation and artificial insemination of endangered animal species.
- Conservation of Kenana and Butana cattle.

2.1.7. Enhancement of the utilization of plant and animal genetic resources

The impact of agrobiodiversity components on the life of the people are clearly reflected when they are utilized to meet the people's needs for food, medicine, shelter, clothing and other goods and services. Multiplication, characterization, evaluation and documentation of plant and animal genetic resources are basic steps towards enhancing their utilization. Some activities, therefore, have been conducted in this domain in Sudan since 2002.

2.1.8. Multiplication, characterization and evaluation of cultivated crop genetic resources

Among the duties of the PGR Unit/ARC are conducting activities for multiplication, characterization and preliminary evaluation of the crop genetic resources under conservation. A total of 5357 entries, including original accessions and descendents of original accessions, from the genetic resources of different crops have been multiplied and characterized since the growing season of 2002/03 (Table 5). During the same period limited activities to evaluate and study the genetic resources of different crops have been going on by scientists in the ARC and by postgraduate students in the universities. These include studies such as the following:

- Evaluation of sorghum germplasm for resistance against *Striga* and insects and for drought tolerance.
- Evaluation of sorghum germplasm for F1 hybrid production.
- Evaluation of watermelon germplasm for production of white seeded varieties for export purposes.
- Evaluation of melon germplasm for resistance against some insects and diseases.
- Evaluation of okra germplasm for resistance against some insects and diseases and for cold tolerance.
- Evaluation of tomato germplasm for resistance against some insects.

2.1.9. Baseline survey of neglected and underutilized crops

A number of plant species grown in Sudan could be classified as neglected and/or underutilized crops. These species, although important for people, receive little or no attention for research and development, and, therefore considered as neglected and/or underutilized. However, some of the crops play important roles in the economy of the country and contribute with considerable shares in the national and international trade. A study was conducted by the plant genetic resources program in the Agricultural Research Corporation between 2003 – 2004 with the objective of collecting baseline data and information on a sample of crops representing the neglected and underutilized crop species in Sudan. Such data throw some light on where emphasis is needed for further research and development in order to position such crops on the right place for benefit of the people and the national economy, and for the purpose of their conservation.

The study was financed by the International Plant Genetic Resources Institute (IPGRI) and was conducted on ten crops, which were:

- Bambara groundnut (*Vigna subterranea*)
- Coriander (*Coriandrum sativum*)
- Date palm (*Phoenix dactylifera*)

- Jewsmallow (*Corchorus olitorius*)
- Lupin (*Lupinus termis*)
- Okra (*Abelmoschus esculentus*)
- Roselle (*Hibiscus sabdarifa*)
- Sesame (*Sesamum indicum*)
- Tamarind (*Tamarindus indica*)
- Watermelon (*Citrullus lanatus*)

Significant results were obtained from this study with regard to the present status of diversity, genetic erosion, production, marketing, conservation, institutes, research and development related to those species. Conservation, research and development gaps have been identified as well.

2.1.10. Documentation of medicinal and aromatic plants

On documentation and publication side MAPRI published several books since 2002 on indigenous medicinal and aromatic plants, including the following:

- MAPRI (2000). Bibliography of Sudanese medicinal plants.
- MAPRI (2003). Medicinal plants of Sudan Part V: Medicinal plants of Ingassana area.
- MAPRI (2004). Aromatic plants of the Sudan.

2.1.11. Enhancing the utilization of farm animal genetic resources

Several research programs are conducted within the animal production research stations with ultimate objective of enhancing the conservation and utilization of local animal genetic resources. Focus of such research is on studying the genetic diversity within some of the local animal breeds using molecular biology techniques, in addition to purification and selection from them. Um Binain station is conserving the Kenana cattle breed, a highly indigenous milk producer breed in Sudan, since 1959. At present activities are under way on purification and selection from within such a breed. Atbara station is specialized on conservation of Butana cattle breed, another indigenous breed for dairy production. Work is under way in the station for the selection of high milk producers from this breed, and the selection of males and females for breeding purposes. Ghazala Gawazat station is conserving the Baggara breed of cattle, which is important for both milk and meat production. The station is active in the selection of types from such a breed for genetic improvement purposes and for distribution to animal breeders. El Huda station is active in conservation of three subtypes of indigenous Desert sheep in Sudan, which are Wateesh, Dubasi and Ashgar. Purification and selection from within these subtypes are underway in the station. Selected males from these subtypes are distributed by the station to known breeders for genetic improvement purposes. At present, studies are being undertaken using molecular biology techniques, to classify sheep types in the irrigated Gezira area in central Sudan, and for identification of subtypes that might be carrying the gene responsible for the number of twins for further utilization and breeding. Post-graduate studies are being conducted at present using molecular techniques for studying the genetic diversity within both Kenana and Butana cattle breeds using samples from milk protein and blood. Such studies are aiming at genetically classifying those breeds and enhance their utilization in selection and breeding practices.

2.1.12. Capacity Building Efforts

Research and management activities in the PGR Unit/ARC are executed by four research scientists, three of them are in the Gezira Research Station (Wad Medani) and one in Kassala Research Station in the eastern region of the country. Two assistant researchers who are B. Sc. holders were recruited in 2003. Four new technicians have been recruited for the unit since 2003: one is an M. Sc. holder and three are B.Sc. degree holders.

Some progress in the training aspect of the PGR Unit staff has been achieved since 2003. It included training for master degree, short specialized training for technicians and short familiarization visit and hands-on training for researchers. One assistant researcher has been enrolled since August 2005 in two years M.Sc. programs on management of biodiversity in Sweden. A technician participated in a six weeks training course on management of plant genetic resources, which was organized in the Nordic Gene Bank in 2004. One research scientist visited the Gene bank of Kenya in 2005 for a two weeks visit and hands-on training.

A number of equipment and materials have been procured for the PGR Unit/ARC during 2004 and 2005. These include equipment and materials for seed testing, packaging and storage and computers. The unit has been provided with a new vehicle and other equipment for the collection trips. A nucleus for regional gene bank unit, the first of its kind in the country, has been established in 2005 in El Obeid in western Sudan. The unit has been supplied with the necessary equipment for long term seed storage.

2.2. Forest and Rangeland Ecosystems

Of prime importance is that the Forests National Corporation (FNC) in Sudan has incorporated biodiversity conservation in all its policies of promoting and developing the forest ecosystem. This is reflected also in that during the last few years and since the NBSAP development (FNC) has made intensive efforts in the way of conservation. Large areas have been designated as reserved forests which eventually indicate more biodiversity conservation. Many amendments have been made by FNC to the exiting laws, ordinances and acts of forestry to enhance in-situ and ex-situ conservation.

Even though rangelands are occupying almost half the Sudan land and have always been supporting livestock production in the country, the magnitude of promotion of this sector has not been matching its importance. Biodiversity of range plants is being lost rapidly. However, lately efforts are being made as to amend and build capacity of the range and pasture institutions. Two range improvement projects are now launched in Butana area in eastern Sudan the other one is in the Kordofan state. First step towards strengthening the existing Range and Pasture Administration (RPA) is an attempt made proposing that the department be upgraded to a corporation. The second step being taken is towards developing a national center for range and pasture research in the University of Sudan.

2.3. Marine and Coastal Habitats

2.3.1. Demonstration Activities

The Sudan being one of PERSGA counties had to respond positively to the call for the preparation of Demonstration Activities Document that is initiated by PERSGA and GEF to address the challenges facing biodiversity in sustainable development.

The said project is composed of five proposals entitled "Use of Biological indicators for monitoring Sudanese coral reefs near Port Sudan area, Rehabilitation of degraded mangrove stands, Rehabilitation of Public Aquarium, Establishment of a Pilot Sea cucumber Hatchery, and Development of an Effective Partnership between Government and Stakeholders. These proposals have been revised in the light of comments and recommendations of the PERSGA/UNDP committee on Demonstration Activities.
During the exercise, meetings were held with prime institutions and lead authors of these proposals and relevant stackholders. The meetings have reached the consensus on a common goal, an agreement on the "on-ground' outcomes that would result from implementing these projects, and anticipated establishment of a cross-set and ICZM committee.

The objectives of the proposals are to:

I. Implement a monitoring program of coral reefs and associated key species that provide a concrete foundation that could be used as a source of data input to the PERSGA Integrated Information Management System (IIMS) through the accommodation of the Standard Survey Methodology (SSM) developed by PERSGA at the national level.

II. Reduce the pressure on the existing mangrove habitats, establish and/or improve mechanisms of sustainability of the mangroves, and provide an example of mangrove rehabilitation monitoring using the PERSGA-IIMS and enrich knowledge and understanding of the role of mangrove habitat through public and participation program.

III. Increase the awareness level among residents, visitors, students, researchers and local authorities about the marine environment and the need for its protection.

IV. Cater for training personnel on running and management of the Hatchery on the one hand and carrying out biological studies pertaining to the basics of cultural organisms particularly in the areas of nutrition, feeding, reproduction and growth as pre-requisites to the future needs of the hatchery.

V. Drive mainly towards increasing of awareness level among residents, visitors, locals about the marine environment and its protection, change the negative human behavior attitudes and encourage to tapping sustainable friendly investments for achievements of the goals.

As has been agreed upon during the joint meetings, each proposal was to be run by an in-country committee made up of the relevant institutes and organizations. Each committee entrusted with a number of functions e.g. the development of linkages with sister committees under the umbrella of this project; linkages with similar activities carried out elsewhere in PERSGA countries for purposes of comparison of results and their verification.
Of the valuable lessons learnt from this exercise was widening the circle of involvement of relevant institutions and stakehoders who pooled their concerted efforts in order to end up valid results.

2.3.2. Integrated Coastal Zone Management (ICZM)

This activity was also organized under the umbrella of PERSGA which added to the reflection of the Sudan coastal profile. It started by identifying the pressures and threats to the coastal zone before proposing the plan for the integrated management. The pressures and threats comprise:

- Pollution by liquid, solid and organic matter.
- Radial pollution.
- Introduction of imported (exotic) species and material.
- Exhaustion of potentials of plants and animals.
- Removal of mangroves.
- Expansion in planning.
- Immigration of various organisms.
- Conflicts over grazing and land use.
- Natural industrial catastrophes.
- Security hazards.

However, the proposed plan for ICZM included:

1) Legislative and administrative concepts for support of integrated management.
2) Identification of the objectives.
3) Proposed strategies and polices for management as to handle biodiversity, conservation and protection of the threatened types, enforcement of laws pertaining to protected areas, collection, analysis of data, mapping of the coastal rescores this is besides awareness, organization and economic policies.

In addition to the above special reference was made to the Fishery Administration that it concerned with the current status in the country and the means of conservation, production and potential estimates; development of regulations that govern fishing gear and methods, handling, protection of breeding sites and extension of awareness to fishers sects.
This plan which was put into effect has so far registered success and appreciable progress towards the achievement of the objectives.

2.3.3. National Work Plan (NWP)

This plan was arranged jointly by PERSGA, and Sudanese experts drawn from universities, research institutes and some government departments backed by active participation of a wide circle of scientists, grouped to plan and execute work on the conservation and protection of sea turtles, coral reefs, mangroves and sea birds. In-country committees for each were accordingly formed. Meaningful and sound results are now recorded.

2.3.4. University Activities

The Faculty of Science, University of Khartoum, through its Suakin Marine Laboratory, and the Red Sea University, through its Faculty of Marine Sciences and Fisheries, have formulated programs and adopted research on Marine biodiversity and already higher Degree theses have been prepared and the findings are included in recent literature.

2.3.5. Marine Fisheries Station

The Ministry of Animal Resources and Fisheries, and the Fishers Research Centre of the Ministry of Science and Technology have paved the road for enrolment in Higher Degree studies.

It follows from the above that considerable progress has been recoded. No clear regress is recorded yet. The Sudan being one of the PERSGA counties had to respond positively to the call for the preparation of Demonstration Activities Document initiated by PERSGA and GEF as to address the challenges facing biodiversity in sustainable development.

2.4. Wildlife Ecosystem

In Sudan wildlife protected areas are classified into Biosphere reserves, National Parks, game reserves and sanctuaries. About twenty six areas are published in gazettes and declared protected areas and an equal number of areas are proposed. The protected areas are of three types; national parks, game reserves and sanctuaries and are distributed over 6 ecological zones. Some of the areas were gazetted as far back as 1936, while others such as Wadi Hower National Park which is recently established in 2002 in the desert ecosystem, Jebel Hassania in 2003 in the semi-desert zone and Dongonab marine National park in 2003 in the Red Sea.

2.4.1. Role of National Non-Governmental Organizations in Wildlife Conservation

Several national NGOs have some degree of contribution to wildlife conservation. Here is a summary of these contributions:

- Sudanese Environment Conservation Society (SECS) is the oldest and one with the largest membership environmental NGO in the Sudan. SECS conducted many activities (about 40% of its activities) that dealt with are biodiversity related issues including wildlife conservation. SECS is still having strong emphasis on natural resources conservation related issues. SECS contributed to the UNDP formulation mission of GEF projects in Dinder National Park (DNP) and the Red Sea Coast. The projects implementation involved SECS contribution in awareness raising among the local communities. SECS started an awareness program since 2001 for the UNDP-GEF funded DNP Project. The program aimed to enhance the livelihoods of the communities living in and around the borders of the park by encouraging them to participate in community oriented projects which will provide them with renewable resources on a long-term basis. The awareness raising campaign was targeting all the stakeholders at the national, state and community levels.
- SECS had organized a regional workshop in collaboration with NOVIB (Netherlands Oxfam) with the main theme being the natural resources conflict resolution in the DNP. The objectives are to study the conflicting interests of the different community sectors. These communities represent the pastoralists, mechanized farmers, local communities and the park authorities. The conflicts are mainly centered on the buffer zone of the park and extend to the natural resources of the park as a whole. The workshop was attended by NGOs from Somalia, Ethiopia, Uganda, Kenya, Netherlands and USA. The recommendations of the workshop were submitted to the project managers of the park and the local authorities for implementation.

- SECS weekly radio program which is aired from Omdurman National Radio present wildlife related issues. Also SECS has weekly environmental pages in the widely distributed daily news papers. The activities of SECS have significant impact on awareness raising towards wildlife conservation.
- The Sudanese Wildlife Society (SWS) was established in 2001 and had contributed in a Khartoum State Tourism exhibition (2002) as part of its public awareness program. Also contributed in a weekly bird census (Jan.-Feb.) conducted yearly, since 2001, together with SECS and Wildlife Research Center.
- Other NGOs such as the Sudanese Development Association (SDA), the Environmentalists Society (ES) and the Natural Heritage Society (NHS) are active in wildlife and community issues.

3. THREATS TO BIODIVERSITY AND CONSTRAINTS TO IMPLEMENTATION OF BIODIVERSITY PLANS

Natural ecosystems in Sudan have undergone serious ecological degradation with potentially significant impacts on biodiversity. Several natural and human factors threaten the existence of biodiversity in Sudan. Factors contributing to this situation include, but not limited to:

- Civil war and continued political instability and conflicts in southern and western Sudan resulted into influx of refugees who eventually have chosen to settle at the vicinity of areas of relatively ample natural resources and rich biodiversity.
- Drought, fire, overgrazing and the imprudent use of the natural resources to the extent of endangering plant and animal species.
- Replacement of landraces and traditional varieties by high yielding improved ones.
- Expansion of mono-crop mechanized agriculture at the expense of natural resource areas. Poor land use policies; the extensive
- Socio-economic factors.
- There is lack of coordination between natural resources departments due to the absence of an overall conservation policy and planning.
- Continued poaching and smuggling of wildlife resources.

Many constraints have affected the implementation of action and biodiversity management plans suggested in NBSAP and/or other initiatives to conserve and sustain the biodiversity ecosystem. Although some progress in Sudan related to conservation of agro-biodiversity, it has been based on fragmented activities under conditions of lacking the adequate infrastructures and clear policy and legislative frameworks. Gaps and constraints hindering conservation of agro-biodiversity in Sudan could, therefore, be identified in the following:

- Lack of clear policy for the conservation of the local genetic resources of both animals and plants. While there is no specialized full-time program to manage these genetic resources. The only existing program is on food and agriculture genetic resources in the Agricultural Research Corporation (ARC).

- Capacities to conserve the agrobiodiversity are very limited and with no major comprehensive progress in the last few years. The only proper gene bank existing in the country is still the one of the Plant Genetic Resources (PGR) Unit in the ARC.
- Poor understanding of the role of ecosystem values and services leading to ineffective management.
- Inadequate legislation and poor law enforcement. Lack of a national framework with legislative and institutional instrument to cater for matters related to access to the genetic resources, benefit sharing and farmers' rights.
- Dominance of sectoral approach that does not lead to sustainable and synchronized management decisions.
- Information related to biodiversity is not quite extensively published or easily accessed. Access to the available information within the different institutions active in this area is hindered by lacking of information and database systems at institutional and national levels.
- Efforts to disseminate knowledge on the strategic importance and values of the different components of biodiversity are fragmented and sometimes poorly conveyed through the media.
- Surveys, updating of information and monitoring data are irregular or not conducted.

4. LINKS WITH INTERNATIONAL AND REGIONAL CONVENTIONS AND FRAMEWORKS

Being party and member of many instruments, Sudan has established links with a number of international and regional frameworks that are related to biodiversity and its components including conventions, treaties, organizations and networks. Below are examples of these connections:

4.1. International frameworks (Agreements, Treaties and Organizations)

The Higher Council for Environment and Natural Resources (HCENR) was established in 1991 as the national environment organ and is a focal point for many environmental conventions including in addition to Rio Conventions others such as Ramsar, CITES, CMS and many others. The prime concern of the HCENR is the long-term protection of the environment and sustainable use of natural resources. It formulates general policies and plans and coordinates all national and state efforts in this environmental context.

4.1.1. Convention for International Trade of Endangered Species (CITES)

Wildlife Conservation General Administration (WCGA) is the focal point for CITES. WCGA exported live animals (2003-2004) including Dorcas gazelle, yellow backed Duiker, Oribi, green monkey, baboon and African hare to Arab States. Exported birds include white bellied bustard, guinea fowl, black crowned crane, common crane, pigeon, African grey parrot, lovebird, sand grouse and Egyptian vulture. Exported reptiles include tortoise, African python, and eyed dabb-lizard. Both reptiles and birds were slipped to Arab States, Netherlands and Japan.

Export of parts and derivatives in 2003 include mounted and air dried skins of tora hartebeest, dorcas gazelle, Nile crocodile, African python and Nile Monitor lizard.

They were exported to Arab and European countries. Dorcas gazelle is the highest shipment compared to others exported live animals (more than 180 live animals were exported). Other exported animals range between 2 to 25 in number. 800 sand grouse were exported while the other

exported bird species range between 2 - 50 species. Eyed Dabb lizard were exported in hundreds while the other slipped reptiles range between 2 - 100 species. Records of exported parts showed that more than 46000 air dried skins of Nile Monitor lizard were exported and less than 800 python skins were shipped to Egypt and Spain. These animals and/or products are exported in accordance with CITES measures.

4.1.2. Ramsar convention

HCENR has made considerable efforts to have Sudan join Ramsar Convention and has made use of the convention guidelines as an important strategy for achieving the goal of sustainable use of Sudan's wetlands resources. Sudan submitted the necessary documents to join the convention by 9 November 2004 and became party to Ramsar Convention by the 7th of May 2005.

HCENR as a focal point for Ramsar Convention had established a National Wetland Committee (NWC) composed of almost all stakeholders. Members of NWC represent the following bodies:

- Ministry of Environment and Physical Development.
- Ministry of Irrigation.
- Ministry of Agriculture and Forestry.
- Ministry of Science and Technology (WRC).
- Forests National Corporation (FNC).
- Wildlife Conservation General Administration.
- Institute of Environmental Studies (Univ. of Khartoum).
- Hydrology Department (Univ. of Khartoum).
- Sudanese Environment Conservation Society (SECS).
- UNESCO Sudanese National Commission.

Several Ramsar-related activities have been undertaken:

-A national workshop was held on the 5th -6th Sept, 2001, in Khartoum (organized by HCENR).

-Sudan attended Cop 8 (Spain 2003) as an observer. With the assistance of Ramsar Convention and WWF Sudan was able to update the scientific information and prepare the Ramsar Information Sheets (RIS) for three nominated sites as wetlands of international importance; (Dinder National Park, Sunt Forest Reserve and the Red Sea coast; Mangrove and coral reef sites). A project financed by WWF is now under implementation to review and update the information and prepare RIS regarding the Sudd area so as to be designated a Ramsar site.

-Sudan also participated in the preparatory African Regional Meeting for COP9 held during 6-10 April 2005, Arusha, Tanzania.

-The Sudan's ratification of Ramsar Convention was a major event constituting the main theme of the World Environment Day (5th of June 2005) celebrations.

-A national workshop on Ramsar related issues was held in Khartoum at 5th of June/2005 and addressed by the Minister of Environment and Physical Development who stated the importance of joining the convention and the need to promote national programs in conservation and management of wetlands.

4.1.3. World Heritage Convention (WHC)

Sudan ratified this convention on 1972. The World Heritage Center at UNESCO headquarters (in Paris) coordinates through the two focal points identified by the UNESCO Sudanese National Commission for the natural heritage and cultural heritage. The Bjrawaya Cultural Heritage site was declared since 2003. The scientific file for Marawy cultural site is under preparation. Sudan had proposed six areas in the tentative list of the natural heritage sites. The areas include Dinder National Park, Radom National Park, Sudd swamps, Wadi Hower National Park, Senganeb Marine National Park and Jebel Mara. The World Assistance Form for the preparation of the nomination document of Dinder N. Park had been submitted to the World Heritage Center by December 2005.

Sudan had participated in the Regional Meeting for the Arab Nations held in Abu Dhabi in December 2005 recommended the establishment of a National World Heritage Committee and a national action plan.

4.1.4. The International Treaty for Plant Genetic Resources for Food Agriculture (ITPGRFA)

Sudan is also member of the FAO Commission on Genetic Resources for Food and Agriculture (CGRFA). It ratified the International Treaty for Plant Genetic Resources for Food Agriculture (ITPGRFA) in the 10th of June 2002 and hence it is party to the treaty since then.

Sudan is involved in the process of developing a global strategy for farm animal genetic resources, a process coordinated by the (CGRFA). A national consultative committee for such a process was formulated since 2002. A country report on the state of animal genetic resources in Sudan was then submitted to the FAO.

4.1.5. Global Crop Diversity Trust (GCDT)

Sudan received in 2004 an invitation to sign the agreement establishing the (GCDT). A committee was formulated by the Ministry of Agriculture and Forestry to study the GCDT documents and to advice on Sudan's position towards such a new instrument. The committee has concluded its work by recommending that Sudan should sign the agreement and become a member in the GCDT. However, as to December 2005, Sudan has yet to sign the GCDT agreement. Nevertheless, the country has been active in formulating a regional strategy in Eastern Africa to be submitted to the GCDT for supporting the crop genetic resources programs in the region. The strategy is aiming at conserving the plant genetic resources of the important food crops in the region through supporting both national and regional mechanisms. Such exercise is being coordinated with the GCDT secretariat by the Eastern Africa Plant Genetic Resources Network (EAPGREN). Sudan participated as one of the steering committee members of EAPGREN in three meetings held so far on this issue in Madagascar (September 2004), Sudan (September 2005) and Kenya (November 2005).

4.1.6. World Wide Fund For Nature (WWF)

With the assistance of Ramsar Convention and WWF (Water for life Project) Sudan was able to prepare the RIS for the three previously mentioned nominated sites and to join the convention. WWF support Sudan to participate in several meetings of Ramsar Convention (Avian/France meeting 2001, COP 8 2003, Tanzania/Arusha COP9 preparatory meeting /Sept. 2005 and Uganda/ Kampala COP9 November 2005). Another project is financed by WWF to review and

update the information and prepare RIS regarding the Sudd area so as to be designated a Ramsar site is almost in the final stage.

4.1.7. World Conservation Union (IUCN)

IUCN has been the executing agency that has provided technical assistance to Sudan to develop its NBSAP in 2000. The organization has been involved in the PDF/GEF biodiversity proposed project for Jebel Mara /Western Darfur. The project has not materialized due to insecurity problems in the area.

4.1.8. Other Initiatives and Instruments

There are some on-going projects in Sudan that are financed by Nile Basin Initiative (NBI). Those are the projects that are concerned with water resources management and sustainable use of natural resources in the Nile Basin countries. The Nile Transboundary Environmental Action Project (NTEAP) is one of the NBI projects. The project financed some of the community based organizations (CBOs) around the DNP to implement natural resources conservation project under micro-grant component of the project. UNDP and GEF are funding a Development Project in DNP since 2001 and the consolidation phase of the project which started in 2004 is mainly funded by UNDP.

4.2. Regional Organizations and Networks

Sudan is also member of many regional organizations and networks that relate to the environment as a whole, biodiversity or some components of biodiversity. These organizations are such as:

4.2.1. Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA)

Sudan one of seven member countries of the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), an intergovernmental body committed to the conservation of the coastal and marine environments in the Red Sea region.

Operating from Jeddah on the Red Sea, PERSGA is responsible for the development and implementation of regional programs for the protection and preservation of the unique ecosystem and high biological diversity of this region.

4.2.2. Eastern Africa Plant Genetic Resources Network (EAPGREN)

Sudan is one of the founding members of the Eastern Africa Plant Genetic Resources Network (EAPGREN). It is a network initiated in 1997 and became operational since May 2003. Member countries include Burundi, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan and Uganda. The network operates under the umbrella of the Association for Strengthening Agricultural Research in Central and Eastern Africa (ASARECA). It has the sub-regional responsibility of promoting the conservation and use of plant genetic resources and enhancement of awareness of their importance and value. Currently the network operations are being guided by a project document developed with a regional interim working group and signed between the ASARECA and the donor, which is the Swedish International Development Cooperation Agency (Sida). Agreements between the respective countries and EAPGREN/ASRAECA on the collaboration and implementation of the network activities were also signed. Based on the guidelines in the project document, the network activities are implemented at both the regional and national levels. The national activities cover aspects related to capacity building and training of personnel working with PGR activities, procurement of conservation and documentation equipment and transportation

facilities, coordination and awareness activities and PGR activities such as collection, conservation, multiplication, regeneration and characterization of germplasm. Activities for the first two years (2003/2004 and 2004 /2005) have already been financed by the network. Sudan as a member in EAPGREN is represented by the Plant Genetic Resources (PGR) Unit of the Agricultural Research Corporation (ARC). Several national activities were implemented by the PGR Unit/ARC between 2003 and 2005 using fund made available by the donor through EAPGREN.

These activities included the following:

- Launching of ten collection missions for different agricultural crops from different regions in the country.
- Procurement of equipment such as conservation equipment, one vehicle and computers.
- Multiplication, regeneration and characterization of 3619 entries of different crop genetic resources.
- Specialized and hands-on training for two PGR Unit staff members outside Sudan in recognized gene banks in Sweden and Kenya.
- Enrolment in M.Sc. degree program on biodiversity management by one of the PGR Unit staff members, a program that has started by August 2005 in Sweden.

4.2.3. Arab Organization for Agricultural Development (AOAD)

Sudan participated actively in related activities and events organized by the Arab Organization for Agricultural Development (AOAD) between 2003 and 2005. These activities and events included the following:

- Preparation of a study on plant genetic resources for food and agriculture in the Arab world in 2003.
- Preparation of a guide on legislations related to plant genetic resources for food and agriculture in 2003.
- A workshop on implementation of the international conventions on biodiversity and coordination between Arab countries with respect to those conventions, which was held in Tunisia between 21 - 23 September 2004.
- A workshop on the use of the guide on legislations related to plant genetic resources for food and agriculture, which was held in Tunisia, 24 - 26 May 2005.

5. BIODIVERSITY PROSPECTS AND TRENDS AFTER THE COMPREHENSIVE PEACE AGREEMENT (CPA)

War and conflicts that were waging in several parts of the country happened to take place in some of the most biodiversity–rich areas of the country. Many forests and rangeland areas were converted into mine and battlefields. This has caused a lot of ecological damage and directly great human losses, and equally biodiversity losses in animal species, plant species and ecosystems.

The Comprehensive Peace Agreement(CPA) signed between the Government of Sudan and the Sudan People's Liberation Movement (SPLM) on 9 of January 2005 has not only ended one of Africa's longest civil wars, but has ushered in new opportunities for national reconciliation, healing, reconstruction and development. On the basis of decentralization and devolution of powers and the need to effectively address the unique post conflict reconstruction needs in the

country, the Sudan Joint Assessment Mission (JAM) prepared a study on capacity building, infrastructure, production sectors and other aspects. As the reconstruction and development process proceeds, environmental and natural resources management and conservation must be mainstreamed into national plans to achieve long term sustainable development.

Universities in the southern Sudan such as Juba, Upper Nile and Bahr el Ghazal which were till recently carrying out their functions from the temporary locations in northern Sudan, are now extending their activities effectively in the South. Some faculties are now operating there particularly those involved in natural resources, with priorities given to fisheries, wildlife and ecology beside training and capacity building. The exploitation of the "Sudd" swamps, its wetlands and their environs are ranking very high. Accordingly, projects streamed in this direction are taking shape to contribute to a brighter, future.

Since environment issues are cross-cutting issue in the JAM, HCENR in collaboration with other government departments approached the World Bank, UNEP and the Nile Transboundary Environmental Action Project to finance the preparation of national plans for environment management in post conflict Sudan.

The first new development after the debut of the National Unity Government was the transfer of the WCGA from the Ministry of Interior to a new Ministry of Tourism and Wildlife both at the Central Government and the South regional government. The personnel of the WCGA are still in military uniform and their administrative status needs to be defined. Nevertheless, the above mentioned initiatives such as CPA, JAM and NTEAP will pave the road for better biodiversity conservation.

Expected direct benefits to biodiversity from the CPA:

- New policies that mainstream biodiversity plans into national plans;
- More accessibility to biodiversity goods and services;
- Increased opportunities for biodiversity inventories and assessments in areas that were previously inaccessible;
- Ecological restoration and minimization of biodiversity loss;
- Institutional reformation, capacity building and strengthening;
- Stability might possibly improve the economy and/or attract donors.

6. IMPORTANT BIODIVERSITY PRIORITY ISSUES AND AREAS THAT DESERVE TO BE TACKLED

Even though there was reasonable coverage of several priority themes in the NBSAP some others did not get adequate emphasis and exposure. However, this is not because of their less importance and lower priorities but perhaps because of lack of readily available financing. The following are some of the issues that deserve to be addressed:

I. Biodiversity economics and incentive measures

Not much is known about valuation and economics of biodiversity in Sudan. During the life span of the biodiversity project only one short training course was held. More emphasis and elaboration on this important issue is needed. The situation is similar with regard to incentive measures and financial mechanisms. More effort is needed to promote these aspects for better biodiversity management and conservation.

II. Animal Genetic Resources

Much of the emphasis was put on plant genetic resources while information and data gathered about farm animals' genetic resources were scanty. Sudan is rich in domestic livestock diversity. Many breeds and types of camel, cattle, sheep, equines and fowl have not had adequate characterization and description. This diversity constitutes an important factor in the utilization of the goods and services that emerge from these resources. More efforts are needed in developing national legislation to access and benefit sharing.

III. Alien Invasive Species (AIS)

Prosopis spp. (mesquite) is one (AIS) shrub-tree that entered Sudan as early as 1917. Even though mesquite is very effective in sand dune stabilization, being fast growing this perennial plant has been spreading and is quickly dominating many areas in the country because of the easy and several means of its dispersal. Dispersal can be by man, wind, water and ruminant and non-ruminant animals. It found its way to arable and cultivated areas. It is now threatening both crop and rangeland areas. Irrigated crop lands are particularly plagued with this invasive plant as it competes with crops in water, nutrients and space. It is unpalatable to livestock when green. A campaign has been launched to control, if not eradicate this plant, as it is contributing to biodiversity loss especially in less arid areas. Research on alien invasive species is lacking. It is important that Sudan considers and carries further Decision V/8 of the (Meeting of CBD-COP V).

IV. Ecosystem Approach

Most of biodiversity data come from sectoral inventories and no integration. This integration can only be achieved by adopting and applying the ecosystem approach. The ecosystem approach has been raised in several COP meetings and decision V/6 elaborated on the principles and guidelines of the ecosystem approach. It is imperative that for conservation of biodiversity to develop understanding of this approach (at least within the scientific and research communities) and encourage its application to end up with better biodiversity conservation results.

V. Taxonomy

Throughout the world, and especially in developing counties, existing taxonomic information is often organized in a manner that CBD objectives can be effective ways to assist recipients overcome the taxonomic impediments and promote CBD objectives of conservation.

In order to facilitate professional management, including the loss of species, and the intrusion of alien species in ecosystems, more focused biogeographical and ecological research needs to be carried out. This, however, will only be possible with sound and science-based understanding of all the taxonomic levels.

Comprehensive and sustainable taxonomic activity and biodiversity conservation can be ensured through:

- Assessment of the current status of research staff training facilities, biological collections and databases in fields of taxonomy and biodiversity.
- Technology and knowledge transfer including setting realistic guidelines to complete global taxonomic inventories, and increased training of taxonomists in various age groups and professional levels.

It is appropriate to consider the situation in both plant and animal taxonomy.

V.1. Plant Taxonomy

In spite of the bulk of information available on flora of Sudan, there is a need for more taxonomic studies with respect to updating nomenclature, synonymy, species distribution, ecological and vegetation changes. It is now appropriate to highlight some of the main features before enlisting the threats that hinder the development of taxonomy and its institutions. Of those are:

- The presence of topographical features such as the Nile and its tributaries, the isolated mountains in the east west and south, as unique features that have created special ecosystems.
- The changes that have occurred over the past four decades, are attributed to climatic changes and human interventions. Here reference is made to the Sahelian era which witnessed severe drought and desertification.
- Large areas have been subjected to massive deforestation and forest destruction especially in northern and central Sudan.
- Drought and desertification have resulted in a series of environmental consequences on species diversity and intensity.
- The fall in the above was attenuated to urbanization agricultural expansion, overgrazing and tree felling for fuel wood.
- Forest diversity is great. A total of 1015 trees and shrubs have been reported. Out of those a total of 214 of trees and shrubs are seriously threatened.
- Sudan is rich in medicinal and aromatic plants over 900 plant specimens are deposited at the Herbarium of Medicinal and Aromatic Plants Research Institute (MAPRI).

Threats to plant taxonomy comprise:

- Scarcity of plant taxonomists.
- Scarcity of published works.
- Limited education and training.
- Poor infrastructure with regard to herbaria and botanical gardens.
- Lack of databases.

V.2. Animal Taxonomy

The animal fauna is rich as derived from the number of species of the various groups including 938 species of birds, 114 of reptiles, 16 snails, 216 mammals, 330 fishes, 201 zooplanktons…etc. but it has been realized that there are threats that face insects, birds and wildlife as illustrated below:

- In case of wildlife reference is made to human population growth, habitat degradation, drought, civil strife and lack of political support.
- In case of birds, habitat loss or degradation is the major factor exemplified by forest clearance for subsistence farming, arable farming, mining, drainage of watersheds, and exposure to pesticides.

VI. Indigenous Knowledge

It would be worthwhile to examine the cognitive foundations of indigenous knowledge, traditional ecological knowledge, ethnoecology and ethnobotany. Rural areas of Sudan are rich in biodiversity. Rural people are the real custodians of biodiversity. These rural areas are replete with traditional knowledge that is contributing to biodiversity conservation and sustainable use. However, there is no clear effort being made in classifying and /or documenting this precious information and knowledge. It is evident that this issue is gaining more importance with the advent of property rights and benefit sharing aspects.

VII. Links to Multilateral and Global Processes

It is of high significance that links are strong and well maintained with global multilateral processes and initiatives that promote biodiversity implementation. It is important that recommendations pertaining to biodiversity coming out of such initiatives be adopted. Examples for such processes are:

A. World Summit on Sustainable Development (WSSD) declarations.
B. The United Nations Millennium Development Goals (MDGs) reports.
C. Intergovernmental Panel on Climate Change (IPCC) assessment reports.
D. Millennium Ecosystem Assessment (MA) reports.
E. BirdLife International

7. CAPACITY BUILDING NEEDS

For effective implementation of biodiversity management and conservation in the country, several capacity building needs require to be met. These needs can be covered through efforts at the national, regional or international levels. The requirements are diverse and variable but mainly include institutional, logistical, legislative and financial arrangements. These are summarized below.

In view of the limitations connected with plant and animal taxonomy outlined above, a number of needs are formulated in order to contribute to a brighter future in biodiversity. Of those are:

1) Establishment of infrastructures in the form of Botanical Gardens, Herbaria, Zoo and Showrooms.
2) Rehabilitation and upgrading of the existing infrastructures.
3) Extension of research to complete faunal and floral species, upgrading of existing classification and diversity of various components.
4) Setting a well articulated training, educational and awareness policy.
5) Surveillance and monitoring of changes in fauna and flora resulting from natural interventions.
6) Promotion of scientific and technical co-operation with other parties through long-term monitoring and updating databases.
7) Developing interest in economic benefits from fauna and flora as to lead to extension.
8) Development of national legislation to regulate access to biological resources.
9) Development of national legislation to protect local communities' rights.

10) Development of national legislation to regulate the movement of germplasm and breeds.
11) Carrying out considerable revisions and amendments of legislations to cope and match with the local conditions and international laws and conventions.
12) Involvement of Sudanese scientists in checklist preparation and updating.

8. OTHER MEANINGFUL INPUTS THAT SERVE THE PURPOSE OF IMPLEMENTING THE CBD IN SUDAN

Capacity building could also be achieved through the execution of a number of named projects that are integral part of the Sudan's NBSAP proposed. These projects are:

1- Biodiversity Assessment in woodland Savanna.
2- Taxonomy of Antelopes in Sudan.
3- Impacts of over-hunting on in-situ conservation in Desert and Arid Zone Ecosystems.
4- Upgrading of systematic knowledge in flora and fauna.
5- Flora and Fauna of the Desert in Sudan.
6- Exploration, collection, preservation and documentation of the flora of the Red Sea coastal plains.
7- Avifauna of Sunt-forest.
8- Sudan water-bird survey and census.
9- Plant taxonomy as a tool of biodiversity.
10- Monitoring of biodiversity in the Sudan
11- Fish stock assessment in Man-made lakes.
12- Strengthening of the fisheries conservation administration.
13- Marine Fisheries management database.
14- Marine Fisheries Infrastructure development.
15- Improvement of fish preservation and utilization.
16- Development of traditional post-harvest treatments and quality control of fish products.

9. RECOMMENDATIONS FOR THE WAY FORWARD

The following recommendations if translated to actions then implementation of biodiversity plans could possibly be achieved:

- Establishment of biodiversity coordinating units or committees and other core environment-related conventions within HCENR.
- Mainstreaming of biodiversity implementation plans into national plans.
- Supporting and building capacities of National focal points of the conventions to enhance coordination and strengthen synergies between conventions.
- Strengthening man power and institutions related to biodiversity.
- Developing effective programs and public awareness campaigns for proper implementation of CBD.
- Drafting and enacting legislation and laws for rangeland use and management and upgrading of rangeland institutions.

- Revision and drafting new legislation for wildlife management and institutional set up.
- Secure financing to establish natural museums, botanical gardens, zoological gardens and protected areas is needed to enhance biodiversity ex-situ conservation.
- Building adequate infrastructure for ecotourism industry development.
- Improving management of marine parks such as Sanganeb Marine National Park.
- Introducing syllabi related to conservation of biodiversity in the general education curricula, and little, if any, in the higher education curricula.
- Developing an overall conservation policy and land use planning.
- Establishment of management plans that cater for the participation of local population in the management of protected areas. The procedures of issuing license and bag limits should be based on the present status of protected animals. This will assist in minimizing illegal hunting which affects many wildlife species.
- Revision of investment procedures in protected animals and game farms.
- Formulation of comprehensive research plans for conservation to address urgent management issues.
- Conservation of endangered species is to be given priority through establishment of captivity breeding centers to propagate and maintain viable populations through a well planned programs and advice of international experts in this area.

It is a blessing for a country to be endowed with wealth in biodiversity but it is equally great responsibility to sustain such wealth, particularly in fragile ecosystems. Livelihoods of the peoples of Sudan are dependent on biodiversity and natural resources. However, at the same time, threats to biodiversity are mounting especially with the advent of oil and associated industries in the country. Integrating wise policies and planning with sustainable utilization and effective management and monitoring are vital for biodiversity conservation and sustenance. The government of Sudan ascertains its commitment to the CBD for the benefit and welfare of the Sudanese people.