



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



**First National Report on the Implementation of  
The Convention on Biological Diversity**

**Khartoum, Sudan  
2000**

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## ABBREVIATIONS AND ACRONYMS

ADB	African Development Bank
ARC	Agricultural Research Corporation
BADEA	Arab Development Bank for Africa
BSAP	Biodiversity Strategy and Action Plan
CBD	Convention on Biological Diversity
CIFOR	Center for International Forestry Research
CITES	Convention on International Trade in Endangered Species
COMESA	Common Market for Eastern and Southern Africa
CSD	Commission on Sustainable Development
FAO	Food and Agriculture Organization of United Nations
GEF	Global Environment Facility
HCENR	Higher Council for Environment and Natural Resources
ICGEB	International Center of Genetic Engineering and Biotechnology
ICPG	International Center for Plant Genetics
ICRAF	International center for Agroforestry Research
IES	Institute of Environmental Studies
IFAD	International Fund for Agricultural Development
IFF	Intergovernmental Forum on Forests
IGAD	Intergovernmental Authority on Development
ILRI	International Livestock Research Institute
IMF	International Monetary Fund
IsDB	Islamic Development Bank
I PCC	International Panel on Climate Change
IPGRI	International Plant Genetic Research Institute
IUCN	The World Conservation Union
IUFRO	International Union for Forestry Research
NBSAP	National Biodiversity Strategy and Action Plan
RPA	Range and Pasture Administration
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Program
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Education, Scientific and Cultural Organization
WCA	Wildlife Conservation Administration
WFP	World Food Programme
WRC	Wildlife Research Center

## Executive Summary

In recognition of the importance of environmental protection for sustainable development of the Sudan, the Government has established the Higher Council for Environment and Natural Resources in 1991 as central government organ coordinating efforts for sustainable development of resources and environment protection. Putting more emphasis on environmental related issues, the Government of Sudan created the Ministry of Environment and Tourism in 1995 to oversee overall environmental management and integrate environmental protection into national development strategies.

Conservation of biodiversity is vital in a country such as Sudan, where ecosystems are fragile and the renewable natural resources are endangered through over-exploitation. The ecosystems of Sudan are deteriorating rapidly due to multiple interacting factors mostly due to 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 subjected 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 non-sustainable use of resources and irreversible loss of biota.

Following the signature in 9 June 1992 and ratification of the Convention on Biological Diversity 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. Signifying its commitment to participate in the conservation and management of the world biological and natural resources, Sudan has also signed and ratified the Conventions on Climate Change and the Desertification.

As first step in implementing its obligations the Sudan Government in accordance with article 6a is currently undertaking a participatory process for development of the National Biodiversity Strategy and Action Plan.

Furthermore, in accordance with articles 26 of the CBD, this Country Report is prepared to highlight measures and progress in the conservation of biodiversity and implementation of CBD in Sudan. This report is part of the products of the NBSAP project funded by GEF through UNDP and implemented by HCENR. It will be submitted to the COP during May 2000.

The National Biodiversity Strategy has included a descriptive analysis and evaluation of data presented in the Biodiversity Assessment Reports. It determined goals and operational objectives, and identified gaps and specific measures needed to close these gaps. By identifying the roles of stakeholders groups, the BSAP was to reach a consensus on acceptable targets and mechanisms for action and investment needed to address each objective and

assign priorities to each. This Country Report includes a summary section describing the current status and trends of biodiversity in Sudan, major threats common to biodiversity ecosystem components in the country and a section defining the long term national strategy and action plan. The strategy is meant for the sound use and conservation of biodiversity in Sudan within the light of its economic development. A fourth section highlighting the resources needed to meet the implementation of the Action Plan.

The Action Plan has spelt out the steps and measures needed to implement the selected strategy and addressed who will take up which activities, over what time frame, at what location, by what means, and with what resources. The preparation of the BSAP was built upon and added to the existing data available in the field of environment and biodiversity.

The BSAP is expected to enhance and strengthen cross-sectoral policy and regulatory framework regarding the conservation, management and monitoring of biodiversity. The BSAP will benefit the whole population of Sudan, the Government and its respective institutions, local NGOs, research scientists, resource managers and the private sector. The project will also contribute to the overall regional and global efforts to conserve, manage and monitor biological diversity, and so the target beneficiaries are seen in a regional and global context, including the people of Sudan.

One of the expected end products of this project is the public awareness and knowledge among governmental planners and NGOs on biodiversity issues and the subsequent incorporation of these issues into the overall national planning processes. An improved integrated approach and inter-institutional fertilization and national capacity to address issues related to the wise utilization and conservation of biological resources will be developed by the end of the project.

## 1. BACKGROUND

The Sudan, the largest country in Africa, covers about 2.5 million km<sup>2</sup>, representing 8.3% of the total area of Africa. The country extends over 18° of latitude, stretching over 2000 km, north to south and over 1000 km from east to west and a coastline of 750 km at the Red Sea. Sudan has wide ecological amplitude thus encompassing many zones, which are replete with both plant and animal genetic resources.

The total population of the Sudan is estimated at 30 millions in 1998. Most of population (80%) is dependent on agriculture for its livelihood. Main staple food crops are sorghum and millet while cash and export crops are cotton, gum Arabic, groundnut and sesame.

The country is characterized by a unimodal summer rainy season ranging from less than 25 mm in the northern arid areas to about 1500 mm in the south. The arid and semi arid areas constitute more than 60% of the total area of the country. The gradual increase in levels of moisture from north to south is reflected in the variation and diversity of both flora and fauna. Although, rainfall is the main water source Sudan is blessed with the river Nile running through the country from the south to the north with an annual flow of 84 milliard cubic meters. In addition, the Nile has many tributaries and several ephemeral streams. This has led to inland water species diversity the most important of which are fish fauna. The marine ecosystem is restricted to the Red Sea harboring many species and mangroves and halophytes along the coastline. There is also great diversity in insect life.

Vast areas of the country are rangeland (estimated at 117.2 m ha) supporting 34.6 million heads of cattle, 42.4 millions of sheep, 36.5 millions of goats and about 3.0 millions of camels. Most of this animal wealth is in the hands of nomadic and transhumant people.

Areas occupied by forests are estimated at 19% of the country area. These forests are diverse in species and diversely used as fuel, timber building material, medicine and for other purposes. Due to lack of alternative energy sources especially in rural areas, trees constitute the main source of energy. This has led to great pressure on forest products and consequently to deforestation and depletion of forest trees.

The country is also rich in its wildlife resources from big game, mammals, reptiles and birds. Wildlife is restricted to certain pockets scattered in the country but are not safe from indiscriminate hunting and destruction of habitats.

## 2. THE STATUS AND TRENDS OF BIODIVERSITY IN SUDAN

Eventhough Sudan is rich in its diversity of ecosystems, habitats, species and genetic resources, no coordinated, comprehensive surveys or assessments have been carried out. Most surveys and studies on biodiversity components were fragmented and were tailored for limited academic or research and

scientific purposes. Data collected or information gathered have most of the time been site-specific, local and at the particular institutional levels. The BSAP assessment was carried out by multi-disciplinary teams. The BSAP project has taken the initiative of updating the information on biodiversity. The recent biodiversity countrywide assessment undertaken by NBSAP project even though not very comprehensive, it constituted a benchmark and a 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 in of the gaps in knowledge is imperative. The status of the main Sudan biodiversity components can briefly be described as follows:

## **2.1 Agrobiodiversity In Sudan**

### **2.1.1 Crops**

In general, Sudan farmers are adopting a mixed crop-livestock agricultural system. Many crop plant species are cultivated to meet the demands for food, shelter, clothing, medicine and fodder. These plant species include field crops, horticultural and forage crops grown in two major farming sectors, rainfed and irrigated.

Crops in Sudan form a long list which includes, cereals, grain, legumes, oil and fiber crops major of which are millet, sorghum, maize, wheat, groundnut, cowpea, sesame and cotton in addition to other crops such as roselle, sugar cane, kenaf and guar. These crops are produced in smaller holder traditional and mechanized farming sub-sectors.

There is also a long list of horticultural crops (vegetables and fruits) most important of which are okra, tomato, hot pepper, potato, eggplant, melons, water melons, pumpkins and squashes and leafy vegetables. Fruits include date palm, mango, citrus, guava, banana and other crops such as tobacco and ornamental plants. These crops are found as many varieties, cultivars, landraces, accessions and strains. Many wild relatives of both field and horticultural crops exist. Diversity is observed within both cultivated and wild types constituting a wealth of genetic resources that need to be well conserved (Tables 1a and 1b).

### **2.1.2 Livestock**

Sudan ranks second to Ethiopia in Livestock populations in Africa. Livestock comprise cattle, sheep, goats, camels, equines and poultry. The most recent estimates show that cattle are 34.6, sheep 42.4, goats at 36.5 and camels at approximately 3.0 million heads, distributed in the 6 regions (26 states) of the Sudan. No estimates are available for equines and fowls.

Despite the narrow range of major livestock species (Camels, cattle, sheep and goats) the animals used represent an enormous breadth of biodiversity. There are many classes, types, sub-types and breeds within classes from different origins. There are very few studies and there is little documentation on domestic animals such as equines, pigs, rabbits and domestic fowls.

**Table 1a: Field crop species that have wild relatives in Sudan**

<b>Species</b>	<b>Wild Relative</b>
<i>Sorghum bicolor</i>	<i>S. aethiopicum</i> , <i>S. verticilliflorum</i> <i>S. arundiacum</i> <i>S. Sudanese</i>
<i>Pennisetum</i>	<i>Pennisetum spp.</i>
<i>Oryza sativa</i>	<i>O. punctata</i> <i>O. longistaminata</i> <i>O. barthii</i>
<i>Eleusine</i>	<i>E. indica</i> <i>E. flagelliters</i>
<i>Sesamum indicum</i>	<i>S. alatum</i> <i>S. latifolium</i> <i>S. angustifolium</i>
<i>Guizotia abyssinica</i>	<i>G. villosa</i> <i>G. scabra</i> <i>G. schimperi</i>
<i>Gossypium spp.</i>	<i>G.somalense</i> <i>G.anomalum</i> <i>G.arboreum</i> <i>G.herbaceum</i>

**Table 1b: Horticultural crop species that have wild relatives in Sudan**

<b>Species</b>	<b>Wild Relative</b>
<i>Hibiscus cannabinus</i>	<i>H.cannabinus</i>
<i>Saccharum sinense</i>	<i>S.spontaneum</i> <i>Erianthus maximus</i>
<i>Cyamopsis tetragonoloba</i>	<i>C.senegalensis</i>
<i>Abelmoschus esculentus</i>	<i>A.ficulneus</i> <i>A.manihot</i>
<i>Solanum melongana</i>	<i>Solanum spp.</i>
<i>Cucumis melo</i>	<i>C.melo agrestis</i>
<i>Citrullus lanatus</i>	<i>C.colocynthis</i>
<i>Corchorus olitorius</i>	<i>Corchorus spp.</i>
<i>Portulaca oleracea</i>	<i>Portulaca spp.</i>
<i>Phoenix dactylifera</i>	<i>P.reclinata</i>

Crop species that might have originated in Sudan

- Pearl millet (*Pennisetum glaucum*)  
 Sorghum (*Sorghum bicolor*)  
 Melon (*Cucumis melo*)  
 Watermelon (*Citrullus lanatus*)  
 Okra (*Abelmoschus esculentus*)

## 2.2. Natural Vegetation

### 2.2.1. Forest Plants Diversity

The Forest Resources Assessment by FAO in 1990 indicated a tree cover of 19% of the Sudan's area (excluding the southern part of the country) while the National Forest Inventory estimated forest cover to be 24.9% of the total area of the country. Reserved forests amount to 837 forests distributed all over the states of the country. They constitute a great potential for biodiversity conservation. Forests play a pivotal role as a component of natural resources and land use.

Since production is not as good an indication as variability of biodiversity, what is considered as unproductive forests and bush land does not reflect less diversity.

It is estimated that there are about 533 tree species in Sudan of that 25 species are exotic. In addition, there are about 184 shrub species of that 33 are exotic. However, the forest wealth has neither been adequately explored nor has it been well documented. What is known is that there are unique forest formations in Sudan in form of relic rain forests termed "Bowl" forests in Equatoria States in southern Sudan such as in Azza, Talenga and Leboni. These areas deserve to be reserved. There are diverse uses for forest products in Sudan the magnitude of which depend on distribution and composition within the region and/or location. These uses can be summarized in timber, non-timber, building material, fuelwood, fodder, gum and tannin production, and medicine and for bee forage and building hives.

There are some important trees species that are under pressure and endangered as a consequence of repeated droughts or over-cutting and felling. Some of these do not have the ability to regenerate such as *Adansonia digitata* (Tabaldi), *Borassus aethiopicum* (Daleib), *Hyphaene thebaica* (Doum), *Cordia abyssinica* (Gimbeel), *Dalbergia melanoxylon* (Abanos), *Grewia tenax* (Gudeim), *Anogeissus leiocarpus* (Sahab), *Lonchocarpus laxiflorus* (Horhor), *Ziziphus spina-christi* (Sidir) and *Khaya senegalensis* (Mahogany). There are many others that are endangered to a less degree.

3156 species representing 1137 genera and 170 families of medicinal plants were identified in Sudan. The experience of traditional use of medicinal plants in Sudan had evolved for centuries as a part of the Sudanese authentic culture. It is believed to have been introduced from West Africa and the Middle East.

There is good documentation of medicinal plants, but more research is needed for scientific evaluation and investment in this area.

## 2.2.2. Range Plants Diversity

Rangeland areas of Sudan are variable as they extend over six ecological zones: desert, semi-desert, low rainfall savanna on clay, high rainfall savanna and mountain regions. These rangeland areas occupy about a 117 million ha. Communal grazing is the dominant use of rangeland. There is no legislation governing rangeland use. So far, 204 range plant species are collected and identified. Currently, perennial and desirable plant species are declining due to expansion of cultivation on rangeland areas and heavy grazing, recurrent droughts and increasing livestock populations. Perennial species are almost extinct and annual grass species constitute more than 94% of the grassland vegetation. The most dominant grass species are *Hyparrhenia spp.*, *Pennisetum pedicellatum*, *Brachiaria spp.*, *Chloris virgata*, *Artistida Spp.*, *Cenchrus biflorus*, and *Eragrostis tremula*. An example of a unique group of rangeland plants is the "gizzu" vegetation, which grow in the desert area and provide highly nutritious winter grazing.

Range plant species under pressure are; *Blepharis linarifolia*, *Andropogan gayanus*, *Panicum turgidum* and *Aristida plumosa*. Some endangered plant species are such as *Cymbopogon proximus*, *schoenofeldia gracilis* and *Rottboellia exalata*.

## 2.3. Terrestrial Animal Diversity

### 2.3.1. Terrestrial Mammals

The areas of wildlife concentration are distributed in many regions of the country including Dinder area in the southeastern Blue Nile, southwestern Darfur Radom area (both are declared as biosphere reserves) and southern Sudan regions. These are the hot spots of wildlife diversity. There are species in common among these regions. However, in southern Sudan wildlife distribution follows the pattern of vegetation distribution or zones. There are species that are site-specific in the south such as *Ceratotherium simum* (White rhino). Giant eland and bongo occur only on the western side of River Nile, while the black rhino (*Dicercus bicornus*), white-ear kob, lesser eland, zebra (*Equus burchelli*), grant gazelle and Beisa oryx are found only on the eastern side of the Nile.

There are four major areas of wildlife concentration in Sudan, these are; Dinder National Park in Blue Nile State, Boma National Park at the foothills of Boma Mountains, Badingeru National Park northeast of Juba town and Southern National Park. The latter three parks are in Southern Sudan. It is evident that the diversity of wildlife resource in Radom area (Southwestern Darfur) and Southern Sudan region is very high. (Table shows estimated numbers of some species in the South in 1979 (before the civil war erupted).

Out of 13 mammalian orders in Africa, 12 occur in the Sudan including 224 species, 17 are considered threatened. These include elephants, giraffe, Oryx gazelle, Sommering gazelle, Dama gazelle, Adda gazelle, Wild Sheep, Wild ass, and Cheetah and Tiang. This is in addition to monkeys, baboons, foxes and elephants.

### 2.3.2. Reptiles

There are at least 80 major reptile species in the country. These include boas, snakes, pythons, lizards and crocodiles.

### 2.3.3. Birds

The avifauna of Sudan includes 931 species of birds of which reported are 127 species common in Sennar, Gedarif and Blue Nile States of the southeastern Sudan.

### 2.4. Insects

Insects in the Sudan are estimated at 500,000 species representing different families. Collecting of Sudanese insects was initiated by European missionaries and tourists who used to travel through the country on their way to the Christian Kingdom of Ethiopia. In 1906 an insect collection was established in Khartoum to form the main repository of Sudanese entomological specimens. Later on the collection was transferred to Wad Medani (the headquarters of the National Agricultural Research Corporation-ARC).

Insects flourish or diminish as a result of climatic changes, habitat alterations or human interference. These factors may lead to the addition of new occupants, the elimination of established groups or their displacement by more competent rivals. The influence of man on the insect fauna was predominantly antagonistic to his welfare. The clearance of highly diverse natural ecosystem to be replaced by oversimplified monoculture systems has favored the survival of very few phytophagous species and led to explosive outbreaks of highly destructive pests. The extensive and intensive use of pesticides has adversely affected protein feeders more than phytophagous species and this is another major cause of ecological instability and stimulant of pest outbreaks. Main crop associated species are classified as parasitoids and predators in different orders such as *Hymenoptera*, *Diptera*, *Coleoptera*, *Hemiptera* and many others.

For nearly 60 years the Natural History Museum in London has been providing free identification services for Sudan. After the levying of identification fees in 1976 identification services are sought only in very urgent cases.

### 2.5. Marine Ecosystem And Coastal Habitats

The Red Sea is an important international water body. It has been since ancient times a source of food for thousands of coastal populations; a maritime, trading and cultural route. It generally comprises the most unique coastal and marine environments. It is one of the most important repositories of biodiversity in the world. The Sudanese Red Sea coast extends for about 750 km. It is famous for its high biological diversity and well-developed habitats and living and non-living resources. All the (Coral reefs, sea grasses and algal beds and mangroves) coastal and marine species depend

ultimately on habitats for their existence. Of the intertidal habitats, coastal vegetation is particularly conspicuous and also ecologically important. Included are saltpans (Sabkhas) and mangroves, which are wide spreading as well as other halophytes which are less prevalent. 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 particularly in the southern part of the coast. Out of the eleven species eight sea-grass species have been reported so far in the Sudanese Red Sea.

### **2.5.1. Mangroves and Halophytes**

Mangroves are the main conspicuous coastal vegetation that constitutes a characteristic feature of the Sudanese Red Sea Coast. Mangrove forests and native halophytes of the Sudanese coastal fringe merit serious attention on account of dangers that threaten this unique tropical ecosystem. Optimal habitats are muddy substrates in shallow high-tide seawater edge. These conditions permit the development of various aggregations of the only woody perennial flowering tree: *Avicennia marina* (Forsk). While terrestrial dwarf shrubs and succulent halophytes are not adapted to muddy shallow locations that are almost under permanent sea water, mangroves have breathing roots (pneumatophores), thus muddy substrates carry pure stands (forests) of mangroves.

Halophytic plant community types of the salt marshes in the Sudan are conspicuous on account of the purity of specific components. The levels of soil salinity, as governed by small differences in local topography and by magnitude of tidal movement, are undoubtedly the limiting factors. This dictated the existence, sometimes-total absence, width and relative vegetative/regenerative vigor of a sequence of halophytic plant communities in an undulating coral pattern parallel to the seawater edge. Woodlots and aggregations of mangroves followed by landward succulent dwarf shrubs, salt tolerant under-shrubs and ephemeral characterize the sequence. Sterile soil patches frequently interrupt this zonal pattern of the halophytes. Lagoons, inland bays and hard hummocks of calcareous deposits are encountered, interrupting the meandering coral pattern of indigenous halophytic stands.

There are four distinct locations where mangroves and halophytes are found along the coast. The floristic composition of the Sudanese Red Sea salt march includes 26 species from different families.

### **2.5.2. Marine Living Resources (key species)**

#### **2.5.2.1. Turtles**

All five species of pantropical marine turtles occur in the Red Sea. Only two are common in the Sudanese Red Sea – the Green Turtle, *Chelonia mydas* and the Hawksbill turtle, *Eretmochelys imbricata*. There are however, some unverified sightings of Olive Ridley turtles *Lepidochelys olivacea* in the area. Green and/ or Hawksbill turtles are known to nest on islands of the Suakin Archipelago and Mukkawar Island at north coast. A study estimated the Red

Sea population of Green and Hawksbill turtles at 3,500 individuals and the main threats to these marine creatures come from continuous oil spills, loss of habitat and development activities and collections. Therefore, they became endangered species and necessary protective measures should be taken for their preservation.

#### **2.5.2.2. Marine Mammals**

Two classes of marine mammals occur in the Red Sea: the *Dugong dugong* (Sirenia), and several species of dolphins and whales (Cetacea). Dugong is reported in a few numbers throughout most of the Red Sea.

They regularly occur in the Sudanese Red Sea mainly at Mersa Arakyai, Suakin Archipelago and Suakin fringing reefs, and are rarely caught. *Dugong dugong* species are considered as endangered mammals and their protection is imperative.

Several species of whales especially the pilot whale (*Globicephala* sp.) and several species of dolphins are observed. The most frequently observed dolphins are the common dolphin, *Delphinus delphins*, which is abundant around Port Sudan; Suakin harbors and some offshore-reef areas.

Other species of dolphins are also encountered in Sudanese Red Sea such as *Tursiops-runcatus* (bottlenosed dolphin) which occurs in small groups in deep waters and *Sousa plumbea* (Humpback dolphin) which is mainly found in shallow sheltered and turbid coastal waters. However, no proper stock assessment study to such key species has been carried out in the Sudanese Red Sea compared to other areas.

#### **2.5.2.3. Marine Fishes**

More than 450 common reef associated species are now recognized in the Red Sea and most information relates to coral reef fishes only. Most of these reef fishes have been reported in the Sudanese Red Sea where coral communities are well developed. The damsel species are considered to be the most important in the reef community structure and of greatest commercial importance, and an indication of endemism. The highest degree of endemism occurs in butterfly fishes and damsel fishes, most species of which are highly territorial.

Certain species of these families may be useful indicators of the conditions of a reef system because of their dependence on the reef for food and/ or protection.

Most species of butterfly and damsel fishes, which are either coral or sponge-feeders, are abundant in the Central Red Sea; some Red Sea/ Indo-Pacific species are rare in the southern region. Special protective measures and more stock assessment studies are necessary for these reef fishes and reefs in the Sudanese Red Sea including other northern areas.

There is a general trend of decreasing species richness with decreasing latitude among parrot fishes (Scaridae) and Surgeon fishes (Acanthuridae), a replacement trend amongst the wrasses and groupers (Serranidae) and an increase in diversity and abundance of snappers (Lutjanidae) and emperors (Lethrinidae).

Available data indicate that at least 450 species are recognized in the Red Sea of which 93 fish species are identified as commercial fish. About 65 fish species of these are of economic importance. 60 – 70% of the total catch comes from 17 artisanal fish species.

Endangered and/or over-fished species:

1. Dugong (*Dugong dugong*)
2. Dolphins (*Delphinus dephis*)
3. Whales Pilot whales (*Globicephala spp.*)
4. Turtles: Hawksbill (*Erethmochely imbricate*), Green turtles (*Chelonia mydas*)
5. Sea cucumber
6. Sharks (*Hammerhead*, Tiger and White-tip)
7. Trochus spp (Kokian)
8. Strompus spp
9. Najil (*Plectropomus spp*)

The Sudanese Red Sea is one of the three major regions of the world, which possess ornamental fishes of potential interest to ornamental fish trade. The other two regions are the Caribbean and the Indo-Pacific. 17 families of the ornamental fishes have been identified, however, no studies have been conducted in the Red Sea to assess the potential and define means and methods of exploitation.

#### 2.5.2.4. Seabirds

Seabirds constitute a key feature in the Sudanese Red Sea Coast. Birds of the Red Sea, in general are typically Indian Ocean, tropical species which can be divided into four groups:

Endemic/regional species e.g. white-eyed gull, *Larus leucophthalmus* and sooty gull, *L. hemprichii* endemic to the coast of north-east Africa and parts of Arabia, but breed only in the Red Sea and Gulf of Aden;

Tropical species e.g. brown noody *Anous stolidus*; a sub species *A. plumbeigularis* is endemic to the Red Sea and Western Indian Ocean;

North Indian Ocean species including north eastern Africa & Arabia coast e.g. White cheeked tern, *Sterna repressa* and Saunders tern, *S. saundersi*;

Widespread species found in both temperate and tropical latitude e.g. *Caspian tern*, and *Sterna caspia*.

Several of the above species of seabirds have been seen in several coastal and offshore islands along the Sudanese Red Sea. Other migrants are observed in autumn and winter (> 30 species) along several parts of the coast & offshore coral islands. Marine birds, as carnivores may have local influence on the food chain especially where large seasonal colonies nest.

#### **2.5.2.6. Prawns**

Studies have shown that there are eight shrimp species in Sudanese waters but the bulk of shrimp is made of only three species namely: *Panesus semiculatus*, *Penaeus latisulactus* and *Metapenaeus monocerus*. Studies have also shown that sexes are separate and spawning takes place in deep water. Surveys by an ODA project estimated shrimps potential at 120 tons/year and projected annual catch at 30 tons/year.

#### **2.5.2.7. Mother-of-pearl oysters**

The Sudan oyster shell potential has not been evaluated. Wild mother-of-pearl shells (*Pinctada mararitifera*) are found along the whole Sudanese shallow coastal water. Fishing is done by diving and collecting shells by hand. The main fishing areas are Dongonab bay, Halayeb area, Suakin area and Shaab El Shubuk. The production has declined sharply lately.

#### **2.5.2.8. Coral Reefs**

Sudan has one of the most beautiful coral reefs in the world. There are three types of coral reefs. These are: the fringing reefs where continuous masses of luxuriant growth of stony corals are found, the barrier reefs (outer reefs) usually 3- 6 miles off – shore and Sanganeb atoll which has already been declared as a marine park of international heritage. These luxurious reefs being in the warm and clear Red Sea water are excellent potentials for tourism activity. They include 32 marine species.

#### **2.5.2.9. Trochus**

*Trochus dentatus* is also found along the whole Sudanese Red Sea coastal shallow waters. The main fishing areas are Suakin area and Dongonab bay. Fishing is done by diving and collecting the shells by hand. Production has been declining.

#### **2.5.2.10. Sea Cucumber**

Sea cucumber is found along the whole Sudanese Red Sea coastline. The major fishing grounds are the areas of Agig, Ashad, Suakin, Arous, Arakyai and Dongonab bay. No studies have been done to estimate its potential. Production of the six identified species is given in. However, production has been increasing. Harvest is done by hand while walking on shallow coral reefs or diving in relatively deeper waters.

#### **2.5.2.11. Sharks**

The Sudanese Red Sea coastline is supporting an active shark fishery. Shark production is estimated at about 10% of the total fish catch. The importance of this potential lies on shark fins. Dried shark fins are in high demand in some countries of Southeast Asia such as Singapore, Hong Kong and Japan.

#### **2.5.2.12. Other Shells**

Shells of commercial importance other than oysters and trochus are Strombus and Lambia Species. These are mainly fished for their meat (Zuramback) and their operculum (Dufra). They are mainly found in places where trochus is found.

#### **2.5.2.13. Lobster**

Lobster is found in negligible amounts and no data are available regarding its potential or actual production.

All of the aforementioned habitats and their associated fauna and flora can be regarded as key resources (or critical habitats) because of their economic value. Particular marine species are also viewed as key resources due to their economic, cultural or scientific values.

### **2.6. Freshwater (Inland) Ecosystem**

#### **2.6.1. Lotic Aquatic Environment (The River Nile)**

The Nile is a dominating physical feature of the northeastern part of the African continent. It plays a major role in the lives of the people inhabiting its basin. The River Nile is one of the largest rivers of Africa and the longest river in the world. The Nile basin is divided into five sub-basins the White Nile, the Sobat, the Blue Nile, the Atbara and the Main Nile.

The White Nile sub-basin has a catchment area of 378000 km<sup>2</sup>. The origin of the White Nile is from the equatorial lakes on the lake plateau. On entering the Sudan it flows through rocky rapids extending for about 170 kilometers, and thereafter flowing through the swampy "Sudd" region where large losses of water are experienced. The sudd or "sadd" is an Arabic word meaning "blockage" or barrier. The terminology is used as the massive papyrus blockage made navigation of the waterways in the upper Nile swamps difficult.

After it emerges from the swamps, Bahr El Ghazal joins it on the west and the Sobat on the east. At Khartoum the White Nile joins the Blue Nile which originates from the Ethiopian Plateau. The main Nile flows from Khartoum down to the Mediterranean and is joined by River Atbara.

The Main Nile, the White Nile, River Atbara and the Blue Nile enclose the fertile central clay plains of the Sudan.

The Blue Nile sub-basin, with a catchment area of 325000 km<sup>2</sup>, lies on the North-Eastern side of the Ethiopian Plateau and is characterized by eroded canyons, more than one kilometer deep, representing an erosion of millions of tons of fertile soil and hard rock. Some of the hard mountains are crested with crater lakes.

The source of the Blue Nile is Lake Tana. The Blue Nile leaves the lake by passing through a series of six distinct cataracts in the upper reef. Below the outlet there is a succession of rapids and cataracts. The Blue Nile on its way towards Sudan collects the flows of eight major tributaries. After covering a distance of 800 km the river enters the Sudan plains at Famaka, which is extended up to its confluence with White Nile at Khartoum. The drop of the river between Lake Tana and Khartoum is about 1470 m.

Inside the Sudan, it collects the flows of two more tributaries, the Dinder and the Rahad, both originating from the Ethiopian Plateau.

After the Junction of the White Nile and the Blue Nile at Khartoum the river is then called the River Nile. It flows northward along a flat country with isolated rocky outcrops until it meets the river Atbara.

### **2.6.2. Lentic Aquatic Environment (Inland Lakes)**

A number of inland lakes are scattered in the Sudan such as lake Kundi, lake Keilak, Merri Bara, Jebel Marra Crater lakes, Malaha lake, lake Ambadi as well as a number of 'Folas' (water pools) in western Sudan.

Lakes Kundi and Keilak lie about 400 km apart in the open Acacia-grass region of western Sudan. They are important as watering places for various cattle-owning tribes. Both lakes show large seasonal changes in area and depth. There is paucity of information on the biology of these lakes.

### **2.6.3. Bentic Aquatic Environment (Dams and Canals)**

These are man-made structures for agricultural, electric power generation or other purposes. Large scale irrigated agriculture started in the Sudan in 1920's. Some of the major schemes under irrigation are the Gezira and Managil Extension, New Halfa, El Suki, Northwest Sennar, El Guneid, Kenana, Hagar Asalaya and Rahad.

Canalization networks are over 10x 10<sup>3</sup> km long. These irrigation networks and the dams which constitute man-made aquatic ecosystems (Lentic-environment).

## 2.7. Aquatic Fauna

### 2.7.1. Microfauna

In general, the microfauna are more dominant in the southern Sudanese water bodies and are characterized by monotony and homogeneity in species composition. The zooplankton is extremely poor in quantity within the stretch of the Nile from Bor to Malakal. The high rate of river current and abundance of detritus dispersed along the water column impedes the development of zooplankton.

### 2.7.2. Fish Fauna

Studies along the whole River Nile revealed that it contained at least 54 genera of fish (over 300 species). In Sudan 29 fish genera and 126 species were detected - many authors described and identified Sudan fresh water fishes.

In the White Nile 24 families, 52 genera and 106 species of fish have been identified. Southern areas are the most favorable condition for reproduction and growth of juvenile fish where there are no considerable fluctuation of water level, and vegetation overgrowth are widely dispersed serving as substratum for ovipositor, sanctuaries and feeding grounds for juvenile fish. This is not confined to fish of southern watercourse since there is no demarcation between them and the Gebel Aulia reservoir, both, are major sites for production of fish in the Sudan.

It is worth mentioning that the southern Sudanese region is considered as an under-fished resource, a phenomenon as dangerous as over-fishing because it leads to suppression in fish growth and reproduction. These biological processes may be conveyed genetically to the coming generation and will prevail even under better conditions. Besides, under the high competition for food and breeding sites, some species of fish will disappear or desert the area to the further north where they are exposed to over-fishing.

## 2.8. Aquatic Flora

### 2.8.1. Macrophytes

The biology, ecology and control of aquatic macrophytes (hydrophytes) in the Sudan are well documented by many workers. There are four major life forms of aquatic hydrophytes; emergents, floating-leafed, free floating and submerged.

The literature contains no data as to the richness of macrophytes of the White Nile in Southern Sudan. Although during the Range and Swamp Survey (1979-83) which was sponsored by Environmental Development Fund (EDF), 350 species of higher plants were identified within the Jonglei Project area; the percentage of true aquatics within this number was not specified. There is only one endemic plant, the remarkable swamp grass *Suddia sagitifolia* discovered in 1979 as a new genus.

The wetlands of the Southern Sudan of which the macrophytes are the major component are a very important complex of ecosystem. They have economic, cultural and historical importance.

Many workers studied the aquatic vegetation of the Blue Nile. The Blue Nile is a torrential river with clear-cut seasonal variations in level and flow. It is characterized by mud flats, which are seasonally inundated, by the river, and by Sennar Dam, if the mud flats lie within its influence. These flats provide very favorable ecological habitats for aquatic macrophytes such as *Najas pectinata*, *Ottelia alismoides*, and *Chara globularis*.

The lentic aquatic environment of Gezira irrigation canals has two main canals that were constructed to irrigate the Gezira scheme and the Managil Extension. These canals take from the Sennar Dam and major canals branch off and supply minor canals. Minor canals supply the field outlet channels, which irrigate cropped land (tenancies).

There are three types of grasslands according to the types of grass found: *Echinochloa haploclada*, *Sporobolus pyramidalis* and *Hyparrheina rufa*.

### **2.8.2. Microphytes**

Unlike the macrophytes, the microphytes reflect a brighter picture. Lake Ambadi lies at the junction of Bahr el Ghazal and River Jour and supports a rich community, in quantity and diversity of desmids.

It is renowned for having a rich community of the desmid algae. The samples collected in 1955 revealed 21 new species, 32 varieties and 7 forms. Two of these new discoveries acquired new nomenclature. These algal groups are all desmids. A rich phytoplankton community is also present. Another group of algae was found as epiphytic on the submerged *Ceratophyllum demersum*, which included two new species. The list is quite long.

## **3. MAJOR THREATS TO BIODIVERSITY IN SUDAN**

Several natural and human factors threaten biodiversity in Sudan. These factors operate at ecosystem, species and gene levels. The major and most common of these threats include the following: -

### **3.1. Drought:**

Recurrent drought spells and fluctuations in rains, floods and temperature can pose direct threats to livelihood of the people.

- Low rainfall and drought result in genetic erosions due to failure in crops and loss of varieties. A good example of such situation is the loss of varieties and complete failure of crops like pearl millet in the western region of Sudan that resulted as consequence of repeated drought spells that hit Sudan during the seventies and eighties. Farmers tended to select early maturing varieties rather than the medium and late maturing varieties providing a good example of the effect of such

practice on the diversity of crops. Such selection practices result in the dominance of some genotypes at the expense of others. After the drought spells farmers of pearl millet in western Sudan.

- Sea warming effect on marine life.

### **3.2. Modern agriculture:**

- Modern agriculture is characterized by the use of advanced improved cultivars in a mono-cropping system of agriculture for different crops, such as sorghum and vegetables. This occurs at the expense of indigenous landraces or old cultivars.
- Horizontal expansion of large scale cultivation in the rainfed agriculture and irrigated schemes in Sudan have always been accompanied by:
  - tree clearance
  - changes in the vegetation complexes and removal of natural vegetation including wild species
  - displacement of domestic and wildlife from their natural habitats.

### **3.3. Land Use Planning:**

Construction and building up of roads, factories, canals, dams and new residence areas pose threats to biodiversity in many ways:

Such expansions in many cases take place in areas used for agriculture or used as pasture lands resulting in:

- Indiscriminate clearance of rare tree species.
- Blocking of livestock corridors and reducing carrying capacity by removing important range plant species.
- Intrusion into wildlife protected areas and destroying their habitats.
- Destruction of fish breeding habitats.

### **3.4. War and Conflicts:**

The war that is waging in several parts of the country, happened to take place in some of the most biodiversity-rich areas. Many forest and rangeland areas are converted into mine and battle fields. It is causing a lot of ecological damage and directly causing great human losses and biodiversity losses in animals and plants. This is specifically severe in the southern part of the country.

**3.5. Fire:**

Fire has drastic ecological effects on ecosystems. Bush fires can be due to lightning, it is sometimes started by livestock herders to make smoke to repel insects that disturb their animals, it can also be initiated by honey collectors or by cultivators to prepare land for cultivation before the onset of the rainy season. All these factors are causes of fire which has great influence on:

- the Presence or absence of particular tree species depends on their fire resistance and it affects the growth form of some individual trees. Fire can also kill the newly establishing saplings.
- Fire drives away reptiles by destroying their habitats or kills them directly.
- It reduces soil seed banks by killing tree and range plant seeds.

**3.6. Pests and diseases:**

These can have direct negative impacts on the genetic variability of both plant and animal and can wipe out a whole species or even an ecosystem.

- They exert selection pressures on crops leading to the extinction of the susceptible strains of cultivated species.
- Inadequate quarantine measures that are ineffective in restricting the introduction of new pests and diseases.
- Outbreaks of epidemics caused by pathogens can affect field crops and forest species.

**3.7. Legislation:**

Most governmental sectors having to do with biodiversity have inadequate or no legislation altogether especially in natural resources management. This can be seen in:

- Illicit felling and over-cutting of tree species.
- Unauthorized introduction of plant specimens (seeds, seedlings,...etc).
- Over-hunting and poaching of wildlife and over-fishing.
- Continuous expansion of agricultural land at the expense of rangeland areas.
- Export or smuggling of genetic material.
- No clear penalties on oil spills that destroy marine life in the Sudanese Red Sea.

**3.8. Socio-economic factors:**

These factors have their impacts on:

- Types of crops grown by farmers through shifting to high yielding varieties or to crops with low input cost and high revenues. A good example of such situation is the shift to production of date palm in the

northern region of the country in areas that used to be cultivated by annual food crops in the past.

- The land tenure system and land fragmentation have forced farmers to migrate from rural areas to cities due to economic insecurity thus abandoning farming and changing to other jobs.
- The impact of socio-economic factors on forest resources is manifested in indiscriminate wide-spread tree clearance for fuelwood production and charcoal making to earn cash income to satisfy basic needs. This situation is more severe in the semi-arid parts of the country where there are major concentrations of human and livestock populations.
- More wildlife poaching.
- Destruction of rare country habitats such as in the Sudanese Red Sea coastal habitat by felling of mangroves for fuelwood. It is also manifested in collecting and selling of corals.

### **3.9. Inadequate Institutional Capacities:**

Most of the government sectors that are relevant to biodiversity conservation or management are inadequately equipped, have resources that do not match the size of the tasks and potential roles they could have otherwise played in conservation of biodiversity.

The only governmental agency entrusted with rangeland management is the Range and Pasture Administration and it is under-staffed and with meager funds.

Limited resources availed for wildlife and fisheries administrations and research centers to monitor or update information.

Limited numbers of insect, plant and animal taxonomists.

Inadequate capacity of sectors to work in a multi-institutional approach.

### **3.10. Over-grazing:**

some regions are occupied by a large number of livestock beyond the optimal carrying capacity. This reflects on:

Considerable reduction in the proportion of livestock feed that comes from shrubs and trees. Most affected tree species are such as *Acacia senegal*, *Acacia seyal*, *Balanites aegyptiaca*, *Maerua crassifolia* "Serehe", *Cadaba glandulosa* (Kurmut) and *Grewia tenax* "Gudeim" as these are difficult to regenerate.

Deterioration in rangeland productivity has led to intrusion and grazing into the Red Sea coastal mangrove and halophyte areas.

Livestock have been competing with wildlife in grazing and habitat areas.

#### **4. BIODIVERSITY STRATEGY AND ACTION PLAN (BSAP)**

The NBSAP project's steering committee formulated a task force of seven national experts to develop the BSAP for the country. The BSAP first draft document was prepared between November and end of December 1999. It was first reviewed by IUCN Eastern Africa Regional Office (EARO). As part of stakeholders involvement and building consensus the BSAP draft was distributed to ministries, institutes, agencies and departments of relevance for comments (listed below). To widen the circle of participation five regional-based workshops were held in different parts of the country. The BSAP was also presented in the project's final national workshop held from 17<sup>th</sup> to 18<sup>th</sup> April 2000. It was then subjected to more discussion and written comments were also received from expert individuals. The participants agreed to adopt the BSAP provided that useful comments that have emerged during the review and discussion of the BSAP draft are incorporated and it is amended. The BSAP has described the current status and trends of biodiversity in the country. It identified the threats leading to biodiversity loss. The BSAP has also identified actions necessary to conserve biodiversity. BSAP covered legislative, economic and social aspects. It took into consideration the opportunities as well as constraints and finally proposed projects with associated budgets. It went through a participatory process in which the ministries, institutes and departments below have been involved and/or represented.

Box 1: Sectors involved in NBSAP preparation

**Ministries**

Ministry of Agriculture and Forestry.  
Ministry of Animal Wealth.  
Ministry of Environment and Tourism.  
Ministry of International Cooperation and Investment  
Ministry of Industry.

**Universities and Research Institutes**

Agricultural Research Corporation.  
Animal Resources Research Corporation.  
El Nilein University  
Faculty of Agriculture, University of Khartoum  
Faculty of Law, University of Khartoum  
Institute of Environmental Studies - University of Khartoum  
Omdurman Ahlia University  
Remote Sensing Corporation  
Upper Nile University  
Wildlife Research Center.

**NGOs**

Fredrich Eibert Foundation  
Humanitarian Aid Commission  
Sudanese Environment Conservation Society  
Sudanese Red Crescent Society  
United Nations Development Program – Khartoum Office  
United Nations Development Programme – Khartoum Office

**Councils, Sectors and Departments**

Climate Change Project  
Forests National Corporation.  
Higher Council for Environment and Natural Resources.  
Land Use and Desertification Control  
National Drought and Desertification Unit  
National Population Council  
Range and Pasture Administration.  
Sudanese Farmers General Union  
Wildlife Conservation General Administration

**Media**

Al Anba' Daily Newspaper  
National Television Corporation  
Khartoum State Television

## 5. LEGAL INSTITUTIONAL ASPECTS

It is not until the 1980s that the Sudan government has started the process of decentralization and development of regions. Currently, with the Federal Government Act the country is divided into twenty six states which further divide into provinces which in turn subdivide into localities. This set up is meant to share power and resources. There is no clear coordination among the different bodies. Environmental local issues have been for a long time confusing under the prevailing federal legal system and the fragmented sector-based legislation instead of a more comprehensive ecosystem approach. It is also imperative to have legislation that cuts across state boundaries, especially in environmental issues. The Higher Council for Environment and National Resources (HCENR) has to efficiently play its role as a coordinating body for environmental issues. It is fortunate that finally environmental legislation has been recently enacted and published. This will, hopefully enhance matters towards conservation.

## 6. VISION

**The Sudan's Vision of Biodiversity is:**

**"Conservation of Diversity, National Heritage and Indigenous Knowledge for Sustainable National Development of Sudan"**

## 7. NATIONAL BIODIVERSITY STRATEGY GOALS AND OBJECTIVES

### 7.1. Goal

The primary goal of the national strategy and action plan is to entrust the people of Sudan to bring about their welfare through conservation, preservation and wise sustainable exploitation of biodiversity components.

It should be recognized that the above goal is in line with the overall objectives stated in the CBD, which are "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources, including appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies and by appropriating funding".

### 7.2. Specific National Objectives

The following goal shall be realized by executing the following proposed objectives:

1. To ensure conservation of the biological heritage for present and future generations
2. To promote the sustainable utilization of biodiversity products
3. To create an enabling environment for biodiversity conservation
4. To promote awareness of biodiversity conservation

5. To implement an active research program, information management system and close monitoring of biodiversity.
6. To comply with and benefit from International Agreements and Mechanisms listed below:

**A. Global**

1. Convention on Wetlands of International Importance, especially as Waterfowl Habitats (Ramsar) Convention for the Protection of the World Cultural and National Heritage;
2. United Nations Framework Convention on Climate Change (UNFCCC);
3. Convention on Biological Diversity (CBD);
4. United Nations Convention to Combat Desertification (UNCCD);
5. Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES);
6. General Agreements on Trade Tariffs and World Trade Organization (GATT/WTO).

**B. Regional**

7. League of Arab States (LAS);
8. Organization of African Unity (OAU);
9. Lome IV Convention;
10. Common Market for Eastern and Southern Africa (COMESA);
11. Inter-governmental Authority on Development (IGAD).

**C. Treaty-based Organizations**

12. Center for International Forestry Research (CIFOR);
13. International Monetary Fund (IMF);
14. Regional Development Banks;
  - African Development Bank (ADB)
  - Arab Development Bank for Africa (BADEA)
15. Islamic Development Bank (IsDB);
16. Food and Agricultural Organization of the United Nations (FAO);
17. United Nations Education, Scientific and Cultural Organization (UNESCO);
18. World Bank (IBRD);
19. International Fund for Agricultural Development (IFAD).

## **D. Non-legally Binding**

### **I. Organizations and Fora**

1. International Center for Agroforestry Research (ICRAF);
2. Center for Plant Genetics (ICPG);
3. Intergovernmental Panel on Climate Change (IPCC);
4. The World Conservation Union (IUCN);
5. International Union Forestry Research Organizations (IUFRO);
6. International Plant Genetic Research Institute (IPGRI);
7. International Center of Genetic Engineering & Biotechnology (ICGEB);

### **II. Initiatives, Processes and other Political Commitments**

1. United Nations Programs (created by the General Assembly of FAO);
  - United Nations Development Program (UNDP)
  - United Nations Environment Program (UNEP)
  - United Nations Conference on Trade and Development (UNCTAD)
  - World Food Program (WFP)
  - FAO Regional Commissions (including Near East and Africa Forestry Commissions)
2. Agenda 21, Chapter 11 (UNCED);
3. Non-legally Binding Authoritative Statement of forest Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All types of Forest-Forest Principles (UNCED);
4. Commission on Sustainable Development (CSD);
  - Intergovernmental Forum on Forests (IFF)
5. Criteria and Indicators for Sustainable Forest Management;
  - Dry Zone Africa Initiative
  - Near East Initiative
13. Global Environment Facility (GEF).

The Sudan NBSAP shall be a useful guide to the implementation of the CBD. It will be processed by the Ministry of Environment and Tourism (MEAT) through the Council of Ministers until it is passed by Parliament and endorsed by the President of the Republic so that it can secure government ownership and commitment to its implementation. The NBSAP will be launched on March 14<sup>th</sup> 2001 the day that the Sudan environment legislation was assented by H.E. the President. The NBSAP will be implemented through 11 projects. The draft NBSAP will be subjected to formal endorsement by a forum of key stakeholders. It will then be tabled for approval by the Council of Ministers, Parliament and the president.

The key institutional stakeholders from whom endorsement will be sought will include:

- Government ministries particularly MAF, Animal Resources, Irrigation, MEAT, Interior, External Relations, National Finance & Economy, Culture and Information, Industry & Investment and Justice.
- Research institutions namely ARC, ARRC, NCR and universities.
- Training institutions including universities and training institutions affiliated to line ministries such as UNDP, FAO, UNESCO, EC and member countries.
- Donor and development assistance partners.
- Relevant NGOs such as SOS Sahel (Sudan) and SECS.

HCENR is envisaged to be the federal agency responsible for dealing with biodiversity in the Sudan. Its organizational setup, hierarchy and mission need to be revised to reflect this and other roles.

The NBSAP will be implemented over an initial period of six years, equivalent to two three-Year Programs in conformity with the planning cycle adopted in CNS.

## 8. PROPOSED PROJECTS AND SUGGESTED BUDGETS

These projects conform and constitute actions to the aforementioned objectives.

<b>Project Title</b>	<b>Estimated Costs (US \$)</b>
Organizational set-up for conservation of biodiversity	1,000,000
Raising awareness of stakeholders at all levels of biodiversity and its importance	1,000,000
Strategic planning for conservation of natural resources	3,000,000
Exploration and documentation of flora and fauna of Darfur, central clay plains, River Nile, Northern, Equatoria, Bahr El Ghazal and Upper Nile regions	2,000,000
Conservation of representative areas of various ecosystems	11,000,000
Rangelands conservation	1,000,000
Ex-situ conservation	41,000,000
Capacity building in systematics	1,500,000
Conservation of local races of livestock	1,500,000
Conservation and sustainable utilization of agro-biodiversity	14,800,000
Establishment of national center for biotechnology	280,000
Reducing impact on biodiversity from civil strife	40,000,000
<b>Estimated Total Cost</b>	<b>118,080,000</b>