REPUBLIC OF SUDAN
MINISTRY OF AGRICULTURE AND FORESTRY
NATIONAL DROUGHT AND DESERTIFICATION CONTROL UNIT (NDDCU)

SUDAN NATIONAL ACTION PROGRAMME (SNAP)

A FRAMEWORK FOR COMBATING DSESRTIFICATION IN SUDAN IN THE CONTEXT OF THE UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION

KHARTOUM – MARCH 2006

Preface

The NDDCU of the Sudan Government, with support from UNDP, has set up a multidisciplinary team of experts (Task force) upon recommendation of the First National Forum in 1995. The task force was to assess past experiences in desertification in Sudan, identify problems of drought and desertification, analyze the immediate and underlying causes and proposes priority actions and strategies within the context of the UNCCD.

The task force (Annex 3) constituted by the NDDCU was to prepare the Sudan NAP strategic planning document according to a designated term of reference. UNDP has agreed to make available the services of an international consultant to work with the team and assist in launching the initial activities of the NAP process.

Meanwhile a Memorandum of Understanding (MOU) was signed between the Ministry of Agriculture (Sudan Government) and UNDP and accordingly a mission from UNSO were commissioned to further strengthen the process and its initial state of launching of NAP. This has added a welcoming new dimension to the work.

The process was then made clear through the UNCCD secretariat guidelines with the support of the international consultant and a bottom-up approach was then used to conclude the SNAP. The process was culminated in the Second Forum and the NAP was to be written.

The AOAD then agreed to support the process of editing the NAP. An Arabic draft was then submitted to the UNCCD secretariat.

The Minister of Agriculture and Forests then located a committee to Review and Prepare the SNAP. The committee agreed to write an English version taking into account the guidelines of the UNCCD and including what is missed in the Arabic version. The committee then used all reference material found and all recommendations from the different workshops and forums and come up with this version.

Acknowledgement

The NDDCU would like to acknowledge the immense efforts of the Committee to Review and Prepare the SNAP for their tireless effort for compiling this report. The NDDCU also recognizes the contribution of the taskforce team in collecting the data and preparing their genuine report which we used as abase for this document. Also the NDDCU recognizes the contribution of the AOAD in preparing the Arabic draft version of the SNAP in 2002. Furthermore, the Committee guidance, directives, inputs and amendments at all stages of this work has been commendable. In addition the NDDCU is highly defiantly appreciated the tireless efforts of the editors for insuring some consistency and coherency to this drat document. Thanks are also due to UNSO and UNDP for financing of the SNAP. The NDDCU is indebted to the Agricultural and Animal Affairs of the Sudan National Assembly, the FNC, and the Drylands Coordination Group (DCG) for their facilitation of finalization of the SNAP.

Acronyms and Abbreviations

ACORD	Agency for Cooperation and Research in Development
AOAD	Arab Organization for Agricultural Development
ARC	Agricultural Research Corporation
CBD	Convention on Biological Diversity
CBOs	Community Based Organizations
DCG	Dryland Coordination Group
DECARP	Desert Encroachment Control And Rehabilitation Programme
FAO	Food and Agriculture Organization of the United Nation
FNC	Forests National Corporation
GEF	Global Environment Facility
GDP	Growth Domestic Product
HCCDDCP	Higher Council for Coordinating Drought and Desertification Control Programmes
HCENR	Higher Council for Environment and Natural Resources
IPRSP	Interim Poverty Reduction Strategy Paper
LWRC	Lands and Water Research Centre
MDGs	Millennium Development Goals
MOAF	Ministry of Agriculture and Forestry
NAP	National Action Programme
NDF	National Desertification Fund
NCCD	National NGOs Coordinating Committee on Combating Desertification
NCS	National Comprehensive Strategy
NCSA	National Capacity Building of Self Assessment in Sudan to Manage Global Environmental Issues
NCR	National Centre for Research
NDDCU	National Drought and Desertification Control Programmes Coordination Unit
NDDCCC	National Drought and Desertification Control Programmes Coordination Council
NGOs	Non- Governmental Organizations
SCSNAP	Sudanese Civil Society Network for Alleviation of Poverty
SECS	Sudanese Environment Conservation Society
SNAP	Sudan National Action Programme
UN	United Nations

UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNESCO	United Nations for Education, Science and Culture Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNSO	United Nations Office for Combating Desertification
WB	World Bank
WSDC	Western Savanna Development Corporation
WSDP	Western Savanna Development Project
WSSD	World Summit for Sustainable Development
WSARP	Western Sudan Agricultural Research Project

Executive Summary

The Sudan has collaborated with and contributed to the international efforts to combat desertification. It is one of the first countries that signed the UNCCD and assigned the NDDCU for the coordination of programmes to mitigate the effects of drought and to combat desertification as a focal point.

As a first step a NAP should be prepared. The UNCCD outlined the basic approach, principles and general features and contents of a model NAP. The convention underlined the principle of integrating strategies for poverty alleviation with progrmmes to combat desertification. It also emphasized those socio-economic and demographic factors contributing to desertification.

This document provides background information on the present environment and natural resources conditions. It covers climate, renewable natural resources, energy, land use, biodiversity and national heritage. Attention has also been drawn to the impacts of the frequent drought periods that inflicted the country in recent decades on the socio-economic status of the population.

The main constraints, challenges and former efforts and policies to streamline the optimum use of natural resources were also reviewed. Several national strategies emphasize environmental issues, natural resources and sustained development, but these are often sectoral, lack comprehensiveness and totality.

Since the thirties of the last century, programmes to combat desertification and its component projects and interventions were being launched in the Sudan through technical and financial assistance (local and international) to improve land resources, production systems, and protection of the environment. This should enable the country to make full use of existing international interventions in the different sectors e.g. GEF (Biodiversity and Climate Change Conventions).

Attention was also drawn to the institutional set up and to the large number of the national, international organizations and NGOs involved in combating desertification. Their programmes activities and interests are so diversified and not particularly coordinated or effectively linked. This, of course, weakens their role greatly.

Research in the area of combating desertification should be supported and strengthened by appropriate actions through the formulation of a comprehensive plan addressing the problem in a scientific manner. Similar efforts should be extended to education and training to establish a viable database.

Financial resources needed to implement SNAP must be sought outside normal national budget which is often limited. In fact most efforts in the area of combating desertification has been supplied by UN agencies. If this situation is to continue projects related to SNAP must be well thought of and presented in a sound and appropriate manner that makes them internationally acceptable and highly saleable in the face of a strong regional competition. Therefore, the establishment of a NDF is paramount importance if desertification is to be checked in any way.

Finally the document focuses on actions in the form of programmes and projects within the context of SNAP and in accordance with the objective of the UNCCD. These projects can be based on guidelines from the NCS and the Agricultural Sector Strategy (2002-2027). Needless to say that these projects have been drawn from proposals submitted by the thirteen affected states based on relevant studies and workshops recommendations. They present broad ideas that can later on be detailed to form draft documents that can be presented for funding.

Since the NDDCU will be entrusted to carry out this tremendous task, its present situation must be seriously considered and strong backing becomes a necessity.

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CHAPTER ONE

1. Background

Sudan is the largest (2.5 million km^2) and most seriously affected country by desertification in Africa. The arid and semi-arid lands cover an area of 1.78 million km^2, which represents about 72% of the total area of the country. These large-scale arid lands prompted the elaboration of a National Action Programme (NAP) state-wise i.e. a plan for each affected state. Sudan has been severely affected by recurrent drought spells (1973/74-1984/85). Sudan is a poor county and there is a need for significant amount of external assistance to achieve the national development objectives. The convention underlined the principle of integrating strategies for poverty alleviation programmes and projects through efforts of combating desertification. The civil war in the south of Sudan has created very difficult socio-economic conditions and caused internal and regional migrations and displacement of people from war-affected areas.

The population in the rural areas relies heavily on natural resources for subsistence (cultivation of marginal lands, reliance on wood-fuel, range lands …etc) and thus the consequence is serious land degradation.

Sudan suffers from serious brain drain that has impacted negatively on technological base, scientific know-how, technical and educational capacity, leading to substantial capacity building requirements.

Sudan implemented several development projects, some of which are relevant to combating Desertification. The county should capitalize and build on existing relevant successful projects, and make provisions for the new features presented by United Nations Convention to combat Desertification (UNCCD) to make the projects sustainable.

Sudan should make full use of existing international interventions and synergies between relevant core conventions such as the Convention on Biological Diversity (CBD) and United Nations Framework Convention on Climate Change (UNFCCC).

1.1. UNCCD Basic Approach

In compliance with and in pursuit of Articles 8, 9 and 10 of UNCCD, Sudan as an affected African country has prepared its National Action Program (NAP). As a prerequisite to the NAP preparation, extensive process of consultation among local communities, administrative bodies, governmental bodies and non-government organizations was carried out. The NAP attempted to identify and analyze the constraints and gaps that are affecting the progress towards combating desertification which eventually hampering sustainable development in the country.

The UNCCD calls for the effective participation of local populations and communities both in the national dialogue and in the design and implementation of programmes and projects in order to guarantee positive impacts on the livelihoods of affected populations and communities.
As conceived in the UNCCD, the NAP is process oriented, bottom-up, iterative and decentralized. Through it a set of integrated measures was identified.

1. 2. NAP Process

1.2.1. Bottom-up Approach and Participation

One of the major reasons for the failure of the past efforts to combat desertification was the top-down approach used and lack of commitment and participation of the local populations and communities. It is now believed that, from several projects and programmes implemented in the field of combating desertification, the effective involvement and participation of local communities concerned with these programmes is vital and guarantees a meaningful impact on the livelihoods of the affected populations.

1.2.2. Key Stakeholders and Partners in the NAP Process

Partnership is needed at the national level to facilitate effective use of resources for combating desertification and the mitigation of drought.
The three main categories of stakeholders involved at the national level are:
A- Government and its various entities.
B- Natural resources users and other civil society sectors and NGOs.
C- External partners consisting of developed country parties, United Nations (UN) agencies, non-governmental organizations (NGOs), multilateral and regional financial institutions.

1.2.3. Enabling Environment

Prior to the UNCCD, fortunately, Sudan has already established the National Drought and Desertification Control Unit (NDDCU) in 1978 and the National Drought and Desertification Control Coordinating Council (NDDCCC) in 1991. Both the NDDCU and the NDDCCC were occupied in coordination and working as focal point for desertification projects and external donors. Also Sudan is already decentralized and divided into twenty-six states and more than sixty provinces and localities. All these institutional arrangements and the establishment of the Higher Council for Environment and Natural Resources (HCENR) in 1991 in addition to the activation of the Environment Protection

Act have created a conducive atmosphere and an environment contributing to implementing the UNCCD.

1.2.4. Steps of Formulation

Soon after the UNCCD entered into force, Sudan started the implementation of the convention by developing the SNAP with the assistance of UNDP. The process started by engaging a committee of six national consultants in compiling and collecting basic information to help in the SNAP preparation. National experts visited the affected states undertaking, among others, the following tasks:

A- Raising awareness about the convention among local communities;

B- Surveying the affected states to gather information that is related to the SNAP process.

C- Identifying the factors contributing to desertification and practical measures necessary to combat it and mitigate the effect of drought.

D- Preparing the communities and civil society organizations in the states for near future consultation meetings.

UNSO has also provided extra financial support for the completion of the SNAP.

The process commenced by workshops involving national partners and local communities' leaders. State-based workshops were convened in the thirteen affected states. Concerned Ministries of Agriculture at these states were the focal points. Experts from the same states prepared papers and some government officials initiated the comments and discussions revolved around three subjects:

i- The state priority programmes in combating desertification and mitigating the effect of drought.

ii- The previous experience of each in combating desertification and mitigating drought effects.

iii- Identification of the roles of different stakeholders in combating desertification.

The participants involved were 67% from local communities and 33% from government institutions and NGOs.

These workshops were planned and coordinated by a steering committee formulated by the NDDCU. The main task of this committee was to assess and monitor the implementation taking into consideration the best approaches to ensure dialogue, negotiation, debate and constituency among and across sectors and institutions. The committee had put guidelines for writing the

papers and programmes on the priority concerns that were addressed and discussed in these workshops.

The second phase of the programme focused on convening specialized workshops at the federal level under a major theme; towards a Unified Strategy for Implementation of the National Action Programme for Drought and Desertification Control. Accordingly, national experts relating to social and economic development and environment conservation prepared ten working papers. The papers covered topics linked to the programme such as resource mobilization, roles of decision makers and NGOs in combating desertification. The programme has offered ideal chances to partners to participate in designation of opinions regarding the preparation necessary for implementing projects produced by the participants.

The participants of these workshops represented decision-makers, government executives, NGOs, and financial sector. It was observed that decision-makers have given more attention to these specialized workshops.

The third phase of the process was the National Forum. Participation in this forum included representatives of all stakeholders in the affected states and government officials. It was encouraging to see that partners from United Nations Development Programme (UNDP) and United Nations Office for Combating Desertification (UNSO) participated and made statements. More pronounced was the auspex of the Vice President, and the presence of states' Governors, and attendance of representatives from constitutional institutions reflected the political commitment.

Papers presented have covered six main topics which included finance, capacity building, indigenous knowledge, programme priorities, government institutional structures, and monitoring and evaluation. It reflected what was agreed upon in the past workshops. Group discussions took place in the second, third, and fourth days of the forum.

Some of the lessons learnt from this experience can be summarized in the following:

- The problem of desertification is now brought out to wider circles and scope thus creating greater opportunity to increased awareness on the problem.
- Successful participation and cooperation between the government officials and NGOs is consolidated.

By closing the national forum, the important parts of the process were convened. Recommendations of the workshops and the national forum were collected, analyzed and a technical committee was formed to compile the written part of the SNAP.

The Arab Organization for Agricultural Development (AOAD), in 2001, through a request from the Minister of Agriculture recruited two national consultants to write the SNAP document using the information collected from the workshops and the national forum. The consultants compiled the SNAP in 2002 and it was submitted to the UNCCD Secretariat as a draft in Arabic Language.

1.3. Environmental settings

1.3.1. Climate

The climate of the Sudan is predominantly tropical and continental. The climatic zones range from the arid and semi arid in the north to the wet monsoon in the extreme south. The rainfall ranges from less than 50 mm per year in the north to more than 1200 mm per year in the southern parts of the country. Rainfall is erratic and the annual variations are very high. The mean minimum temperature range between 18^{o}C to 21^{o}C in winter while the mean maximum temperature ranges between 42^{o}C to 44^{o}C in summer. The Red Sea area and its highlands are dominated by Mediterranean climate. The potential evapotranspiration is higher than the actual precipitation in most parts of the country.

The country being part of the Sudano-Sahelian region, has been subjected to recurrent droughts especially during the 1970s and the 1980s.

1.3.2. Geology and Geomorphology:

Sudan has boundaries with nine countries and enjoys more than 750 km of coastline on the Red Sea. The geology reflects two different structural zones. In the south and east there is the ancient Basement Complex Formation, which has been uplifted and mostly covered by superficial deposits of continental origin with Umm Ruwaba series occupying a basin upon it. Horizontal sedimentary rocks resulting from marine incursions have overlain the northern and western parts of the country. Sandstones and other tertiary rocks appear on the surface as extensive outcrops, dipping very gently northward (Barbour, 1964). The combined action of gentle warping and faulting has produced the Red Sea and its adjoining hills, while volcanic activities have produced Jebel Marra. Volcanic lava occurs in many other areas.

The geological structures and geomorphic processes have given rise to a topography which is generally flat, with a gentle northward slope. This generally flat, low plain is dotted with a few highland areas, which mostly occupy its fringes. The major highland areas include the Jebel Marra massif in the west (3100 m), Mount Kingeti along the Sudan- Uganda border (3200 m) and the Red Sea hills (2200- 2700 m). Of lower significance are the scattered

small rock masses the most prominent of which are the Nuba Mountains which do not exceed 1450 m in elevation. The ironstone plateau occupies the south- western part of the country, while sand sheets and fixed and mobile sand dunes cover northern Sudan, particularly west of the Nile. Most of the area of the country is below 500 m, while the valley of the Nile is less than 300 m above sea level .

The Nubian Sandstone Formation is the largest aquifer in Sudan with sandstone containing non-flowing artesian water. In western Sudan, recharge comes from Chad and Darfur highlands, while in the eastern part it is secured by the Nile. South of Khartoum the soil is too clayey for significant infiltration. Umm Ruwaba Formation contains a considerable storage of water (Alic and Usmab, 1982).

As a result of ancient geological processes, erosion and deposition, 95% of the Sudan's total land surface has an elevation of between 300 to 1200m above Sea Level, with almost half of the area below 500 m.

1.3.3. Natural Resources

The natural vegetation of the country is a result of the active interaction of climatic, topographic, edaphic and economic factors. It increases in richness from north to south, ranging from desert and semi-desert drought resisting, scanty type of vegetation through woodland savanna in the low and high rainfall areas to high savanna/semi-equatorial forests. The mountain types of vegetation are confined to limited isolated sites.

Harrison and Jackson (1958) have distinguished the following three main ecological zones:

- **Desert Zone**

It receives an annual rainfall of zero to 75 mm and is only used for short periods by camels and sheep in good years of rainfall.

- **The Semi-Desert Zone**

This zone covers the northern parts of North Darfur, West Darfur and North and West Kordofan, the northern limits of the White Nile, Gezira, Khartoum, Gedarif, Kassala, Red Sea, River Nile and the Northern states. Annual rainfall varies from 75-300 mm. The vegetation is valuable for grazing and its distribution is more related to soil types rather than rainfall. The characteristic dominant woody species are Acacia sp. While the dominant grass cover is mainly annual with few perennials.

- **Woodland Savanna**

This is the largest ecological zone and it covers large expanses in Kordofan, Darfur and the Blue Nile States. The annual rainfall varies from 300-800 mm.

Some valuable grazing areas are found in Southern Darfur and Kordofan States.

This extensive ecological zone is divided into

1- The low rainfall woodland Savanna in which large areas is used for cultivation and livestock production under nomadic pastoralism.

2- The high rainfall woodlands Savanna which occurs in the wetter parts of the south on the slopes and terraces in an alluvial soil complex. The natural vegetation forms are woodland savanna with shrubby undergrowth and sparse grasses.

The Sudan is endowed with a wide range of ecosystems and Biodiversity. The ecological range extends from the desert in the north to the rain forests in the South. This is in addition to the fresh water and marine environments. There are 12 orders of flowering plants out of the 13, which are available in Africa, including a number of families, genera and species. Records indicate the presence of 3132 species of flowering plants, 409 of those are endemic.

There are 265 species of mammals seven of which are endemic. The bird species amount to 938, while the fresh water fish species are 106. Reptiles are estimated to be 91 species, six of which are endemic. There are three endemic amphibian species.

1.3.3.1. Soils

The Sudan sits on the Basement rocks of the African continent. It is overlain by the Nubian Sandstone formation in the centre and north-west and by the Umm Ruwaba formation in the south. The Basement rocks appear to the surface in the eastern part of the country forming the Red Sea Hills. Soils of the Sudan are products of these parent materials plus the alluvial deposits of its rivers and their tributaries. According to the Food and Agriculture Organization of the United Nation (FAO, 1995), soil resources of the Sudan can be divided into seven broad regions as follows:

Soils of the hyper-arid area (about 78 million ha) of Xerosol comprising part of the Sahara Desert are superficial deposits of sand with bare rock debris, shifting dunes; and consolidated dunes. Recent alluvium provides a basis for productive agriculture in the narrow Nile valley north of Khartoum. Elsewhere soils are sandy with little agricultural potential.

To the south of this region are the soils known locally as Goz and (gardud), soils; classified as Arenosols (about 28 million ha in area). Further to the south are 12 million ha of the more weathered Arenosols in the semi-arid climate of western land central Sudan. These soils are low in nutrients and organic matter

and have a high sensitivity to erosion. The sands are free draining, with some clay or ferruginous clay as a bond near the surface, making them firm after the rains. Under high torrential rains their nutrients could be easily leached.

Vertisols (about 70 million ha) have considerable agricultural potential in the semi-arid zone of the Sudan. They form the central clay plains extending southwards to the eastern part of the flood plains. Special management practices are required to secure sustained production of these Vertisols. Their problems lie in the area of physical soil characteristics and water management, while their assets are a rather high chemical fertility and their location in extensive level plains where mechanical cultivation is possible. Ferrasols (about 30 million ha) are the soils of the dry sub-humid and the moist sub-humid zones embracing the tropical rain forest of the Sudan and the lush tall grasses. These soils have good physical properties but are chemically poor. Their low natural fertility and very low nutrient retention capacity are serious limitations. Their great depth, high permeability and stable microstructure make them less susceptible to erosion than many soils in the country, other than the Vertisols.

The rocky soils of the Red Sea Hills and parts of Marra mountains, classified as Leptosols, constitute about 18 million ha. The Red Sea Hills soils are shallow and poor in nutrients and with high gravel content. The Marra mountain soils are relatively rich volcanic soils. Because of the limited soils depth and sloping terrain these soils are liable to erosion by water.

Cambisols are the smallest soil group in the Sudan (about 2 million ha), but could be among the most productive soils in the country. These soils lie along the undulating Ethiopian Highlands under dry and moist sub-humid conditions, and thus are prone to water erosion.

1.3.3.2. Water Resources

Rainfall

Summer is the main rainy season, extending from May to October, with precipitation ranging between less than 50 mm in the extreme north to more than 1200 mm in the extreme south. Rainfall, however, is characterized by significant variations in distribution as well as in timing and location thereby magnifying the risks of localized crop failure. To avert this risk, mechanized rainfed production schemes have been spread over substantial area of central Sudan. Apart from agriculture, the rains replenish the underground reserve and provide the scattered

(wadis) and water points with annual quantities to support the enormous wealth of livestock and wildlife.

Nile water

Sudan is a meeting point of river tributaries that emanate from the Ethiopian plateau and the region of the Great Lakes. The Blue Nile with its tributaries, Dinder and Rahad, flows from the east annually providing some 54 md.c.m. The Atbara tributary adds another 12 md.c.m. On the other hand, Bahr el Jebel commences from Lake Victoria with permanent rains, but the greater part of the runoff is lost in the swampy area known as (*Sudd)* in southern Sudan, bringing only about 15 md.c.m. at Malakal. The Sobat River, which joins the White Nile at Malakal, flows from the Ethiopian plateau and is fed from tributaries inside and outside the Sudan. About 8 md.c.m. of its runoff (estimated at 13 md.c.m.) are lost in the *Sudd* area of Sobat and Mashar. Almost all the water flow of Bahr El Ghazal River (estimated at 14 md.c.m.) is lost in the *Sudd* area of Bahr El Ghazal basin, leaving only half a md.c.m. to join the White Nile at Lake No. The big variation in the Blue Nile and River Atbara flow between the high river during the flood season and the low river during the months from March to May has necessitated the construction of dams to store water for irrigation and for the generation of hydroelectric power. At present, there are three dams: Sennar (1 md.c.m.), Roseires (3.4 md.cm.) and Khashm El Girba (1.3 md.c.m). However, the accumulated silt in the dam lakes has reduced the storage capacity by 25% in Roseires dam and by 40% in both Sennar and Khashm El Girba dams. Thus, heightening the Roseries dam to increase the storage capacity to 7.3 md.c.m. and constructing Siteit Dam across upper Atbara River to install additional storage capacity for irrigation projects are being seriously considered by the Sudan Government.

Sudan is now utilizing about 14.6 md.c.m. of its share of the Nile water for irrigation, of which 9.5 md.c.m. are from the Blue Nile, 1.7 md.c.m. from River Atbara, 1.8 md.c.m. from the White Nile and 1.6 md.c.m. from the River Nile. The heightening of Roseries Dam and the construction of the new dams will enable the country to fully utilize its share of the Nile water, which stands currently at 20.5 md.c.m. at Sennar (18.5 md.c.m. at Aswan) according to the Nile Water Agreement of 1959. During the early eighties, Sudan and Egypt launched a joint project to excavate the Jongli canal and bypass part of the *Sudd* region, thereby sparing some 4 md.c.m. to be divided equally between the two countries. However, the project was hampered by the civil strife, which started in 1983.

Seasonal Surface Non-Nile Waters

These include El Gash seasonal river which has an annual runoff of 600 million cubic meters (m.c.m.) and Khor Baraka with 500 m.c.m., in addition to about 40 smaller riverlets or wadis scattered all over the central plain, providing about 6.7 md.c.m., which are so far not utilized with the exception of about 0.16 md.c.m. used for domestic purposes. This has been made possible by constructing 63 barrages across the wadis to store 130 m.c.m. and by digging 840 (hafirs) to store about 26 m.c.m.

Underground Water

The water bearing rock strata comprise the Nubian Sandstone, the Um Ruwaba Series and the basement complex which cover, respectively, 28.1%, 20.5% and 9.1% of the total area of the Sudan. The preliminary surveys of the underground reserve quote the figure of nine md.c.m. However, there is need for more research to ascertain the actual figures for the reserve and the replenishment rate. At present, only about 1.3 md.c.m. underground reserves are utilized, of which about 0.45 md.c.m. are used for domestic purposes, while about 0.85 md.c.m. are used to irrigate about 67,200 ha.

Almost all the drainage systems flow into the Nile system. The Blue and White Niles, Bahr el-Ghazal and Bahr el-Arab perennial streams are fed by natural reservoirs located beyond the Sudanese boundaries. Other streams, including the Atbara and the Dinder and Rahad, which make appreciable contribution in summer to the Nile, dry up into disconnected pools, or disappear under their sandy beds during the dry season, or end up in inland deltas. Other occasional, intermittent streams radiating from the highlands during the rainy season, rarely if ever reach the Nile.

1.3.3.3. Forests

The forest resources of the Sudan cover approximately 47.3 million hectares and are mostly woodland Savannas. Their distribution is such that 65% are in the southern region whereas the remaining 35% are found in the northern region (Annex N0. 1: Woody areas in Sudan)

Wood for fuel is the major forest product and Northern Sudan consumes about 13.13 million m^3 annually (FAO, 1994).

Gum Arabic is also a major product and Sudan produces 80% of the world production. Building materials, fencing and furniture are locally produced from the forest resources.

1.3.3.4. Rangelands

The grazing resources as supplied by the natural rangelands cover about 116 million hectares. These spread to occupy the ecological zones that range from the desert in the extreme north, where grazing areas are limited to semi-desert, the rainfall Savanna and the high rainfall woodland Savanna in the south. The northern rangelands are dominated by annual herbaceous plants with trees and bushes. In the Southern portion, perennial herbaceous plants increase with dense stands of woody cover.

Browse species (trees and shrubs) are important components of the natural rangelands upon which livestock and wildlife depend during the dry season.

In the drier areas where Acacias predominate, the pods, fruits, twigs and leaves are the main browse materials. In the wetter areas to the south where broad-leafed woody plants are dominant, livestock depend heavily on tree foliage.

Some range areas are under-utilized during the dry season because of water shortage while others are overgrazed because of intensive water supply.

The expansion of agriculture in the mechanized and traditional sectors has seriously reduced the grazing areas. A satisfactory balance must be found before the situation gets out of hands.

1.3.4. Energy

Forests are the most important renewable source of energy in the Sudan. The rural communities depend on forests, woodlands and vegetation for their livelihood. Fuel wood, sawn wood, building materials and fodder are obtained by direct picking from trees, felling or uprooting of standing trees. The total annual removals from Sudan forests amounts to about 15 million cubic meters of which 87% are consumed for fuel.

FNC estimates that about 30% of the quantities of wood are consumed in Khartoum and Gezira states. It is also worth mentioning that 59% of wood consumed is obtained from the low rainfall savannah and 39% from the poor vegetation of the semi-desert region. The amount of wood removed annually exceeds the allowable limit by about 5 million cubic meters.

The discovery of petroleum initiated the use of butane gas (Ghabat Gas) which hopefully adds a glimpse of hope to stop to the present forests attrition and recover an already lost asset.

1.3.5. Wildlife

It is generally accepted that wildlife was more abundant in northern Sudan than it is today. Wildlife has been disappearing from several areas in northern Sudan. The human and livestock populations are increasing creating more demand on natural resources. Natural pastures are destroyed and very little is done to keep human activities in harmony with the natural ecological balance.

The diversity in the ecological zones is reflected in a wide variety of wildlife species. It has been reported that 91 genera and 224 species and sub-species of mammals other than bats have been described in the Sudan. It is worth mentioning that out of the thirteen-mammalian orders in Africa, twelve occur in Sudan.

1.3.6. Socio-Economic Aspects

Population has grown from 10.26 million in 1956 to 25.6 million in 1993. At present the country's population is estimated at 31.7 million (WB, 2003) and its annual growth rate has increased from 1.9% to 2.7%. According to the fourth national census (1993) rural-to-urban migration has been steady and high, with urban population growth of 4% between 1983/1993. The urban population has grown from less than one million (854,000) in 1956 to 7.5 million in 1993. The rural population in 1993 constituted 71% of Sudanese, (60% rural settlers and 11% nomads), whereas the urban population was 29%. At present, the urban population is estimated at 37 % of the total population (WB, 2003).

It is predicted that urban population will double every 26 years. This trend of high rural-urban migration is due mainly to recurring droughts (which are increasing in frequency), major civil conflicts, budget cuts, and declining developmental investment in the rural areas.

According to the fourth national census (1993) population density per square kilometer is estimated to be 10.2 persons. This figure, however, proves to be a misleading indicator, when population distribution is considered. In Sudan, a great deal of land is desert, desert-like, or simply non-arable. Therefore, when land area is limited to that which has some potential arability (as done by Modawi et al. 1995), measures of population density increase to 31.4 persons/km2, and go as high as 370 persons/km2 when considering land presently cultivated. About 35% of the population resides adjacent to the Nile in Khartoum, Gezira, Sennar, Blue Nile and the White Nile States. This is mainly due to areas being uninhabitable, or becoming depopulated with the shrinking nomadic population in the drought prone north, and the harsh desert conditions from 12°N to 16°N. Overall, population density in relation to arable land is 63 people per square kilometer, but the central region, adjacent to the Nile valley, is most densely populated compared to traditional rainfed areas.

Agriculture is the backbone of the national economy with about 80% of the people engaged in crop and animal production. This makes millions of people in the country directly dependent on natural resources for their livelihood and employment.

This heavy dependence of Sudanese economy on natural resources is reflected in the contribution of the agricultural sector of Sudan GDP, which amounted to 29 to 46% during the period 1985 to 1997 and over 46% in 2001. The share of industry, manufacturing and mining in the GDP is estimated at 15%, although the emergence of petroleum as Sudan's primary export commodity is likely to change the situation in the years to come.

CHAPTER TWO

2. Desertification in Sudan

Sudan with its large area and diversified ecosystems reflects different types of land use. The intensive use of the available resources has led to the appearance of the problem of desertification.

In Sudan, desertification is regarded as the first environmental threat that poses a real constraint to achieving sustainable agricultural development. Desertification is a human made problem through misuse and mal practices of natural resources. Humans are thus the main agents of desertification as well as its victims. Land degradation is invariably accompanied by degradation of human well being and social prospects.

Climate with its great variation and intensity is the second causal agent of desertification. The frequent severe drought that struck Sudan from 1967-73 and 1982-84, in addition to lesser severe drought in late eighties with their great impact on the natural resource led to famine and human displacement.

2.1. Causes and Extent

2.1.1. Overgrazing

Overgrazing is the most prevalent cause of desertification in almost all over Sudan. This is especially so around water points and where water table is often lowered after increased or excessive use of water. Sudan with its rich livestock is vulnerable to desertification through overgrazing. This has led to the disappearance of some palatable species and replacement by non-palatable types in some rangelands in Western Sudan. The carrying capacity of most of the rangeland areas in Kordofan, Darfur and Butana can hardly support the large number of livestock in the area.

2.1.2. Deforestation

Felling of trees for different reasons and the use of fuel wood energy are the causes of deforestation leading to desertification in forest areas. Alternative energy sources (solar, wind, biogas…etc) must be thought of if desertification due to deforestation is to be controlled.

The use of butane gas as a substitute to biomass as a source of domestic energy has significantly improved the situation in this respect. The recently launched FNC Scheme (Ghabat gas) is really commendable.

2.1.3. Over-cultivation, Cultivation of Marginal Lands and Irrational Use of Heavy Machinery.

The over-cultivation and cultivation of marginal land especially in low rainfall areas is a serious cause of desertification in Sudan. This often causes: a) loss of soil fertility b) soil impermeability and c) loss of nutrients and biological activity.

2.1.4. Bush Removal and Unplanned Burning

The uprooting of bushes for wood and burning of grass and forest shrubs for crop cultivation can lead to desertification. This is practiced in some areas in Central Sudan. Fires destroy the soil cover leaving it bare and hence vulnerable to erosion and desertification.

2.2. Drought and Desertification Impacts

Drought and desertification had threatened the irrigation sector, mechanized crop production schemes and the traditional rain-fed agriculture. Moreover desert encroachment is threatening almost all the potentially cultivable land in the country. Large tracts of soils, even in the Gezira Scheme, have fallen out of production due to desert encroachment. Similarly forestlands over the country, especially the gum Arabic production belt in Kordofan are threatened with desert encroachment to a very large extent with all consequences on the country's economy. The major impacts of Desertification on natural resources can be summed up in the following:-

a. Socio-economic livelihoods
b. Decline of land productivity.
c. Food production shortage.
d. Resource based Conflict
e. Decline in environmental quality.
f. Decline of rangelands and pastoral resources.
g. Shifting of sand dunes.

In N. Kordofan and N. Darfur sand is continuously heaping over fairly productive soils. The entire strip of the Nile is subject to serious dune

encroachment, particularly the area between Delgo and Karima in northern Sudan.

2.3. Land Degradation

Assessment of land degradation and its trends was based on the interaction of the factors of climate, soil, vegetative cover and the current human activities. Accordingly the concerned desertified states could be grouped into three categories. The states within each of the three classes share some common factors. The first class encompasses the most arid States, which are located in the northern and northeastern zones of the Sudan. It includes the Northern, the River Nile and Kassala States. Due to the relatively high aridity coupled with excessive agricultural land use, the land is experiencing a serious state of desertification. This stage has already been manifested in the form of bare lands around villages and water points. Riverbank erosion (Haddam) and sand dunes accumulation particularly in the western side of the Nile are all common symptoms of deterioration.

The second class includes the states that are dominating the central clay plain of the Sudan, as well as the main irrigation schemes. These are the States of Gedarif, Sennar, Gezira and White Nile. This region enjoys a relatively high annual rainfall (100 – 500mm) and hence moderately desertified.

The area had a fairly good vegetative cover but, currently the land has undergone serious degradation as irrational mechanized farming, extensive woodcutting and over-grazing are over mining land resources.

northern Gezira and the western part of the White Nile are now experiencing progressive sand dune encroachment.

Class three includes the western Sudan States of North Kordofan, west Kordofan, North Darfur and West Darfur. The soils are predominantly sandy and due to their favorable permeability and workability the soils are being extensively used for rain-fed traditional farming. These states are also the main resort for the nomadic pastoralists who flee livestock pests and diseases in the clays further south during the wet season. Consequently a multiple factors of climate, soil and irrational land use have contributed greatly to the current state of land degradation. But still the fact remains that prevention of land degradation is more cost-effective than suffering the severe consequences of desertification.

2.4. Geographical Extent of Desertification in Sudan

The desertified area in the country is confined to the mentioned ecological zones which fall between latitude 10^{o}-18^{o} N.

Sudan is one of the Sudano-Sahelian countries that have been seriously affected by drought and desertification since the late sixties to the present. This has its lasting imprints on natural habitats, means of livelihood and socio-economic fabric of the societies. The magnitude of desertification in Sudan was assessed by assimilating the existing information through the use of Geographical Information Systems (GIS). The indicators used were:

- Land Use.
- Geomorphology.
- Human settlements.
- Soil and drainage pattern and
- Rainfall distribution.

Accordingly five classes of desertification were identified: Very Severe, Severe, Moderate, Slight and Very slight (Table 1).

The maps produced by NDDCU show rainfall fluctuations. The most striking result is the shift of the rainfall isohyets during the period 1930 – 1990 from north to south, indicating an increase of the area under more arid conditions. The results in table (1), show that the area affected by desertification between Lat. 10^{o} – 18^{o}N is approximately 1,260,000 km^2, which is about 51% of the country's total area.

Table (1) Areas at Risk to Drought between Lat. 10-18 N

Desertification Classes	**Ecological Zones**	**Rainfall (mm)**	**Area in (000Km^2)**	**% to Zone Area**	**% to Sudan Area**
Desert	Desert	0-100	307	24.4	12.3
Very Severe-Severe	Semi-Desert	100-300	414	32.9	16.6
Moderate	Low Rainfall Savanna	300-800	513	40.6	20.6
Slight	Montane Vegetation	600-800	0.8	0.1	0.0
-Very slight	Higher Rainfall Savanna	>800	25	2.0	1.0
Total			1,260	100.0	49.5

Zone: 10^{o} – 18^{o}N,
Zone area = Studied affected Area (10^{o} – 18^{o})
Source: E.M. Salih (1994).

Hence it is an urgent necessity to initiate operational programmes to control desertification and mitigate drought particularly under severe and very severe conditions.

2.5. Policies and Legislation

2.5.1. Polices

The main objectives of these policies are the achievement of food security, appropriate use of natural resources and sustainable development, poverty eradication, mitigation of drought effects and desertification control.

Sudan has sensed the problem of drought and desert encroachment since the late sixties and prepared and implemented the Desert Encroachment Control And Rehabilitation Programme (DECARP) in 1976, followed by the National Comprehensive Strategy (1992-2002).

Recently the Sudan embarked on a 25-year strategy with similar objectives.

2.5.2. Legislation

Land tenure systems in Sudan are complicated and consequently their role for optimum utilization of natural resources is confused and ineffective. Rules and regulations protecting the environment as a whole available, but hardly needed to activate these laws and regulations.

The Sudan government is about to set up relevant bodies for the well management of natural resources to safeguard against tribal conflicts with specific role for tribal leaders. At present laws be issued locally (Mahallia), State (Wilaya) or Nationally.

The role of the HCENR in this respect is, of course, of paramount importance in the area of coordination.

2.6. Institutional Framework

In trying to review the organizations and institutes invariably all of them focus strongly on the way that makes best use and management of natural resources. Hence a clear and long term vision and in depth view of those strategies. It is high time that such approach be the prime target for all those involved in combating desertification. Needless to say that should have clear objectives, holistic and well coordinated with others to ensure the best use of the already strained financial resources.

In spite of the relatively large number of institutions, organization and NGOs involved in combating desertification and the wide distribution of

responsibilities and tasks there is a pressing need to achieve complementarities of activities and coordination efforts.

2.6.1. National Drought and Desertification Control Programmes Coordinating and Monitoring Unit (NDDCU)

The Ministry of Agriculture and Forestry (MOAF) is responsible for food security and mandated to operationalize the national strategies, policies and programmes. The Ministry has been the main entity to forecast disasters of drought and desertification since the sixties.

Within its capacity and mandate the ministry has established the National Desertification Control and Monitoring Unit in 1978, which has been supported by United Nations Sudanosahelian Office (UNSO) (UNDP) in 1980. After the workshop on Guidelines of the National Plan for Combating Drought and desertification, the unit was upgraded to National Drought and Desertification Control Programmes Coordinating and Monitoring Unit (NDDCU) and its coordinating council was restructured to comprise the involved representatives from the relative sectors.

NDDCU as an organ of information, synergy, dissemination and coordination, and the Coordination Council (high level experts) are responsible for formulating, and updating the approved national plans, programmes of action and for articulating elements and issues of the drought and desertification problems. They are mandated to modify the projects of priority according to actual conditions and essential needs.

The present position of the National Drought and Desertification Control Programmes Coordinating and Monitoring Unit (NDDCU) under the Administration of Land Use and Desertification Control reflects an insufficient understanding of the role and importance of the unit. This position deprives the unit of autonomy and flexibility required to perform its function at the national level. It is hence imperative to reconsider the status of the unit within the context of enhancing the overall commitment of the government to tackle the problem of desertification in the country.

2.6.2. Agricultural Research Corporation (ARC)

In the process of trying to solve agricultural production problems ARC has humbly contributed to desertification control and research. Lands and Water Research Centre (LWRC) is contributing to research on desertification control through tackling programmes on land and water management, cultural practices, rehabilitation of forests and agroforestry. LWRC is also generating some useful data contributing to the understanding of desertification phenomenon in the Sudan.

However, ARC in its ongoing programmes in the area of desertification in Gezira, White Nile, Khartoum, and Northern States is executing the following projects:

1- Assessment of some degraded soil series and soil research.

2- Soil sedimentation and soil crusting in wheat plots in Gezira.

3- Water harvesting techniques in Butana and Gedarif.

4- Salt-affected soils and use of organic agriculture in Khartoum and River Nile States.

5- Reclamation of upper soil terraces in Southern Khartoum and Northern States through:

- Organic manure.
- Water leaching.
- Use of urea.
- Use of salt tolerant wheat varieties.

6- Land and water management techniques in Gardud soils and cultural practices for gum Arabic production in Kordofan.

2.6.3. National Centre for Research (NCR)

The National Centre for Research in its broad objectives and targets is clearly set to:

- Lay sound solid database for sustainable development,
- Plan for scientific and technical state and the creation of an indusive environment for scientific research; and
- Fill up research gaps not covered by other research institutions.

NCR via the institute of environmental research and natural resources launching an ambitious programme to combat desertification and mitigate its effects but, as expected, was faced with tremendous difficulties during the execution phase. The constraints are mainly financial resources and cadre. Nevertheless, the programme managed to contribute significantly in the areas of:

- Stabilization of sand dunes.
- Effects of shelterbelts.
- Use of sandy soils for agricultural and animal production.

2.6.4. Desertification And Desert Cultivation Studies Institute (DADCSI)

The institute is contributing significantly to desertification control knowledge through their guided research and studies.

2.6.5. The Non-Governmental Organizations (NGOs)

The role of NGOs need not be underscored and this is reflected in a few examples:

The Sudanese Environment Conservation Society (SECS) could be classified as a leading NGO conducting participatory process in support of implementation of the SNAP related activities. SECS first strategy (1992–2002) specified the desertification problem as the major environmental problem in the Sudan. SECS housed the national NGOs Coordinating Committee on Combating Desertification (NCCD). SECS acted as focal point for a network of 100 branches located in more than 13 states. Also SECS had been active in conducting workshops and meetings at Khartoum and in the states where direct consultation and discussion on issues of SNAP related activities were discussed. Also SECS in its headquarters office housed the NGOs network for poverty alleviation. It should be added that the NCCD NGOs network was not as active during the period 2002-2004 when compared to 2000-2002, and that efforts to activate this network are being made.

- The Sudanese Civil Society Network for Alleviation of Poverty (SCSNAP) which was established by a group of NGOs in collaboration with the Netherlands' Oxfam participated in the consultation of IPRSP. The network conducted several meetings and workshops with emphasis on identifying Community Based Organizations (CBOs) best practices in mitigating the negative impact of poverty and work with other stakeholders towards introducing or recommending pro-poor macro-policies.

- During 2003 the FNC has put forth participatory efforts with CBOs to establish 105 community forests in 10474 feddans during 2003. Also Agency for Cooperation and Research in Development (ACORD) in the Red Sea State distributed 1500 seedlings and rehabilitated 50 feddans of rangeland. The SOS Sahel International (UK) established 14 community forests associations in Northern Kordofan. The associations registered in 2002 were responsible for tree plantations in 7018 feddans in privately owned land and in 85,000 feddans in communally managed land. It was reported by SOS that community forestry had proved to be an effective strategy in strengthening the livelihood resources base of 32,000 persons in N. Kordofan.

2.7. The Present status of Desertification in the Affected States

The thirteen-affected states have tropical sub-continental type of climate whose nature is determined by two main air movements. One is a very dry air from the north that prevails throughout the year but not uniform. The second is a major airflow of Maritime Origin that enters the area from the south and carries moisture and brings rain. Accordingly there is a dry season from November to April and a wet season from May through October. The rainfall follows a general north-south gradient increase from 25 mm in the extreme north to 1000 mm in the southern fringes. Thus the states that are located in the southern part of the desertified area receive more annual rainfall than those in the extreme north, and hence less vulnerable to desertification, except the Northern State which is located in the desert.

Each of the eleven remaining states are situated in two or more of the desert, semi-desert, arid and semi-arid climatic zones that follows consecutively from north to south similar to the rainfall isohyets.

The annual rainfall is highly variable and the distribution is erratic with all direct implications on the cropping season. Except in August, which is the most humid month, the potential evapotranspiration in all other months exceeds the relative humidity.

Assessment of land degradation and its trends was based on the interaction of the factors of climate namely: soil, vegetative coverage and the current human activities. Accordingly the concerned desertified states could be grouped into three categories. The states within each of the three classes share some common factors. The first class encompasses the most and states, which are located in the northern and northeastern zones of the Sudan. It includes the Northern, the River Nile and Kassala States. Due to the relatively high aridity coupled with excessive agricultural land use, the land is experiencing a serious impact of desertification. This state has already been manifested in the form of bare lands around villages and water points. Riverbank erosion in the form of bare lands around villages and water points. Riverbank erosion (Haddam) and sand dunes accumulation particularly in the western side of the Nile are all common symptoms of deteriorations.

The second class includes the states that are dominating the central clay plain of the country as well as the main irrigation schemes. These are the States of Gedarif, Sennar, Gezira and White Nile. This region enjoys a relatively high annual rainfall (100-500 mm) and hence moderately desertified. The area had a fairly good vegetative cover but, currently the land has undergone serious degradation as irrational mechanized farming, extensive woodcutting and over-grazing are over mining land resources.

Northern Gezira and the western part of the White Nile States are now experiencing progressive sand dunes encroachment.
Class three includes the western Sudan States of North Kordofan, west Kordofan, North Darfur and West Darfur. The soil is predominantly sandy and due to their favorable permeability and workability the soils are being extensively used for rain-fed traditional farming. This State is also the main resort for the nomadic pastoralists who flee livestock pests and diseases in the clays further south during the wet season. Consequently a multiple factors of climate, soil and irrational land use have contributed greatly to the current state of land degradation.

2.7.1. Current Plans for Combating Desertification

There are few national and externally supported projects for combating desertification in most of the states but the effects are limited and localized due to the large area affected and the vast degree of deterioration. Some of the projects have already ceased to function due to lack of funds.
Therefore unless serious and immediate action is pursued the gap between the sustainability of resources and the degree of exploitation will further widen.

CHAPTER THREE

3. Past and Present Projects for Combating Desertification

3.1. Perspective

About a quarter of a century back, the Rural Development Administration implemented several agricultural development projects in Sudan over a wide range of a climatic and soil conditions. Some of these projects were designed for combating what was referred to as Desert Encroachment Control And Rehabilitation Programme (DECARP, 1976). It was realized then that this phenomenon is triggered by human and livestock activities including, overgrazing, irrational cultivation, wood cutting and deforestation, uprooting shrubs for fuel, the lowering of water tables due to increased water use, and burning of grasslands forests and shrub lands. Some sort of action programmes supported these activities.
The obvious hypothesis was that man and livestock are behind desertification.
Hence appropriate projects to combat: overgrazing, marginal cultivation, wood

cutting and deforestation, lowering of the water table and burning of grasslands (*Harig*) were implemented as priority action programmes. More, recently, several anti-desertification projects were set up, of which the following will be evaluated.

3.2. Restocking of Gum Arabic Desertification Control

Objectives

The main objectives of the project are to establish ten extension service centers in three districts of northern Kordofan (Al Obied, Um Ruaba and Bara) and to promote individual and community involvement in the restocking of the gum belt. By so doing it is aimed to create facilities and a level of technical ability within the rural communities to enable them to become self reliant in combating desertification and in improving their living standards.

Activities

The activities include establishment of extension centres to mobilize community in restocking of the gum belt. Establishment of central nurseries. Distribution of seedlings to the farmers *(Acacia Senegal, Acacia Trotilis, and Acacia Balamites).*

3.3. Integrated Resource Management for Desertification Control (Al-Odaya)

Objectives

The aim of the project is to establish institutional structure to promote individual and community involvement for the regeneration, conservation and proper management of the natural resources in their area. The Immediate Objectives are:

- Creation of self-reliant rural communities through establishing operational Village Councils Development Committees (VCDCs) with their subcommittees that focuses on the natural resource management.
- Improvement of land management with emphasis on range management, and
- Development of water harvesting techniques.

Activities

- Consolidation of eleven operational VCDCs and formation of new ones**.**
- Creation of nomadic development committees. .
- Creation of a Council for Area Resources Management (CARM).

- Establishment of specialized sub-committees on range, water, finance and village nurseries.
- Provision of on-job training for village during participation in project activities.

3.4. Western Savanna Development Project (WSDP)

This project has formed an integrated part of government long-term agricultural and rural development programme in Southern Darfur.

The Western Savanna Development Corporation (WSDC) became operative in 1978 and had two projects, namely South Darfur Rural Development Project and The Savanna Development Project.

Objectives

- Increasing small farmer incomes through higher production.
- Adoption of farming system.
- Arresting the ongoing land degradation.
- Rehabilitation of water supplies facilities.
- Extension of new technologies.
- Conservation of rangelands and pastures.

Activities

- Adoption of operational research and establishment of four controlled settlements with secure tenure.
- Initiation of the registered deferred wet season enclosures.
- A programme of rotational deferred wet season grazing system was implemented with a group of nomads
- The WSDC worked closely with the National Water Corporation (NWC) to rehabilitate water yards.

The Western Sudan Agricultural Research Project (WSARP) as an integral part of WSDC was supposed to generate new farming systems, crop varieties, introduce tillage implements, improve crop production and protect the environment. However, numerous problems and constraints interacted and limited its success to few technological packages.

Each project achieved some of its objectives, for example:

- Establishment of nursery techniques and restocking of gum Arabic gardens.
- Techology of rest-rotation grazing system WSARP.
- Concept of traditional reserves and water catchment techniques (Al Odaya).
- Establishment of an extension system WSARP.

- Trials and partial success in the establishment of a new farming system and a sustainable environment WSARP.

Almost all three projects were limited by one or more of the following:

- Lack of efficient public awareness and popular participation mechanisms.
- Lack of adequate community services in the project areas.
- Some of the projects are heavily sector oriented, with slow cash flow process.
- Lack of trained manpower in the field.
- Almost all three projects lack an effective assessment and monitoring evaluation system, with coordination at minimum.

Other projects were designed to conserve the forest resources by providing energy substitute for use by households and services. Such projects included: the project of briquetting of groundnut shells and improved-strata dissemination at Al Nuhoud and the project of charcoal production from cotton stalks in the agriculture schemes of AlRahad, Gezira and biogas plants in Darfur State.

Mobile or shifting sand dunes blockade watercourses cover productive lands, rail, roads and building. A notable successful project for sand dunes stabilization was implemented near Al-Bashiri village, 18Km northwest of Bara (L14 N). The method included fencing, establishment of chess board designed fences using local bush and planting of drought resistant grasses such are: *Panicum turgidum* and *Leptadenia pyrotechnica* shrubs, which are available in the area proved the best for making microfences.

CHAPTER FOUR

4. Priority Programmes and Activities

These priorities are based on previous work and documents. Paramount among these, are the workshops carried out by the NDDCU in partnership with the NCCD in the 13 most affected states and the subsequent national workshops. They are also based on the parallel efforts of the NCCD which culminated in a national workshop and the recent work on the Millennium Development Goals (MDGs), especially Goal "7" which calls for ensuring environmental sustainability. The programmes were prepared and identified in conformity with the spirit of Chapter 12 Agenda 21.

The programmes can be classified into four main programme types:

- Programmes and activities related to institutional building for coordination, monitoring and evaluation.
- Programmes and activities related to capacity building and human resources development.

- Programmes and activities related to priority programme areas at state levels.
- Other priorities related to the implementation of the UNCCD.
- Pilot projects.

4.1. Programmes And Activities Related to Institutional Building, Coordination, Monitoring And Evaluation

It is recommended that a Higher Council for Coordinating Drought and Desertification Control Programmes (HCCDDCP) and its organs should be established. This council is to be enabled to play progressively and effectively its role within the SNAP process through institutional support to its General Secretariat and its organs through promoting the NDDCU to a general Secretariat.

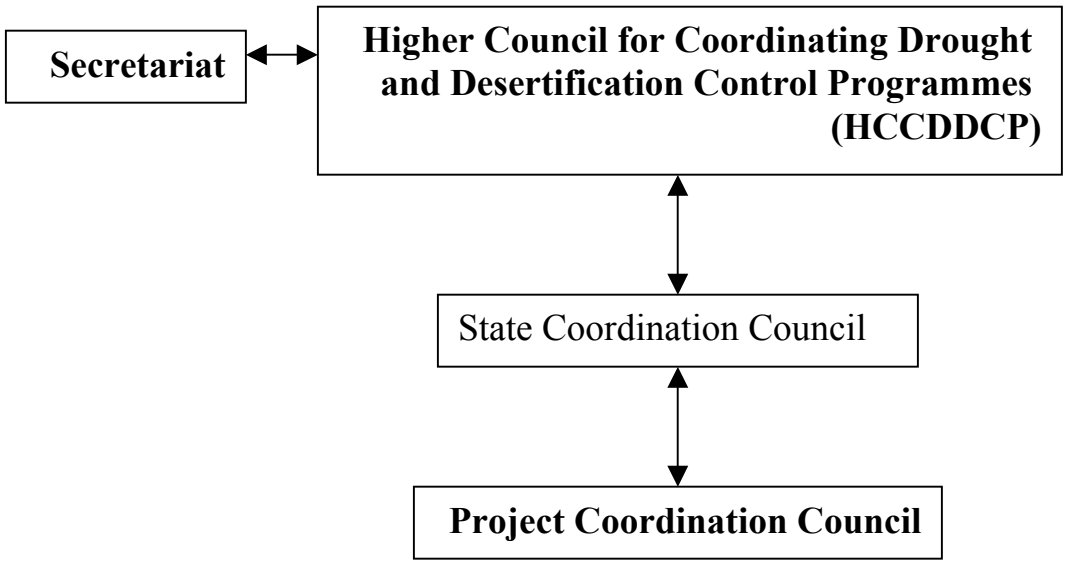
The logical framework could be described as follows:

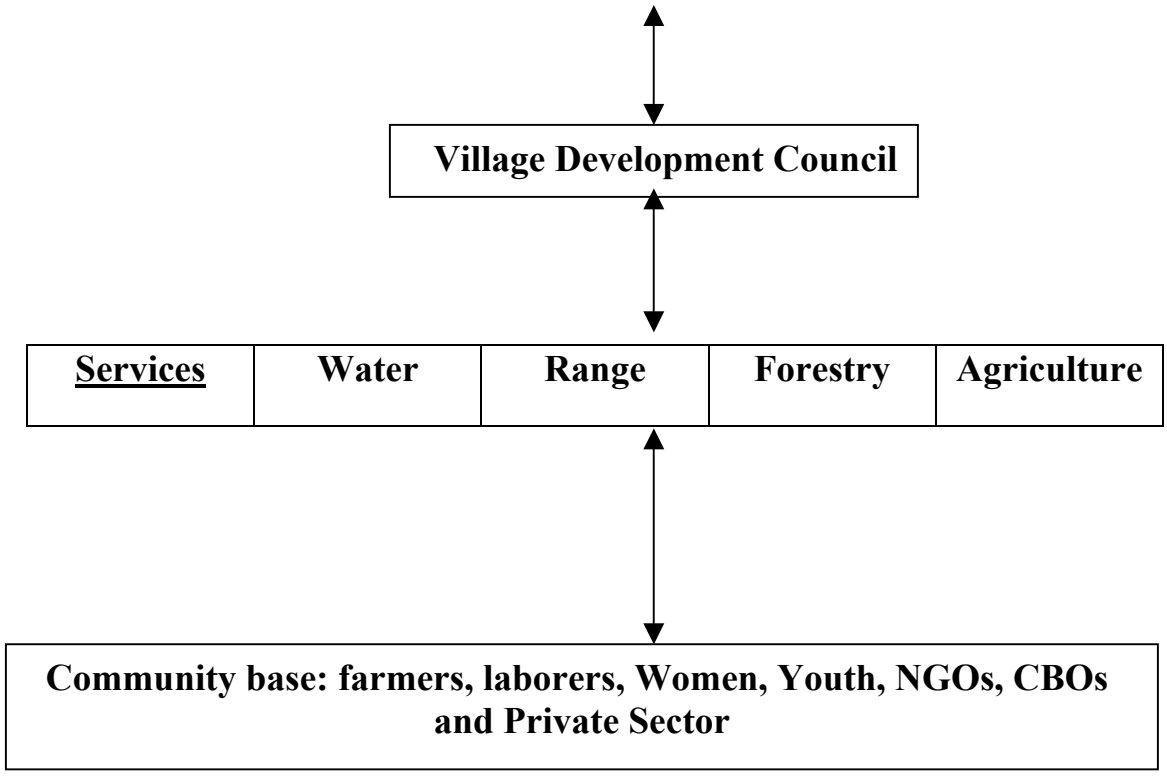
i)- Immediate objectives:

- Formalizing the new organizational chart (Fig. No. 1) for SNAP activities coordination, monitoring and evaluation.
- Restructuring the NDDCU in order to promote it to a General Secretariat for HCCDDCP.
- Building operating capacities of the General Secretariat (former NDDCU) and its organs in the fields of desertification monitoring indicators, integrated information systems on environment and desertification, data collection and processing, policy analysis,

Figure No. 1

Organization Structure of the HCCDDCP





capacity building, partnership promotion, resources mobilization and funding, etc…

ii)- Expected outputs should include:

- Effective built in capacity within HCCDDCP .
- Effective coordination and synergy between Rio conventions.
- Initiating an integrated information system on desertification.
- Improvement of decision-making processes with regard to natural resources management issues at federal and state levels.
- A better-integrated approach towards sustainable development in desertification affected areas.
- Substantial increase in desertification control activities at grassroots level.

iii)- The programme activities include:

- Training at relevant levels.
- Improvement and strengthening of communication channels.

- Supporting the HCCDDCP and its General Secretariat with required equipment.
- Improvement and strengthening of infrastructure and premises.

4.2. Programmes And Activities Related to Capacity Building And Human Resources Development

Programmes under this group aim at:

- Unifying environmental policies involving civil societies at state level through the provision of an integrated/holistic Environment Information Systems.
- Promoting environmental public awareness using popular and state of the art communication channels.
- Enhancing scientific research in the field of environment at federal and state levels.
- Introducing environmental education programmes in curricula courses at various levels, including scientific research outputs.
- Extending and promoting the utilization of environmental sound intermediate technologies in rural areas.
- Promoting and developing alternative renewable energy sources (bio-energy, solar energy, wind energy, etc…) as appropriate.

The specific objectives of these programmes aim at building national capacities in various fields such as:

- Environment policies.
- Extension and public awareness on environment.
- Scientific research on environmental issues.
- Environmental education issues.
- Intermediate technologies.
- Renewable energy sources.

4.3. Programmes And Activities Related to Priority Programmes Areas at State Levels

At State level the SNAP process identified rough but clear state programme proposals covering the major aspects of desertification. However, these proposals did not identify regarding programme priorities, or criteria to be adopted in order to assess programme priorities within a given state. Nevertheless, these proposals are to be considered as an appropriate pipeline for the implementation of the SNAP taking into consideration the hypothetical scarcity of funding resources and, the priority criteria.

In this regard a set of indicative criteria are proposed to be used when funding resources are secured. In order to facilitate the use of an integrated approach towards the preparation and implementation of these programmes. The proposed criteria are based more on socio-special or socio-geographic consideration than on sector. These criteria are:

- Natural resources potentialities: the highest is the potential to be valorized or to be restored/protected; the highest is the priority to be considered.
- Scope of intensity of desertification processes.
- Demographic density.
- Dependency to rural employment: number of inhabitants for each employment when available.
- Vicinity of an ADS or ARS or degree of complementation with any other former ongoing development activities.
- Local socio-geographic balance and equity.

4.4. Pilot Projects

Thirteen projects were selected among state priority programme areas, on the basis of one project for each affected state, to serve as pilot projects. These projects are summarized in (annex No. 2). The preparation and the implementation of these projects are intended to:

- initiate the implementation of the SNAP process through a learning implementation process.
- give consistency to SNAP orientations and mechanisms.
- allow substantial feed-back for further refinement of SNAP components.

4.5. Other Priorities Related to the Implementation of the UNCCD

4.5.1. Mainstreaming of the SNAP in the National Development Strategy

The National Comprehensive Strategy (NCS, 1992 – 2002) has laid, for the first time, an environmental strategy for Sudan. The NCS has stipulated that the environmental issues must be an integral part of the all-developmental activities. The HCNR and the National Planning Council, supported by the United Nations Division for Sustainable Development (UNDESA-DSD) held a number of activities to draw a National Sustainable Development Strategy for Sudan. This effort is reflected in the 25-year National Strategic Plan to link desertification with poverty, food security and conservation of the

environment. The Government of Sudan is preparing an Interim Poverty Reduction Strategy Paper (IPRSP), with technical assistance from the World Bank and the United Nations Development Program (UNDP). The SNAP should be a focal point for all these strategies which require a very high state of political commitment and support.

4.5.2. Reform of Policies and Legislation

The current policies, especially in the agricultural sector, are increasing land degradation and leading to impoverishment of the rural communities. This is manifested in the expansion of crop cultivation even in marginal areas at the expense of forests and rangeland. This should be tackled in a way that balances the need for intensified crop production for food security and increase the areas of forests and rangelands. A second issue is the crucial issue of land tenure and land use. There is a clear need for a proper land use plan that caters for the needs of all land users. A Third issue is the current levels of governance (local, state and federal) which has generally adverse effects on the natural resources of the country.

4.5.3. Establishment of the National Desertification Control Fund (NDF)

All the stakeholders are convinced of the establishment of a National Desertification Fund (NDF). The current situation in Sudan is favourable following the signature of the Comprehensive Peace Agreement and the creation of the Multi Donor Trust Fund.

Capacity Building 4.5.4.

The state workshops carried out by the NDDCU has shown the need for building capacities at states and localities levels. This applies equally to the governmental and non-governmental organizations including the CBOs and the women and youth organizations. At the federal level, the capacities of the NDDCU as the focal point for the UNCCD in the country should be strengthened to deal with the multitude of problems associated with desertification and drought. In this regard the National Council for Desertification is to be revitalized. This process will make use of the project entitled : National Capacity Self Assessment Project (NCSA) in Sudan to manage global environmental issues" which is currently under implementation by HCENR. The objective of NCSA is to provide national stakeholders the opportunity to articulate a thorough participatory self-assessment and analysis of national capacity building needs, priorities and constraints as set forth in the Rio conventions and related international instruments. The NCSA will closely link to already planned/ongoing

activities, specifically through GEF funding and will compliment the activities that were undertaken in context of the World Summit for Sustainable Development (WSSD).

4.5.5. Awareness Raising and Partnerships

To develop necessary mechanisms to enhance and activate public participation of CBOs, NGOs, private sector and local communities in all phases of implementation of the SNAP, with specially on the involvement of women, youth and administraters in the bottom-up approach.

4.5.6. Priority Projects Areas

- Promotion environmental awareness among all parties at different levels.
- Promotion and rational management of rural water sources through proper distribution of water points, (hafirs) and boreholes.
- Increasing the storage capacity of ground water through the construction of dams, terraces, and water harvesting techniques.
- Compilation of information and data on natural resources surveying, land use mapping and establishing information bank.
- Improvement and rehabilitation of degraded rangelands through reseeding, nurseries, enclosures, and rehabilitation of vegetation cover especially in the marginal areas between latitudes 10^{o} and 18^{o} N.
- Development of forest cover and afforestation through dune fixation, shelterbelts, community forests, enclosures and greening of public utilities and rehabilitation of gum Arabic belt.
- Concentration on vertical expansion of agricultural production to decrease pressure on natural resources through integrated research programmes.
- Capacity building, training and scientific research to support sectoral institutions, academic, NGOs, public organizations, trade unions and land committees in all affected local communities.
- Protection of the Nile basin and its tributaries against gullying and sand encroachment.

- Promote and enhance poverty alleviation programmes through encouraging alternative livelihoods, and enhancing the use of traditional and intermediate technologies and rural industries.

- Establishing group solutions for local communities in marketing and fund mobilization.
- Strengthening and activating policies and legislation and their executing mechanisms to protect the environment and natural resources.

- Conservation and development of wild life through enhancing care of the national reserves and establishment of new reserves and forest areas to protect the wild life and tourist villages with cooperation and coordination of respective authorities.

- Development and provision of energy alternatives and optimizing energy use through use of biogas, solar and wind energy and utilizing of agricultural residues, molasses blocks, electricity and expanding use of improved stoves.

- Preparation of comprehensive plans for drought preparedness, relief management in drought periods, self-preparation in the affected and prone areas, and ready programmes to receive refugees and displaced.

- Establishment or creation of benchmarks and indicators to monitor the progress in combating desertification.

- Establishment of early warning system to monitor and enhance the preparations for the drought spans.

- Establishment of an endorsed roster of experts to the UNCCD secretariat to be used when appropriate.

4.6. Traditional Knowledge

As far as traditional knowledge is concerned, the SNAP strategic orientations has been based on the findings of the present situation and analyses with the following characteristics:

- The high importance of traditional knowledge and practices creates the need to apprehend and use traditional knowledge and practices in the field of desertification.

- The coordination with local communities in the reproduction of traditional knowledge and its sustainability.
- Traditional knowledge and practices cover all aspects of human life and activities.
- Inspite of their importance, traditional knowledge and practices are neither written nor referenced and sometimes too difficult to access.

4.7. Research on Desertification in Sudan

Recently, in February 2005, a committee of nine national experts chaired by the manager of UNESCO Chair of Desertification Studies, affiliated to the University of Khartoum, was mandated to put a plan of research for desertification in Sudan. After seven meetings and many deliberations the committee was finally able to draft a plan of research for clusters of similar states. The research efforts and management are to be coordinated at the national level. The principles and approach adopted towards formulating the plan were based upon UNCCD Articles relevant to preparation of the SNAP. Among the main features of the desertification research plan are the following:

- Review and documentation of relevant previous work.
- Imperativeness of database for identification of gaps.
- National, regional and international institutional linkages are vital.
- Making use of the NCS and the 25-year Strategy documents (irrespective of their status of approval).
- Research should consider sustainable development.
- Emphasis should be put on efficient exploitation of fish resources.
- Change in underground water needs to be examined.
- It should be noted that Khartoum State is the only State in Sudan that is blessed with three rivers.
- Salinity as one of the prominent problems of the State's soils and should have been given some emphasis in the paper.
- Soil management, shelterbelts, water harvesting.
- Legislation is important in many aspects especially land use and tenure.
- Adoption of ecosystem approach.
- Sticking to UNESCO's classification of the ecological zones.
- Standardization of methodology used in development of the plan.
- The Plan formulated has to encompass all the states of the country.
- A separate a plan for each individual state might be difficult; clustering of similar states is more reasonable.

- Distinction has to be made between sand movement (creep) and desertification.
- Evaluation of traditional irrigation systems is important.
- Sand encroachment and salt-affected soils are identified as areas of research.
- Gully erosion (Haddam) needs further investigation.
- Sud Merwi or Hamadab impacts on environment should be connected with the research.
- The environmental impacts of Sud Merwi on Hod El Silaim need to be evaluated.
- Identifying three separate environments in the northern states of the country:
  - Nuba Lake;
  - Oases; and
  - Wadies.

References

Andrews, F.W, (1950-1960) The Flowering of the Anglo-Egyptian Sudan, Vol. 1 (1950). Vol. II (1952) Vol. III (1956), Buncle, Arboath

Babiker, I.A. el Mustafa, M.A. Salih E.M. (1992) Desertification Assessment and Mapping Methodology in Sudan (NDDU).

Badi, Kamal Hassan (1999). Protection against fire in the low rainfall savanna region of the Sudan, Sudan Silva No. 28 Vol. III, 1999, Khartoum.

DANIDA (1989) Environmental Profile, the Sudan Department of International Cooperation, Ministry of Foreign Affairs, Copenhagen, Denmark.

Department of Statistics, Census Office (1995) Sudan Fourth Population Census 1993, Final tabulations, Sudan – Northern States. Vol. I Demographic Characteristics.

Desert Encroachment Control and Rehabilitation Program (DECARP), (1976).

Elamin, H.M. (1990) Trees and Shrubs of the Sudan, Ithaca Press, Extrer.

El-Khalifa, M.D. and H.O. Abel Nour (Eds). (1991): Republic of Sudan National Report. United Nations Conference on Environment and Development, Brazil

FAO, FNC (1995): FAO and Forestry Corporation Study (1995), Khartoum, Sudan.

FNC (1995). Forest Products Consumption Survey in the Sudan, Summary of findings, FNC, Khartoum.

FNC (2001). The Forests of the Sudan in hundred years, 1902-2002, FNC and the Arab Organization for Agricultural Development, Khartoum (in Arabic).

Fourth Population Census of Sudan 1993: Final Tabulation, Vol. I, Central Bureau of Statistics Khartoum, 1995.

Guidelines of the National Plan for Combating Drought and Desertification (NDDU) 1991.

Harrison. N.M. and J.K. Jackson (1958) Ecological Classification of the Vegetation of the Sudan. Forest Department, Bull. No. 2, New Series – Khartoum.

Hillman, J.C. (1985). Wildlife Research in the Sudan in relation to Conservation and Management Seminar on Wildlife conservation and

management in the Sudan. In: Dieter E. (Ed), Wildlife conservation Forces and the German Agency for Technical Cooperation (GTZ) Khartoum, Sudan.

Ibrahim, F.N. (1984) Ecological Imbalance in the Republic of the Sudan with Reference to Desertification in Darfur, El Fashir.

Ministry of Agriculture, (1985) Proposed National Plan for Combating Drought Effects and Desertification, Khartoum, Sudan.

Mudawi, Abdel Wahab Ali, and Siddig, Kamal El Hag (1995) Population Distribution in the Sudan. Fourth Population Census of Sudan Advance Census Results, 1993, Central Bureau of Statistics, Khartoum, Sudan.

NDDCU (1985). Proposed National Plan for Combating Drought Effects and Desertification (1985).

NDDCU (1993). Sudan Five Year Program for INCD (1993).

NDDCU (1993). Sudan National Case Study on Drought and Desertification for (INCD), 1993.

NDDCU (1994). Technical Notes on Maps and database.

Ramsis, H. Salama (1976) Ground Water Resources of Sudan, Rural Water Corporation Report.

Salih, E.M. (1995) The Geographical Extent of Desertification in the Sudan.

Stebbing, E,P. (1932). The Creeping Desert in the Sudan and Elsewhere in Africa between 13˚ & 15˚latitudes, Forest Department Khartoum.

Sudan National Comprehensive Strategy (SNCS) 1992-2002: Sudan National Comprehensive Strategy 1 Section 14 page 101.

Tolba, M.K. and O.A. ElKholy (Eds.) 1992. The world Environment (1972-1992) UNEP.

UN Convention to Combat Desertification in Those Countries Experiencing Drought and/or Desertification Particularly in Africa, 1997.

UNDP 1992: A report of Integrated Rural Development in Sudan.

UNICEF 1996: Situation Analysis of Children and Women in the Sudan, Khartoum, UNICEF Head Office.

UNSO 1979: Assessment of the Problem of Desertification in Sudan.

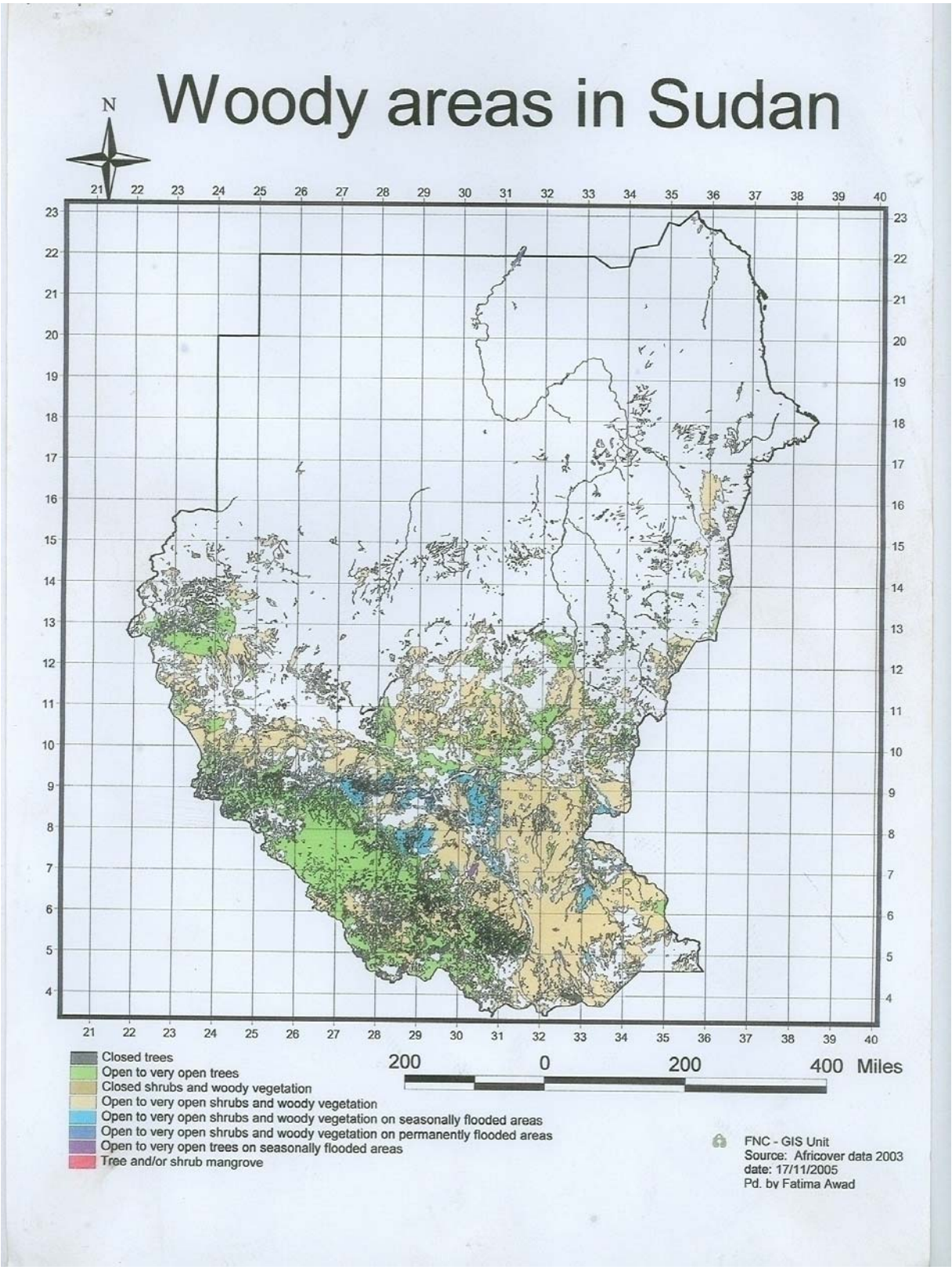
World Bank (1986). Sudan Forest Sector Review. The World Bank, Washington.

World Resources Institute UNEP/UNDP 1994, People and Environment. Oxford University Press.

World Bank Operational Manual (1994), Operational Directive OD 4.02 Environmental Action Plan Annex a World Bank Publications.

المراجع باللغة العربية

- الإتفاقية الدولية A/AC/241/27 1994.
- المنظمة العربية للتنمية الزراعية/ البرنامج الوطني لمكافحة التصحر في جمهورية السودان/ الخرطوم / أبريل (نيسان) 2002.
- جعفر كرار وآخرون/ نحو خطة قومية للعمل البيئي في السودان، المجلس الأعلى للبيئة والموارد الطبيعية، لجمعية السودانية لحماية البيئة بالتعاون مع منظمة فريدريش أيبرت الألمانية 1996.
- يعقوب عبد الله ونادر محمد عوض: البيئة الحضارية، ورشة عمل الإرتقاء بالبيئة الحضرية، المجلس القومي للسكان 1995م


Woody areas in Sudan
N
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4
Closed trees
Open to very open trees
Closed shrubs and woody vegetation
Open to very open shrubs and woody vegetation
Open to very open shrubs and woody vegetation on seasonally flooded areas
Open to very open shrubs and woody vegetation on permanently flooded areas
Open to very open trees on seasonally flooded areas
Tree and/or shrub mangrove
200 0 200 400 Miles
FNC - GIS Unit
Source: Africover data 2003
date: 17/11/2005
Pd. by Fatima Awad

Annex No.2
Selected States Pilot Projects
Annex No. 2 – (1)

State: Red Sea

Locality: Olib

Objectives	Activities	Participation			Expected output	Indicators for output assessment
		Gov	Com	Oth		
▪ Combat desertification and mitigate drought effects. ▪ Establish effective water management. ▪ Provide adequate food production. ▪ Rehabilitation of natural resources. ▪ Ensure community participation in sustainable development. ▪ Provide technical training in environment management. ▪ Use of intermediate technology to establish reliable land use. ▪ Control gully erosion.	▪ Management of grazing areas. ▪ Collection of seasonal seeds of grasses, shrubs, and trees. ▪ Provision of needed spp. ▪ Certified seeds quality. ▪ Irrigation management. ▪ Moisture regulation. ▪ Seed propagation. ▪ Water storage. ▪ Nurseries.	X	X	X	• Cultivation of an area of 5900 feddans with sorghum and vegetables. • Rehabilitation of forests in 43600 feddans. • Improvement of range and pasture in 80220 feddans area.	• The quantity of seeds collected. • The managed irrigable areas in feddans. • Establishment of nurseries. • The quantity of stored water. • Cultivated areas in feddans. • Forest stand area. • Improved range and appearance of palatable spp. • Number of trained people and degree of community participation.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (2)

State: Gezira

Locality: Abu Quta

Objectives	Activities	Participation			Expected outputs	Indicators for output assessment
		Gov	Com	Oth		
• Environmental awareness raising • Wind breaks establishment • Increase of natural pasture and vegetative cover. • Establishment of community forests • Sand dunes fixation	• Environmental awareness campaign. • Planting shelterbelts and community forests. • Terass cultivation, water-harvesting techniques by ridges and furrows. • Increase of rangelands. • Use of alternative energy. • Sand dune fixation. • Training of staff and community members.	X	X	X	• Training of 36 of technicians in combating desertification. • Training of 90 persons from local communities on desertification control techniques.	• Increase of vegetation cover area. • Extent of alternative energy using. • Situation of vegetation cover in water spreading areas. • Increase of grass and range land cover in area wise. • Sand dunes fixed. • Number of trained people, CBOs leaders and technicians.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (3)

State: Northern
Locality: Eddebba

Objectives	Activities	Participation			Expected outputs	Indicators for output assessment
		Gov	Com	Oth		
• Soil conservation in the proposed project. • Village tree planting. • Training.	• Handcrafts establishment. • Community awareness. • Staff training and CBOs training at the village level. • Nursery establishment. • Planting shelterbelts and wind breaks length of 40 km.	X	X	X	Shelterbelts and windbreaks. Improved soil management. Training and community awareness.	• Number of nurseries, distributed seedlings and shelterbelts established. • Number of trees planted in the villages. • Degree of soil stability. • Extend of community participation and awareness. • Number of trained people.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (4)

State: Gedarif
Locality: Subagh

Objectives	Activities	Participation			Expected output	Indicators for output assessment
		Gov	Com	Oth		
• Combating and stopping desertification. • Rehabilitation of vegetation cover. • Increase of palatable species for animal feed. • Control of animal routes of movements. • Enlighten the pastorals in the field of soil conservation as pets and vegetation cover.	• Rehabilitation of pasture and tree cover. • Seed production and distribution in an area of 500 feddans.	X	X	X	• Increased vegetation cover. • Increased good rangeland. • Smooth animal passage corridor (Roots). • Sand dunes fixation.	• Vegetation cover situation. • Appearance of palatable species. • Number of trained people and degree of community participation. • Measurement of soil erodibility before and after

Gov = Government Com = Community Oth = Others

Annex No. 2 – (5)

State: Khartoum
Locality: Wadi el Mugaddam

Objectives	Activities	Participation			Expected output	Indicators for output assessment
		Gov	Com	Oth		
• Cropping of 30 feddans in Bohat area with vegetables and winter pulses. • Planting social forests and rehabilitation of rangeland in Funga area. • Cropping of fodder and winter pulses in Ziraiab area. • Planting social forest in Warat el Bagar area. • Increase rangelands in Wadi Abu Ushar. • Increase rangelands in Mahmeila	• Digging boreholes in Bohat village. • Installation of the well in Funga el Zariab and Warat el Bagar. • Rehabilitation of earth dam in Abu Ushar. • Establishment of earth dam on Medaisees wadi.	X	X	X	• Cropping of 30 feddans in Bohat area with vegetables and winter pulses. • Establishment of socisl forests. • Cropping of 20 feddans in Funga area with vegetables and winter pulses. • Cropping of 30 feddans in Ziraiab area with vegetables and winter pulses. • Cropping of 10 feddans in Warat el Bagar area with vegetables and winter pulses. • 500 Feddans natural rangelands and forests in Wadi Abu Ushar. • 300 Feddans natural rangelands in Mehaimeela.	• Cropped areas and number of established social forests in each location. • Area of reserved rangeland. • Number of established or rehabilitated earth dams. • Extent of community participation.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (6)

State: Sennar
Locality: Singa Rural Area

Objectives	Activities	Participation			Expected output	Indicators for output assessment
		Gov	Com	Oth		
• Increase environmental awareness. • Find new alternative methods of livelihood. • Improve potable water. • Link the people with their environment. • Conservation and rehabilitation of vegetation cover. • Stop migration and increase animal production. • Provide education and health services and training on handicraft production in addition to women education and removing illiteracy.	• Seed distribution of range plants. • Establishment of nurseries. • Establishment of experimental farms. • Boreholes maintenance.	X	X	X	• Boreholes maintenance. • Upgrading of range areas by seed distribution. • Establishment of the nursery and the farm. • Establishment of the training and extension cntre.	• Number of maintained boreholes. • Quality and quantity of rangelands • Number of trained people and degree of community participation. • Number of established nurseries and distributed seedlings.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (7)

State: Northern darfur

Locality: Dar Assalam

Objectives	Activities	Participation			Expected output	Indicators for output assessment
		Gov	Com	Oth		
• Mitigate the effect of drought, desertification control and poverty alleviation. • Upgrading of pasture. • Training in the field of combating desertification. • Encouraging of community participation and cpacity building. • Encourage clay soil cultivation instead of Qoz lands. • Elight the negative impacts of the arbitrary allocation of water points. • Link people with their environment for sustainable development.	• Rehabilitation of tree cover. • Water harvesting techniques. • Training on optimizing the available biomass. • Focus on planting indigenous quick maturing species to combat desertification.	X	X	X	• Rehabilitation of vegetation cover. • Establishment of shelterbelts and windbreaks around the villages. • Cultivation of Wadis. • Introduction of mixed cultivation. • Introduction of solar energy as an alternative energy.	• Extent and success of hashab and millet in Qoz soils. • Number of seedlings planted around villages. • Evaluation of earth dams experience for water harvesting. • Increase of per capita income. • Extend of vegetation cover and success of quick maturing varieties. • Number of trained people and degree of community participation.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (8)

State: Northern Kordofan
Locality: Lagawa

Objectives	Activities	Participation			Expected outputs	Indicators for output assessment
		Gov	Com	Oth		
• Rehabilitation of vegetation cover by using water harvesting techniques. • Introduction and making of improved stoves. • Encourage the community participation.	• Production of seedlings. • Training water harvesting techniques. • Establishment and production of improved stoves • Extension and awareness campaigns.	X	X	X	• Production of 250 000 seedling of some indigenous species. • Establishment of 100 feddans reserves. • Training of 50 persons in environmental awareness. • Training of 100 persons in making improved stoves. • 3X3 m wood lots in 5 villages.	• Improvement of soil moisture. • Extent of vegetation cover. • Quality and quantity of produced stoves. • Number of trained persons and CBOs leaders.

Gov = Government Com = Community Oth = Others

Annex No. 2 (9)

State: Western Darfur
Locality: Kerainik

Objectives	Activities	Participation			Expected outputs	Indicators for output assessment
		Gov	Com	Oth		
• Rehabilitation of forestry and refugees nurseries in Genaina. • Rehabilitation of *Acacia enegal* belts. • Introducing of *Acacia enegal* belts in sandy areas. • Training in nurseries administration and execution of agricultural programmes. • Natural resources rational use.	• Survey the affected farms. • Rehabilitation of forestry nurseries. • Seedlings production. • Training workshops.	X	X	X	• Production of 300 000 *Acacia enegal* seedlings. • Planting of seedlings. • Increase environmental awareness. • Training of 150 producers on seedling preparation, planting and nursing.	• Increased forest cover. • Gum Arabic belt rehabilitated area. • Number of established nurseries and seedlings produced. • Degree of community participation and awareness and number of trained people. • Extent and success of Hashab tree in Qoz soils.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (10)

State: Western Kordofan
Locality: Khuai – Wad Banda

Objectives	Activities	Participation			Expected outputs	Indicators for output assessment
		Gov	Com	Oth		
• Soil conservation. • Rehabilitation of gum Arabic belts. • Development of stoves. • Production of water melon seeds. • Rehabilitation of animal herds.	• Rehabilitation of gum Arabic belts. • Increased of desert sheep number. • Development of storage facilities. • Production of water melon in Qoz soils.	X	X	X	• Rehabilitation of 250 000 feddans of gum Arabic belt.	• Degree of increased vegetation covers and rangelands. • Developed storage facilities and introduction of new techniques and number of water points provided. • Conserved soils and erodability. • Extent of rehabilitation of gum Arabic belt. • Extent of sand dunes.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (11)

State: Kassala
Locality: Kassala Rural Area

Objectives	Activities	Participation			Expected outputs	Indicators for output assessment
		Gov	Com	Oth		
• To apply agricultural production. • Use of teras cultivation to increase production. • Increase relative humidity of dry soils by water harvesting. • Increase community participation. • Use of crop residues for animal feed. • Control gully and sheet erosion. • Planting shade trees. • Enhancement of community income. • Training.	• Land preparation. • Teras construction. • Use of crop residues for animal feed. • Control gully and sheet erosion. • Increased of desert sheep number. • Development of storage facilities. • Planting shade trees. • Training.	X	X	X	• A 10 000 m^3 teras. • Measuring soil moisture after each rain shower. • Planting 1000 feddans cultivated by water harvesting. • Increase of production from 2 to 4 sack/feddan.	• Evaluating the effectiveness of dams in increasing soil moisture. • Productivity can be measured by sacks/feddan • Conserved soils and erodability. • Extent of community participation.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (12)

State: White Nile
Locality: Giuly

Objectives	Activities	Participation			Expected output	Indicators for output assessment
		Gov	Com	Oth		
• Establishment of nurseries. • Establishment of windbreaks around the villages to stop sand dunes movement. • Staff and CBOs training. • Protection of villages and agricultural lands against sand movements. • Enhancing capacity building among rural people and technicians.	• Reserved areas. • Preservation of 50 feddans in Surait area. • Sand dunes fixation around four villages. • Training of technicians.	X	X	X	• Fencing 50 feddans as reserved area. • Sand fixation in 4 feddans area. • Planting 2000 seedlings in each farm.	• Sand dunes fixation. • Increased awareness and number of trained people. • Preserved areas size and fenced areas. • Increase vegetation cover. • Number of successful seedlings by each farmer. • Number of trained people and degree of community participation.

Gov = Government Com = Community Oth = Others

Annex No. 2 – (13)

State: River Nile
Locality: Berber

Objectives	Activities	Participation			Expected output	Indicators for output assessment
		Gov	Com	Oth		
• Combating desertification and protection of the irrigation pumps. • To avail farmers required equipment. • Trees over-cutting alleviation. • To avail shadow and fodders. • To avail the right environment for agricultural crops and increasing the agricultural production. • To protect Alebaidiya villages.	• Planting of multiple-benefits trees on a 15km^2 area.	X	X	X	• Planting 6000 seedlings on an area of 15 km^2.	• Number of nurseries established. • Number of seedlings produced by farmers trained people. • Windbreaks and shelterbelts established. • Increase vegetation cover. • Sand dunes fixation.

Gov = Government Com = Community Oth = Others

Annex No. 3

Names and Specialization of the Taskforce team

No.	Name	Specialization	Status
1.	Prof. Ibrahim Ahmed Babiker	Soil Scientist	Team Leader
2.	Prof. Mukhtar Ahmed Mustafa	Soil Scientist	Member
3.	Dr. El Tigani M. Salih	Soil Scientist	Member
4.	Dr. Mahgoub Zaroug	Pasture Specialist	Member
5.	Mr. Mohamed Fadl el Mula	Pasture Specialist	Member
6.	Mr. Adil Mohamed Ali	Community/NGOs	Member
7.	Mr. Yousif Yaagoub	Remote Sensing Specialist	Member
8.	Mr. El Tayeb A. Abdalla	Forestry	Member
9.	Mr. Kamil Osman M. El Hag	Environmentalist/ National Project Coordinator	Member
10.	Ms. Fathia Salih Mousa	Environmentalist/ Socioeconomist	Member

Annex No. 4

The Committee to review and prepare the NAP

No.	Name	Status
1.	Mr. Abd El Gabbar Hussein	**Supervisor**
2.	Mr. Salahaddeen Abdalla Alebaid	Team Leader
3.	Prof. Mukhtar Ahmed Mustafa	Member
4.	Prof. Ibrahim Ahmed Babiker	Member
5.	Dr. Gaafar Karrar Fadul	Member
6.	Dr. Nadir Mohamed Awad	Member
7.	Dr. El Tigani Mohamed Salih	Member
8.	Dr. Mutasim Basheer Nimir	Member
9.	Dr. Ahmed Suliman El Wakeel	Member
10.	Dr. Izzat Mirgani Taha	Member
11.	Ms. Fathia Salih Mousa	Member
12.	Mr. Adil Mohamed Ali	Member
13.	Mr. Malik Abu Sin	Member
14.	Mr. Kamal hassan Badi	Member
15.	Ms. Fatima Shoeib	Member

Annex No. 5

Funds allocated from the United Nations Agencies

No.	Agency	Amount in US$
1.	United Nations development Programme	60 000
2.	Office to Combat Desertification and Drought (UNSO) (UNDP)	160 000