Republic of the Sudan

Higher Council for Environment and Natural Resources
Wildlife Conservation General Adminstration (WCCGA)
UNDP/GEF Project SUD/98/G41 and SUD 00/014

Management Plan for Dinder National Park Sudan

Khartoum, 2004

Introduction

The history of conservation areas and national parks in Sudan has always been closely linked to the historical and political evolution of the country. Sudan is the largest country on the African continent. The area of the Sudan is 2.5 million square kilometers, the population totals 33 million, comprising 540 tribes and a number of sub-tribes that speak a total of 150 different languages. The war in Southern Sudan is the longest civil war in Africa, which is still continuing after more than five decades. Causes of the war in Southern Sudan are deeply rooted in the colonial policies of concentrating development projects in the north and discouraging the integration of the people of the North with the black tribes of the South. The civil war has spread since the 1980's from Southern Sudan to the Nuba Mountains, Blue Nile, Kassala and Dar Fur State.

The Civil war in Sudan can only be explained as conflict over the natural resources. When Africa was carved up by the colonial powers, cultural divides and ecosystems were not taken into account, the result of which still negatively impacts on Africa today. The Sudan that the British ruled was more like two separate countries. Issues of ethnicity are obvious as people of African origin dominate the southern, western and eastern Sudan and those of Arab origin are in the north and center. The civil strife is primarily due to conflicts over access to resources, power and governing structures (not necessarily at central government level) and fueled over the years by cultural differences, ethnicity and religion (Abu Sin and Takana, 2001). The Sudan also exhibits a diversity in soils and the water resources, mainly from the Nile, extends 2 258 km from the South to the North. Rainfall varies from 0 in the North to 1200 mm per annum in the South. The Sudan has a rich biodiversity and these variations in natural resources implied differences in economic potentials, leading to contrasting abilities to utilize resources which again further generated regional and hence ethnic inequalities and conflict.

The northern part is Sahara and has many ancient pyramids and cultural treasures, has trade centers such as Omdurman, Khartoum and Port Sudan and thus more wealth. The southern part is totally different comprising of black African tribes such as the Dinkas, Azandes and the Nuers; it has a tropical climate with rainfall above 800mm per annum and is poor and undeveloped. The British succeeded in maintaining a level of peace but governed the North and the South as two separate countries in developing the country, yet civil war erupted even before independence in 1956 and the north and the south are still at war today. The four million war refugees in Sudan are more than twice as many as compared to any other country in the world, and come mostly from the south. The 1993 population census revealed new social phenomena, with important social and gender implications, namely that about 25% of all households are female-headed.

The civil war resulted in the neglect of management and protection of conservation areas and national parks. Impact of the civil strife was not only restricted to the war area but triggered migration of people and livestock from Ethiopia, CAR, the DRC, Eriteria, Uganda and Chad to the northern parts of the country and thus increasing the pressure on the natural resources in the north.

A. Sudan Overview

A.1. Population

The 1993 population census puts the total population of the country at 25.59 million which, when projected, would give 29.59 million persons for 1999, and 31.34 millions for the year 2002 (El-Tayeb, 2002). The average annual rate of growth is about 2.7% but it varies regionally between 0.5% in the Red Sea State and over 4% in Khartoum State. Population changes in size and distribution are necessarily reflected in population densities. The overall population density in the Sudan increased from 4.1 persons per sq. km in 1956 to 5.6 persons in 1973, to 8.2 in 1983 and to 10.3 in 1993, and is estimated at 11.7 for the year 2002. Regional population densities show wide variations, ranging between 2.8 persons per sq. km in the Northern State and over 200 persons in Khartoum State (UNICEF 1999).

The population is predominantly rural, but urbanization is growing at a high rate. Total urban population grew from 9.7 million persons in 1996 to 10.3 millions in 1999. It is estimated at 11.1 million in 2002. The overall annual average growth rate of urban population is about 7%, while the growth rate of rural population is only about 1.4% per annum.

The sex ratio is generally balanced with an overall sex ratio of 102. At the state level it ranges from 91 to 115. The variations in sex ratios are essentially due to the sex ratio of migrants who are predominantly males. Thus the sex ratio tends to be low in the original (sending) areas of migrants like Kordofan and Darfur States as well as rural areas, and tends to be high in receiving areas (destination) like Khartoum State and urban regions in general. The age structure reveals that 16% of the population is under 5 year of age, 28% in the age group 5-14 years, 17% in the age group 15-24 years, 35% in the age group 25-59 years and only 4% aged 60 years and more. This young age structure of the population, which reflects a high fertility rate, is indicative of a high rate of dependency and a heavy demand on social services, especially health and education.

A.2 Economy

The Sudanese economy is heavily oriented towards agriculture and nomadism. The average contribution for the period 1985-95 of the various economic sectors to the gross domestic product (GDP), excluding petroleum, is as follows: agriculture including forestry, animal wealth and fishing is about 39%, commerce, finance and services 36%, industry and mining about 11%, transport and communication 6%, and construction about 6%. Biomass (fuel wood, charcoal and crop residues) is the major source of energy, especially in rural areas where the population over-exploits the tree cover. The contribution of the electricity and water sector is still negligible .The oil sector is expected to bear more heavily on the national economy. At this point in time it satisfies the local demand and exports about 200 000 barrels per day.

Agriculture is the main economic activity. It provides the government with over 50% of its revenues, employs about 80% of the total labour force, and contributes over 95% of the value of Sudanese exports excluding oil. Agriculture is essentially of a subsistence nature. Intensive, irrigated agriculture has been developed, mainly in central and eastern Sudan, to produce crops for both the domestic and foreign markets. The intensive

application of chemicals, particularly pesticides, to enhance productivity has polluted the soils and contaminated water in the irrigation canals. These polluted waters are sometimes used by people without treatment, as in the case of the Gezira scheme. Mechanized, large-scale rain-fed cultivation has witnessed substantial expansion since its inception in the 1960s at the expense of both traditional cultivation and grazing lands. This type of farming is confined to the rainier southern half of the country. Recent decrease and fluctuation of rainfall have increased the probability of crop failure. Most of the owners of mechanized schemes are absentee landlords residing mostly in urban centers outside the respective States.

Unlike the large scale and commercialized mechanized farming, traditional cultivation, practiced by most rural petty-producers all over the country, aims at the satisfaction of the household subsistence needs.

Sorghum and millet are the major grains and subsistence crops. The main commercial crops include cotton, groundnuts, sesame, wheat, gum Arabic, fruits and vegetables.

Animal raising comes next to crop production as an economic pursuit. Nomads whose movements with their herds follow the rainfall incidence and who constitute about 16% of Sudan's total population and owns approximately 80% of the aggregate animal wealth. Regionally, Kordofan and Darfur States house about 38% of all sheep, cattle and goats and about 60% of the camels. This sector has experienced rapid commercialization, transforming the animal from a social symbol to an economic asset. Thus the contribution of the animal sector to the GDP increased from 11.9% in 1990 to 19.2% in 1995 and to 21.7% in 1998. In addition to satisfying the local demand for animal products and providing raw materials for many industries, the animal sector is significantly and increasingly contributing to the export trade of the country, as indicated by Table 1. Its contribution to the national economy can be increased if the grazing, water, marketing and socio-economic problems encountered by livestock and pastoralists are effectively addressed.

The expansion of agriculture and subsequent squeezing of animals in smaller areas and less productive ecological zones have resulted in over-grazing and conflicts with other land users.

Table 1. Exports of Animal and Animal Products (USD million)

Item	1990	1992	1995	1998	Average 1990-98
Value of all national exports	374.0	319.2	557.0	595.7	481.8
Value of agricultural exports	340.0	249.3	451.5	433.4	361.4
Value of animal and animal products experts	43.4	66.6	118.9	170.8	124.9
Value of animal as % all experts	11.6	20.9	21.3	28.7	25.9
Value of animal as % of agriculture experts	12.8	26.7	26.3	39.4	34.6

Source: Computed from Bank of Sudan Annul Report, 1990-98 Khartoum.

The industrial sector is still in its infancy. Industries are generally light, emphasizing import-substitution of basic consumer goods and processing of local agricultural products. They are highly localized in urban centres, especially Khartoum State. Major industries include cane sugar, textiles, food processing, cement, flour mills, vegetable oil and soap, leather tanning and leather products, plastic and paper products, metallic and wooden products, electrical equipment, and others. Local industries suffer from competition of foreign manufactured goods, high cost of production, excess capacity, lack of spare parts, power cuts, and limited local market.

Despite the abundant and diverse natural resources,varied climate, flat and fertile land, water resources, minerals etc. Sudan is one of the least developed countries of the world.

The greater majority of the population is entangled in absolute poverty estimated at over 80% of the population (Nur, 1995) and at 90% by Ali (1994). The annual per capita income is about USD 320.

A.3 National Strategy and Policy

Central programming and socio-economic planning have been, since independence, the major mechanism to execute National policies. Plans up to 1976 emphasized a transformational approach whereby modern agriculture got most of the resources at the expense of the environment and the traditional sector upon which over 80% of the population depend. The main objective was to increase the national income. These plans sectionalized the total nature of the development process. Objectives such as the conservation of natural resources and the environment were beyond the conception of that policy (Mohammed, 2001). The six-year plan (1977-83) was the first to reflect a reasonable concern about natural resources and the environment by calling for soil conservation, forestation and natural resource protection. The National Economic Conference (1986) gave adequate consideration to a wide range of resource management, ecology and the environment. Its recommendations were reflected in the Recovery Programme (1988-92), which assigned priority to the twin objectives of sound environmental management and poverty alleviation.

The most recent policy document is the National Comprehensive Strategy NCS (1992-2002) covering all economic and social sectors and spheres. The NCS has shown serious concern for poverty alleviation and sustainable development which incorporate participation of the local communities and indigenous knowledge. The NCS includes the national environmental strategy whose policies and directives call for sustainable productivity of resources, adoption of environmentally and culturally appropriate technology, inclusion of environmental impact assessment in the project document whenever a project is likely to affect the environment, revision and updating of environmental legislation, provision of concession for environmentally friendly activities and the establishment of a national body, entrusted with the coordination and supervision of environmental activities in the States.

The Higher Council for Environment and Natural Resources (HCENR) was established in 1991 as the national environmental organ. Eventually each State would have its own council. The prime concern of the HCENR is the long-term protection of the environment and sustainable use of natural resources. To this end, the HCENR is to formulate general policies and plans, coordinate all national and State efforts in this

environmental context, recommend legislative improvement and updating, support environmental research and raise public environmental awareness.

The State Council for Environment and Natural Resources (SCENR) is accountable to the State government. Since most States have too meager financial resources to carry out their administrative and socio-economic functions and responsibilities, they tend to excessively use the natural resources in their respective States. This will seriously limit the effectiveness of the SCENR in environmental conservation.

The implementation of the NCS has been accompanied by the execution of the Structural Adjustment Program prescribed by international financial institutions, particularly the IBRD and IMF. This program includes economic liberalization, privatization of public enterprises, reduction of public expenditure and lifting of subsidies. These policy measures have worsened the already depressed standard of living conditions of the great majority of the population who would be forced by need to over-use natural resources.

Environmental legislations in the Sudan date back to the Colonial era, but they were and continued to be fragmented, sectoral, uncoordinated and mainly concerned with resource organization and use. Only after the Stockholm Conference (1972) and particularly after the Rio Conference (1992) did they become more concerned with the management of natural resources on a sustained basis. Legislations also began to incorporate international standards in national laws. Efforts to formulate an umbrella law harmonizing the over 140 laws, orders and regulations, culminated in the year 2000 in the promulgation of Sudan's **Environmental Act.** The Act, which is supported by provisions in the 1998 Constitution, sets environmental standards, obligates the incorporation of the environmental dimension in all socio-economic plans, as well as the preparation of an environmental impact assessment before the execution of any development project. Furthermore, the Act calls for protection/promotion of biodiversity, prohibition of pollution, popular participation and awareness raising.

Environmental legislation, though reasonably adequate, is of limited effectiveness because of institutional, financial and structural problems, conflicts between Federal and State governments and low level of general environmental and legal awareness, to mention only some causes.

A.4 Climate

A wholly tropical and a predominantly continental climate characterizes Sudan. Climatic zones range from the desert in the north to the wet monsoon in the extreme south (Table 2). The average annual rainfall increases from north to south, from 100 mm to over 1400 mm in amount and from a few days to eight months in duration (Fig. 1a). Rainfall is the critical climatic element in determining the length of the growing season. The mean maximum temperature in the coldest month ranges between 18^{o}C to 21^{o}C and hence the whole year can be regarded as a growing season, temperature-wise. The general climatic pattern is interrupted by the winter rainfall regime along the Red Sea coast and in its highlands.

The low elevation, the topicality and the continentality of the country have resulted in the fact that potential evapo-transpiration is higher than actual precipitation in most parts of the country at most times of the year (Fig 1b).

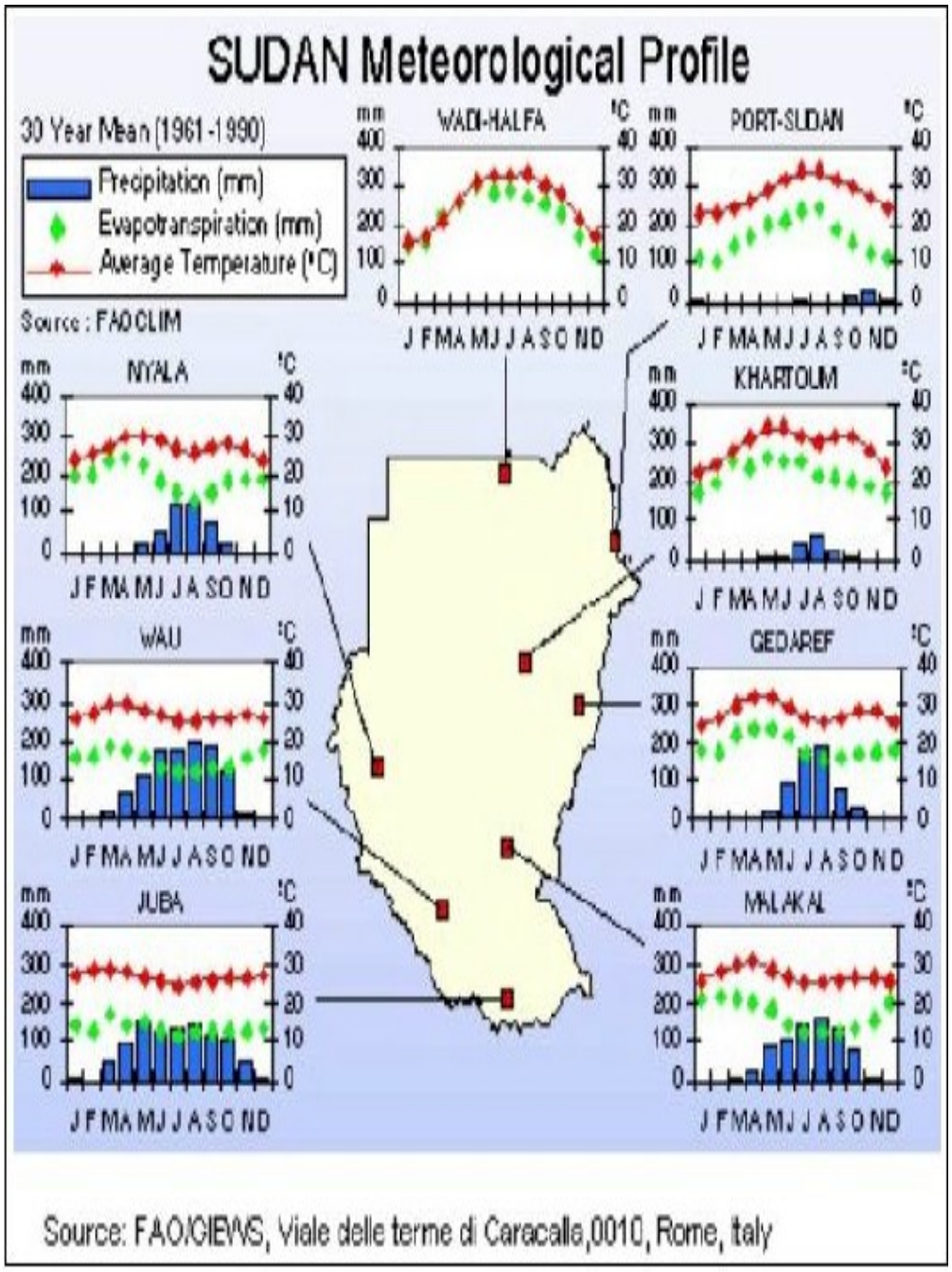


Fig 1b: Precipitation and evapotranspiration figures for Sudan.

Fig 1a: Mean annual rainfall(mm) of Sudan.

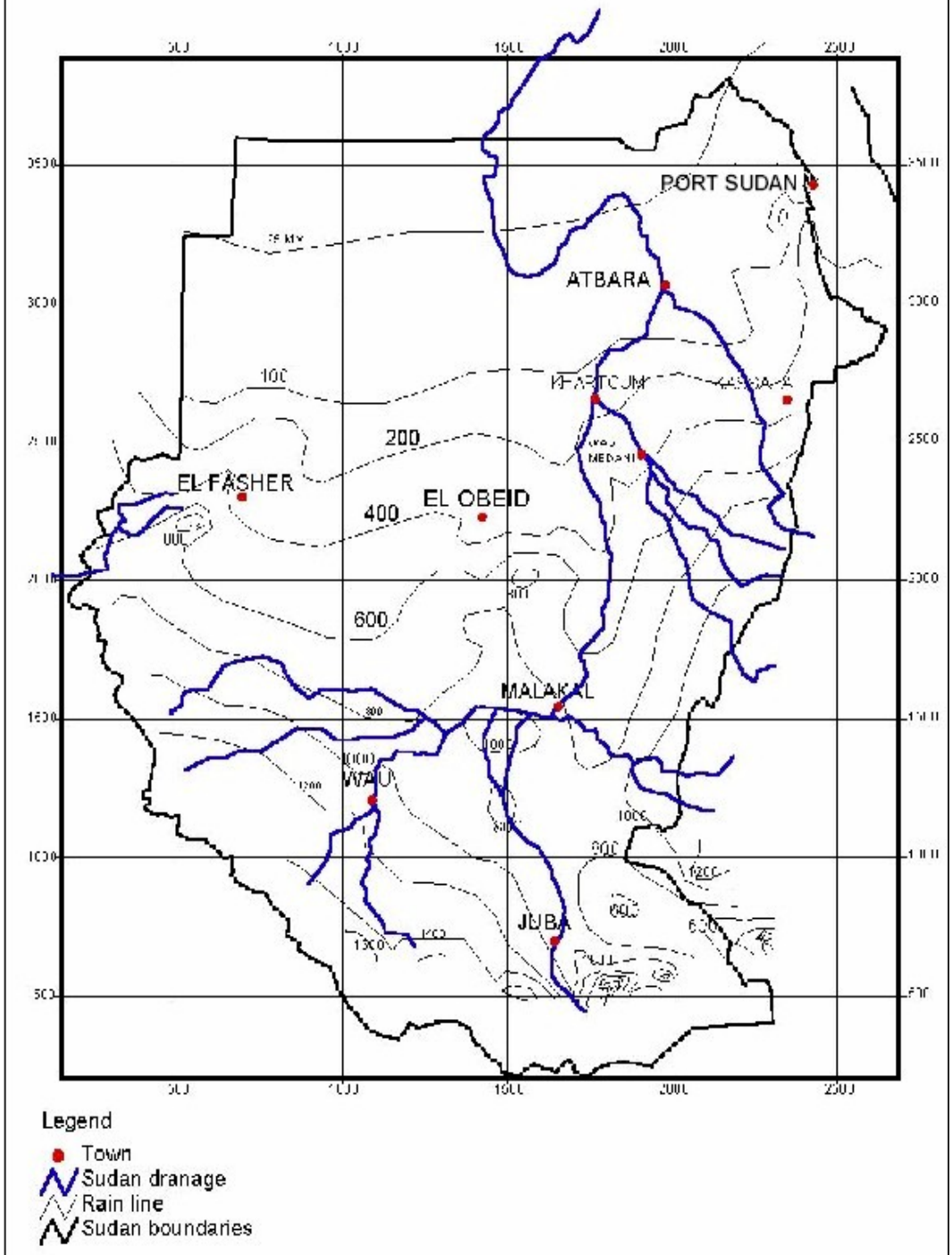


Table 2. Climatic Zones in the Sudan

Symbol	Description	Humid months	Growing season (month)	Average annual rainfall (mm)	Mean min-temp. (C°)	Mean max-temp (C°)
D.1.1	Desert, summer rain, warm winter	0	0	100	13-15	42-44
D.1.2	Desert, summer rain, cool winter	0	0	100	8-13	42-44
D2	Desert, winter rain	0	0	75	13-18	42-44
D 3.1	Semi-desert, summer rain, warm winter	0	0	100-225	13-16	40-42
D 3.2	Semi-desert, summer rain, cool winter	0	0	100-225	8-13	40-42
D 4	Semi-desert, winter rain	0	0	75-225	18-20	40-42
A 1.1	Arid, summer rain, warm winter	0	1-2	225-400	13-17	40-42
A 1.2	Arid, summer rain, cool winter	0	1-2	225-400	8-13	40-42
A2	Arid, winter rain	0	1-2	225-600	13-20	40-42
A3	Arid, no marked season	0	3-4	550-750	18-20	37-38
S 1.1	Semi arid, summer rain, warm winter	1	3	400-750	13-17	39-40
S 1.2	Semi arid, summer rain, cool winter	1-2	3	300-600	8-13	35-39
M 1.1	Dry monsoon long dry season, warm winter	3-5	5-7	750-1000	17-20	36-41
M 1.2	Dry monsoon long dry season, cool winter	3-4	5	600-850	5-13	38-39
M2	Dry monsoon, medium dry season	2-3	6-8	850-1000	18-21	36-68
M3	Wet monsoon, medium wet season	5-7	7-9	950-1400	10-12	34-39
M4	Wet monsoon, long wet season	7-8	10-11	1200-1600	14-19	34-35
1	Highland, short wet season, warm summer	3	5	600-1000	6-8	36-39
H2	Highland, medium wet season, cool winter	5-6	8-9	1000-1600	10-17	23-33

Source: ALIC and USMAB (1982), Environmental Profile of the Democratic Republic of Sudan, Washington.

A.5 Geomorphology

With an area of 2.5 million sq km, Sudan is the largest African and Arab country. It shares boundaries with nine countries and possesses a 750 km coastline on the Red Sea, but is not seaward oriented. The geology reflects two different structural zones. In the south and east 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 volcanism produced Jebal Marra. Volcanic lava occurs in many other areas . Subsequent geomorphic processes have resulted in the reduction and smoothing of relief, the deposition of sands and clays over extensive areas and the emergence of coral terraces as well as reefs along the Red Sea coast.

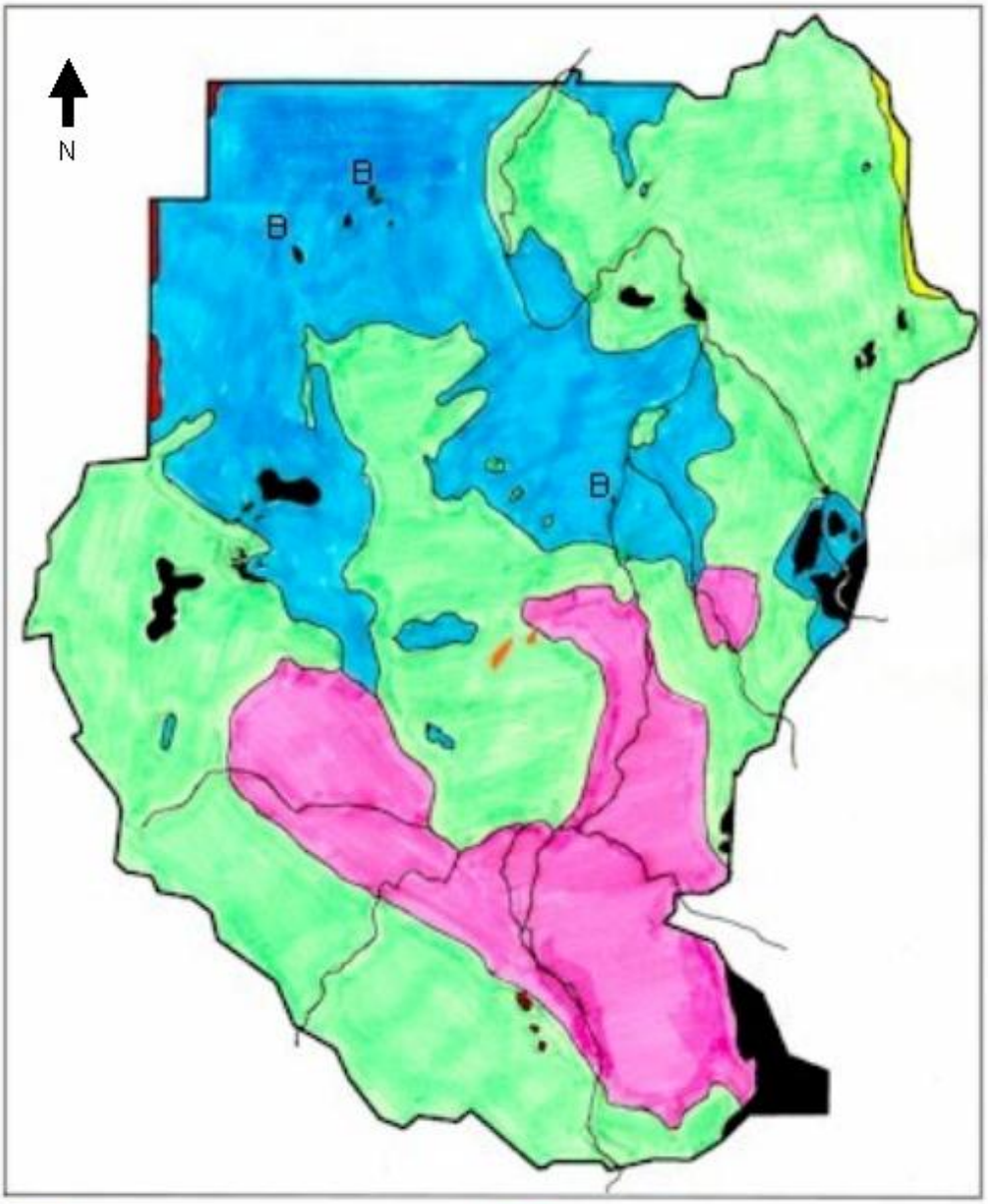


Figure 2a: The Geology of Sudan.

The geological structures and geomorphic processes have given rise to a topography, which is generally flat, with a gentle northward slope Fig 2a. This generally flat, low plain is dotted with a few highland areas, which mostly occupy its fringes. The major highland areas include the Jebal 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 (Fig.2).

In the absence of significantly high topographical features, the drainage pattern becomes dependent on the dominant types of soil or surface rocks. Sudan is characterized by the unity of almost all its drainage constituents into the Nile system. Except for the extreme south of the country, where rainfall is copious. There the perennial streams are fed by natural reservoirs located beyond the Sudanese boundaries, like the Blue and White Niles, Bahr el-Ghazal and Bahr el-Arab. 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.

Runoff is quite limited in the almost flat plains where surface water is generally lost through either gradual evaporation in the clay regions or percolation in the sandy plains. In the sloping and more deeply dissected area, where run-off is greater than in the plains, there is a thin layer of soil to retain water. A good portion of rainwater finds its way into the sandy watercourses and can be tapped by shallow wells all the year round. Nile basin subsidiary channels get filled when rivers overflow their banks, and water remains for most of the dry season. Further into the clay plain, hollows and chains of depressions also hold water for a considerable period of time (Barbour, 1964).

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).

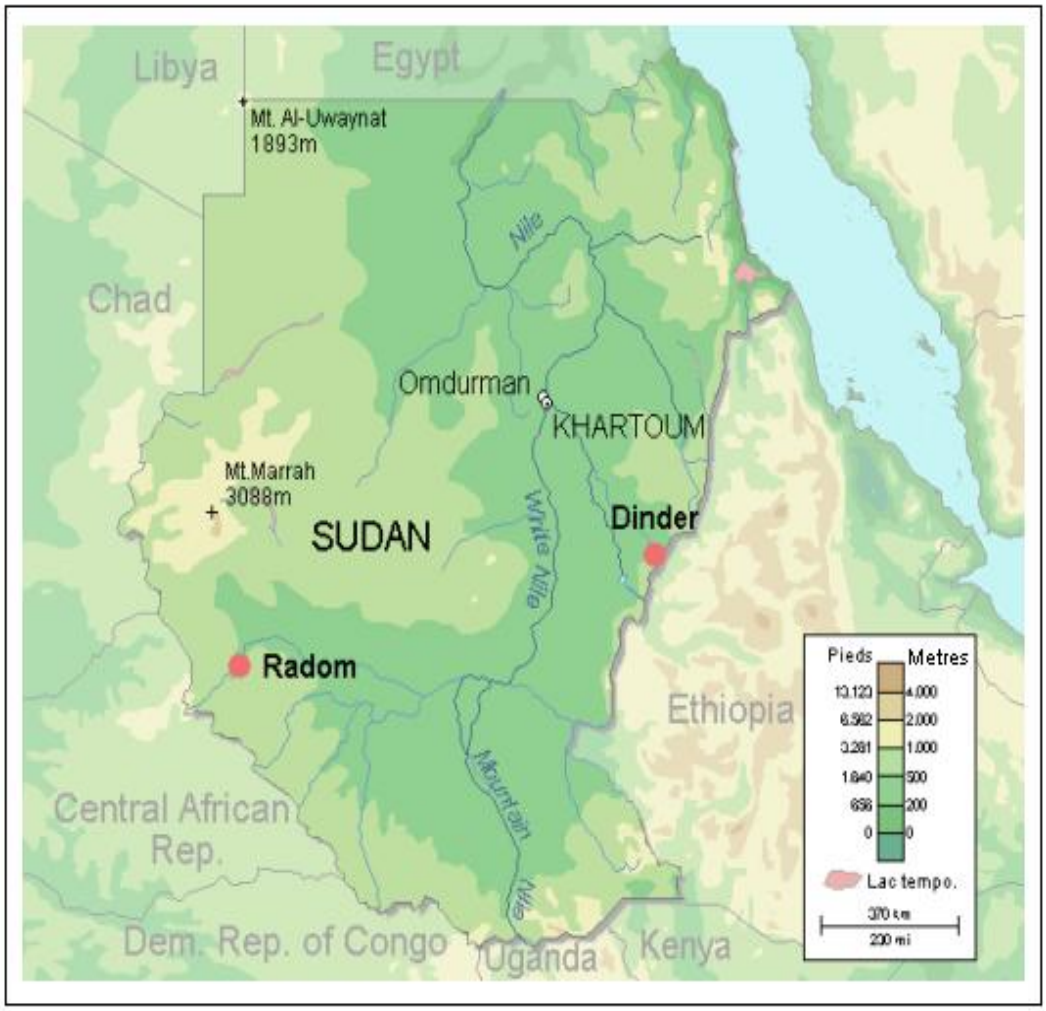


Figure 2: Relief forms of Sudan.

A.6: Soils

Although soils are a part of the hypsographic structure of the country, they are described here separately to emphasize their paramount significance as a medium through which man – nature interaction takes place.

Of the various soil classifications, the simple genetic one adopted by Barbour (1964) is adequate for the purpose of this section of the study. The major soil groups are as presented in (Fig. 3):

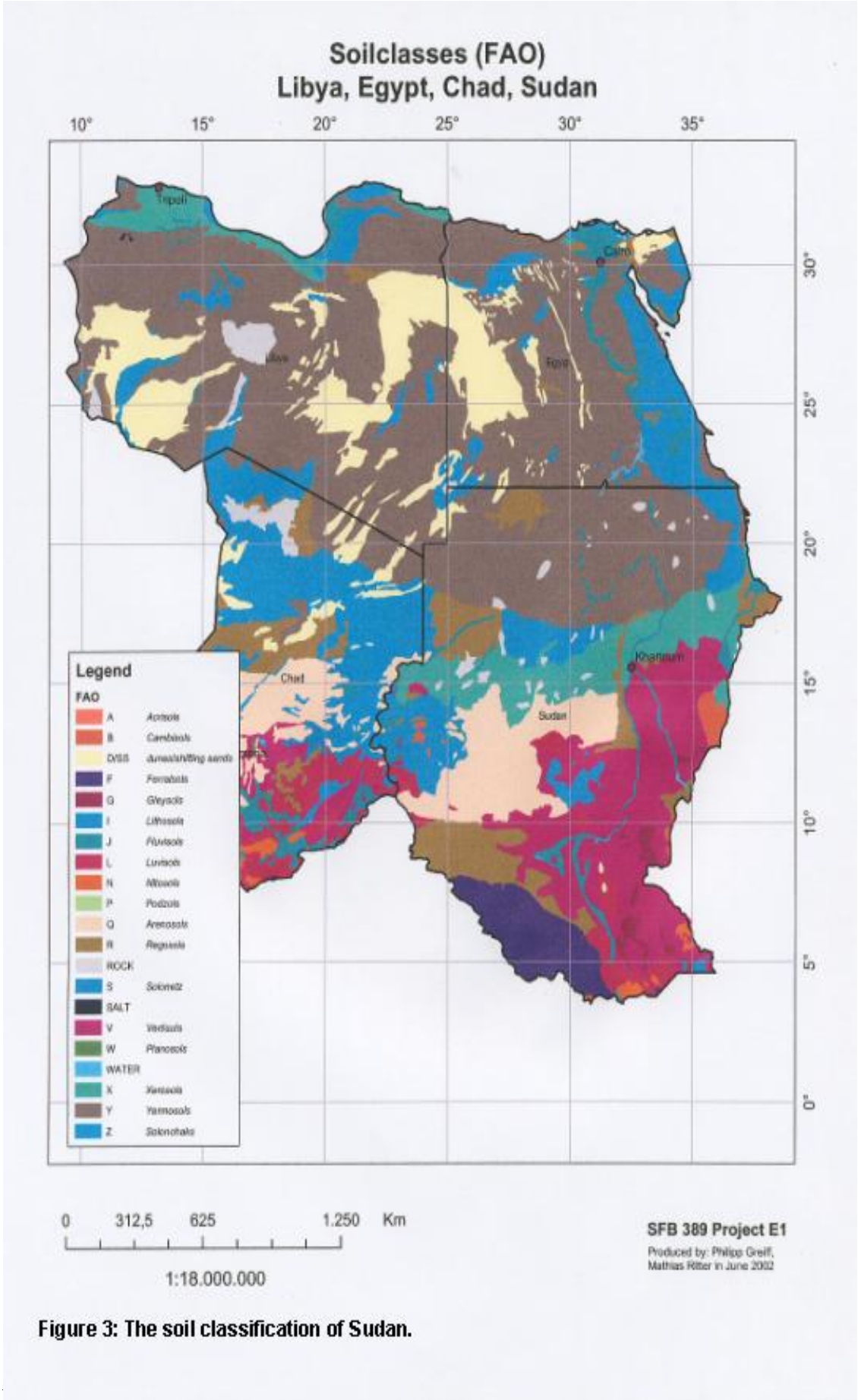


Figure 3: The soil classification of Sudan.

A.6.1. Desert Soils

These soils are extremely thin and lack humus. In the sandstone northwestern part of the county, the soils consist of sand dunes and level expanses of gravel. In the northeastern regions, which are dominated by the Basement Complex Formation and experience occasional rainstorms, bare rocky hills alternate with sandy streambeds, alluvial outwash fans and salty incrustation. In the absence of water, these soils are virtually of no economic use to human beings.

A.6.2 Semi-Arid Soils

These are formed in situ as a result of the breakdown of the local Basement Complex or basalt rocks. East of the Nile, e.g. the Butana and the Gedarif area, a number of hills stand above the plains and are covered by deep, dark cracking clays. They are well drained except in bottoms of depressions and watercourses. These are among the best soils of the Sudan.

In Jebel Marra and western Darfur, soils are transitional between the desert soils and the laterized soils. Between streams and khors are areas of thin, reddish sandy loams, liable to sheet erosion, while extensive clay flats occur beside the streams. The most fertile soils here are those volcanic soils brought down Jebel Marra and the silts covering the valleys. The presence of water enhances considerably their use value.

In the wet south, where annual rains approach 1000 mm, a grouping of soils (catena) occurs. These soil associations are generally found where there are marked differences of altitude, e.g. the Nuba Mountains and the extreme south – eastern parts of Sudan. The highest component of this grouping is the partly weathered rock on which scanty drought-resisting vegetation finds a foothold. Below this, spreads reddish, weakly alkaline detritus supporting hardy, thorny bushes. Further below is the fertile, brown soil. The two reddish soils are locally known as gardud.

A.6.3 Lateritic Soils

These soils predominate the southwestern part of Sudan, and are composed of a range of reddish loams. In the upper horizon, iron and magnesium have been removed by leaching, and are precipitated in the lower horizon, which rests on the parent Basement Complex rocks. Depending on conditions of relief, rainfall and parent rock three types can be distinguished:

- Red loam where rainfall is more than 1200 mm and difference in altitudes marked.
- Ironstone where rainfall is also over 1200 mm per annum, but difference in relief is smaller.
- Toich soils in low-lying areas with 1000-1200 mm annual rainfall.

The ironstone plateau is drained by a number of streams, which have built various flood plains.

A.6.4 Alluvial Soils

These are widespread in Sudan. In the desert, semi-arid and lateritic soil regions; alluvial soils cover limited areas as a result of local drainage. In the north, they are confined to the alluvial terraces adjoining the Main Nile, and in the east they cover the terraces of river Atbara and the inland deltas of the Gash and Baraka streams. In central Sudan, they occur in the terraces of the Blue and White Niles and their tributaries, the extensive Gezira plain and the area stretching from the Nuba Mountains up to the foothills of the Ethiopian plateau. In the south, these alluvial soils are more extensive.

These soils may be divided into those which are periodically flooded and those, which are mainly dry. The former include the sudd and toich soils, the cracking clay soils and the non-cracking loamy soil and sandy clay soils. The latter are very heterogeneous, ranging from heavy loam, with a high clay content, to very light sands with very low clay content.

A.6.5 Aeolian Soils

This group of soils does not include the vast desert active sand dunes, which are outside the range of cultivation and which show no mechanical or chemical effects of soil-water movements. Aeolian soils occur mainly in central Kordofan and eastern Darfur. They are derived from the disintegration of the Nubian sandstone and deposited by the trade winds as desert sands.

They are eventually stabilized by iron oxide or clay. The finest particles tend to be washed down into the hollows of the dunes to form a thin clayey crust, which supports some vegetation. The soils are highly permeable and of relatively low fertility.

A.7 Natural Vegetation

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 savannah in low and high rainfall areas to high savannah/semi-equatorial forests. The mountain types of vegetation are confined to limited, isolated sites (Fig.4).

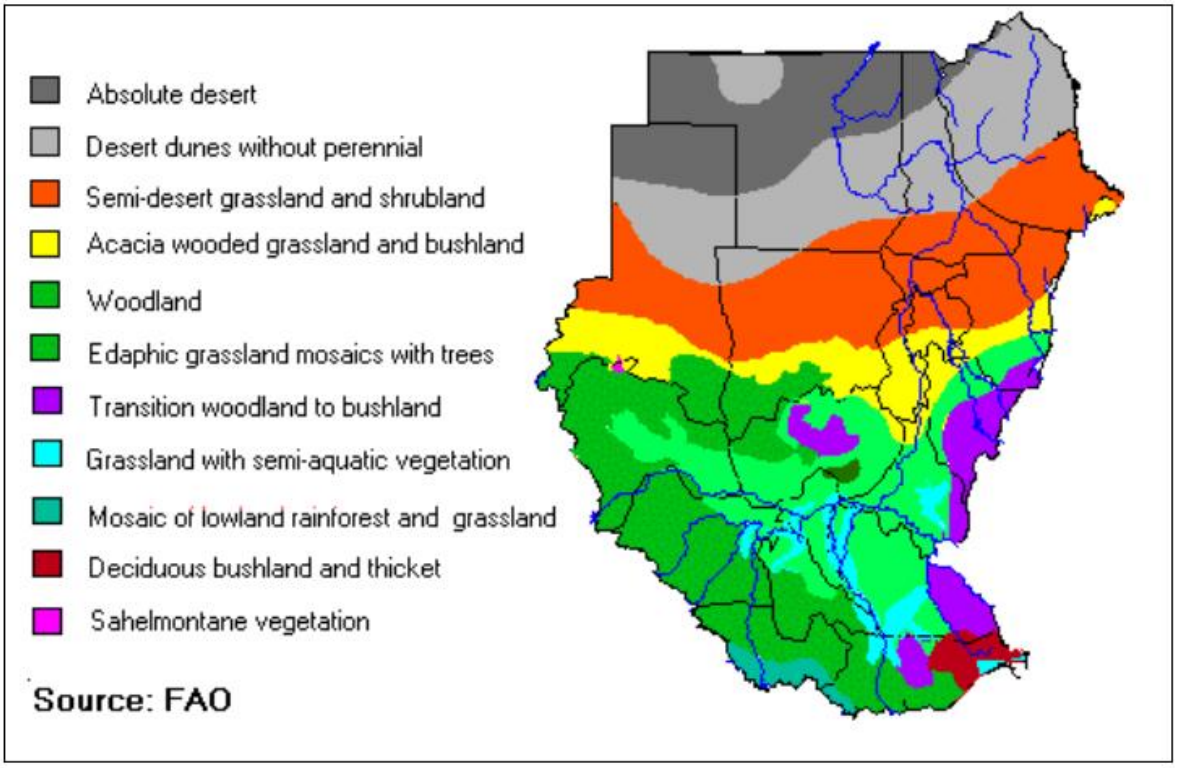


Figure 4: Vegetation map of Sudan.

A.7 Main Environmental Problems

Some of Sudan's environmental problems are general while others are localized. However, the main problems can be aggregated in the following:

A- Poverty as a state of human degradation

B- Desertification

C- General land degradation

D- Urban decay

E- Wildlife depletion and reduced biodiversity

F- Marine, coastal, soil, water and air pollution

G- Energy-related problems.

A.8 Sudan Wildlife

A.8.1 Resources and Laws

The wide variety of ecosystems and vegetation types in the Sudan is reflected in its fauna. Brocklehurst (1931) in his book titled: Game Animals of the Sudan their habitats and distribution provided useful information on the "game animals" at historic times. Setzer (1956) reported that 224 species and sub-species of mammals, other than bats, belonging to 91 genera, have been described in the Sudan. It is worth mentioning that out of the thirteen mammalian orders in Africa, twelve occur in the Sudan. Nimir (1983) produced a list of 52 major wildlife species and their distribution in Northern Sudan. Hillman (1991) produced a list of 83 major wildlife species and their distribution in 19 protected areas in the Sudan. Cave and Macdonald (1955) reported on the distribution of 871 species of birds in the Sudan. Nikolaus (1987) produced the distribution atlas of Sudan's birds with notes on habitat and status, which included information on 931 species. There is only limited information on amphibians, reptiles and insects in the Sudan.

The London Convention of 1933 was the beginning for establishing protected areas in the Sudan. Part III of the 1935 Wild Animals Ordinance enables the Minister of Interior to establish national parks, game reserves and game sanctuaries. Entry into national parks is restricted to holders of entry permits issued by the Minister of Interior or the Director of the Wildlife Administration. Hunting is prohibited in national parks and game sanctuaries and may be permitted in game reserves-only under the authority of a special permit, issued by the Director of the Wildlife Administration. Amendment of the laws introduced in 1969 prohibits residence, cultivation and pasturing of domestic animals in game reserves without the permission of the Director.

The 1939 National Parks, Sanctuaries and Reserves Regulations prohibit the use of firearms within the national park except in self defense, prohibits forestry, agriculture, mining and other activities involving the alteration or configuration of the soils or vegetation, except with the permission of the Minster and prohibits the introduction of any wild or domestic animal in the park. The Minster is empowered to make rules for the regulation of activities within each national park. With respect to game reserves, each reserve was established for certain species and other species could be hunted with appropriate hunting license.

Tables 3 to 7 respectively present the distribution of protected areas over the ecological zones of the Sudan. They also include lists of national parks, game sanctuaries, game reserves and proposed protected areas. Game reserves and national parks are shown on Fig.5.

A.8.2 Conservation Status in the Protected Areas

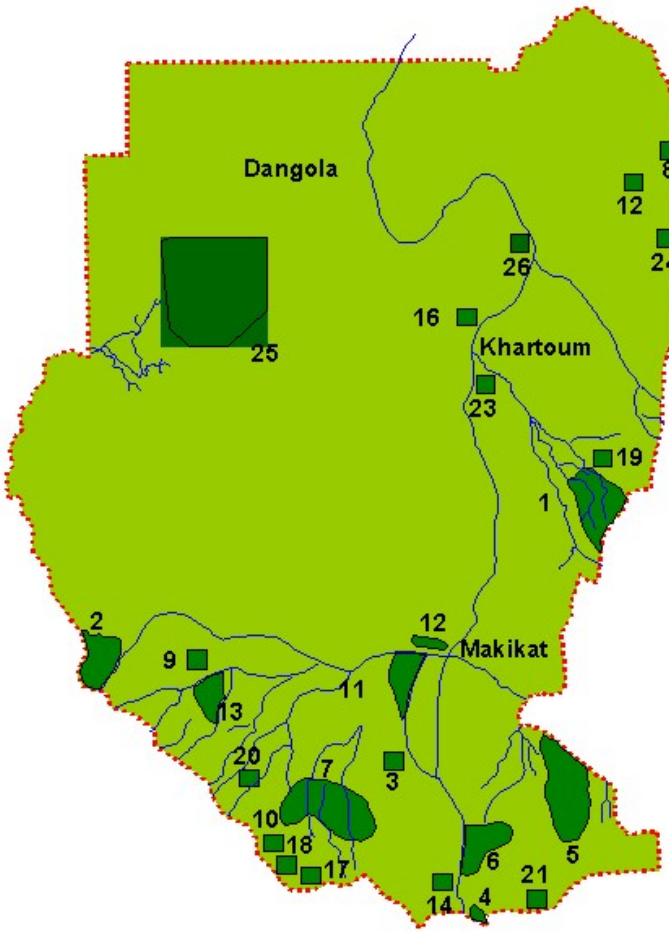
About twenty-six areas are gazetted and declared protected areas and an equal number of areas are proposed. Some of the areas were gazetted as far back as 1936, while others were relatively recently established such as Wadi Howar National Park in 2002 and Jebel Hassania in 2003(Fig.5). The civil war in Southern Sudan has a serious impact on the wildlife resources of the South. Only a few of the protected areas have game scouts present or conducting regular patrolling.

Table 3. Distribution of Protected Areas over Ecological Zones in the Sudan.

Ecological zone	National parks	Game reserves	Game sanctuaries
Desert	Wadi Howar N.P	None	None
Semi desert & Marine	Senganeb Marine N.P. Jebel Hassania	Tokar Sabaloka	Arkawit Arkawit-Sinkat Khartoum Sunt Forest
Savannah	Dinder Radom Southern National Park Nimule Boma	Chelkuo Achana Namitina Juba Kidepo	None
Flood region or plain	Bandingilo Shambe	Fanyikango Zeraf Island	None
Rain forest	None	Mbarizunga Bengangai Bire Kpatus	None
Montane	None	None	None
Total	**11**	**12**	**3**

Source: The Wildlife General Administration

FIG. 5 GAME RESERVES AND NATIONAL PARKS OF SUDAN



National Parks

1. Dinder
2. Radom
3. Shambe
4. Nimule
5. Boma
6. Badingilo
7. Souther
8. Senganeb

Game Reserves

9. Ashana
10. Bengangai
11. Ez Zeraf
12. Sheilko
13. Fanyikango
14. Juba
15. Tokar
16. Sabeloka
17. Mbarizunga
18. Bire Kpatues
19. Er Ra had
20. Numatinna
21. Kidepo

Sanctuaries

22. Erkowit Sinka t
23. Khartoum
24. Erka wit

New National Parks

25. Wadi Howar
26. Jebel Hassania

Table 4. List of National Parks in the Sudan

Name	Establish date	Area (hectares)	Ecological zone
Dinder Area Increased	1935 1982	890 000 1 029 100	Savannah
Southern National Park	1939	2 300 000	Savannah
Radom	1983 1980	1 250 000	Savannah
Nimule	1945	41 000	Savannah
Boma	1986	2 280 000	Savannah
Bandingilo	1986	1 650 000	Flood Region
Shambe	1985	62 000	Flood Region
Senganeb Marine National Park	1990	26 000	Semi desert
Wadi Howar	2002	10 000 000	Desert
Jebel Hassania	2003		Semi desert

Source: The Wildlife General Administration

Table 5. List of Game Sanctuaries in the Sudan

Name	Establish date	Area (hectares)	Ecological zone
Arkawit-Sinkat	1939	12 000	Semi Desert
Arkawit	1939	82 000	Semi Desert
Khartoum Sunt Forest	1939	1 500	Semi Desert

Source: The Wildlife General Administration

Table 6. List of Game Reserves in the Sudan*

Name	Establish date	Area (hectares)	Ecological zone
Achana	1939	90 000	Savannah
Bengangai	1939	17 000	Rain Forest
Chelkou	1939	500 000	Savannah
Fanyikango	1935	48 000	Flooded Plain
Juba	1939	20 000	Savannah
Zeraf	1939	970 000	Flooded Region
Toker	1939	630 003	Semi Arid
Sabeloka	1946	116 000	Semi desert
Mbarizunga	1939	1 000	Rain Forest
Bire Kpatues	1939	550 000	Rain Forest
Kidepo	1939	120 000	Savannah
Namitina	1939	210 000	Savannah

Source: The Wildlife General Administration

**Status of Conversation in several of these areas is questionable*

Table 7. Proposed Protected Areas in the Suda

Proposed Site	Area (hectares)
Khashm Girba Dam BS	10 000
Lake Abiad BS	500 000
Lake Kailak BS	3 000
Lake Kundi BS	2 000
Lake Nubia BS	10 000
Sennar Dam BS	8 000
Abroch GR	150 000
Barizunga GR	200 000
Boro GR	150 000
Machar GR	450 000
Mashar GR	450 000
Mukawwar MNR	12 000
Port Sudan MNP	100 000
Lantoto NP	76 000
Suakin Arcipelago NP	150 000
Imatong Mountains NCA	100 000
Jebel Elba NCA	480 000
Jebel Mara massif NCA	150 000
Lake Ambadi NCA	150 000
Lake No NCA	100 000
El Rosieries Dam BS	70 000
Jebel Awlia Dam BS	100 000
Jebel Hassinia	
Jebel Gurgei massif GR	10 000
Red Hills GR	15 000

Source: The Wildlife General Administration

There are 26 proposed sites, but unfortunately only Wadi Howar and Jebel Hassania both in the desert and semi-desert and Baja in arid area have been declared as parks. (Source: Brigadier John Awang Awok Tut, director Federal Park Administration, General Administration of Wildlife Conservation).

Few out posts and /or occasional patrolling, marked boundaries and some passable car tracks can be found. Most of the protected areas exist on paper only. Darling (1961) noted that the reserve system, as a whole, had been quite inadequately staffed. Hashim and Nimir (1978) remarked that the Wildlife Administration had done very little to enforce conservation in protected areas and noticed that all protected areas in the Sudan have experienced serious deterioration in numbers of wild animals and their habitats.

All protected areas in Sudan are managed without "**management plans**". Although a management plan was developed for the Southern National Park, it was not implemented due to the outbreak of war. In spite of the fact that both Dinder and Radom National Parks have been declared as Biosphere Reserves, since 1979 and 1982 respectively, no measures were taken to implement the relevant MAB concepts.

The Wildlife Ordinance has been criticized in several areas such as lack of clear distinction between a game reserve and a game sanctuary. Although the Wildlife Administration has drafted new wildlife legislation, it has not yet been completed or ratified. IUCN categories of protected areas will be included in the new legislation.

The Sudan Government has shown a strong commitment to wildlife conservation and protected areas as reflected in signing international and regional agreements such as the African Convention, the MAB and World Heritage Sites Conventions and the Biodiversity Convention. Only one gazetted protected area was subject to cancellation (the Rahad Game Reserve), in 1994. In 2001,the President declared a new national park to be established in Wadi Howar. The Wadi Howar National Park will be the first desert park in the Sudan and its proposed area is to be 100,000 km^2. It will be one of the largest Parks in the world. The wildlife protected areas amount to about 4%, of the total area of the Sudan. The National Comprehensive Strategy 1992-2002 stated that protected area (forest and wildlife) should be increased to 25% of the area of the Sudan.

B. Dinder National Park

B.1 Introduction

B.1.1 Location

Dinder National Park is bordered by three States: Sennar, Gedarif and the Blue Nile. The Park is bordered by Rahad river at latitude 12°26'N and longitude 35° 02'E, and then continues in a northwestern direction up to lat. 12° 42' N and long. 34° 48'E at Dinder River. The boundary continues again up to lat. 12° 32'N and long. 34° 32' E along khor Kennana and finally the boundary slightly diverts to the southeast to lat. 11°55'N and long. 34° 44'E and then gets to the Sudan – Ethiopian border (Fig. 6).

Figure 6: Location Map of Dinder National Park.

B.1.2 Topography

Dinder National Park falls within the flat plains of the Southern Blue Nile. On the southeastern portion of the Park, towards the Ethiopian Plateau, isolated highlands occur. The two seasonal rivers, Rahad and Dinder, water the Park during the rainy season. They descend from the Ethiopian highlands and flow in a northwesterly direction across the flat plain to empty their waters into the Blue Nile River.

The Dinder River flows through the middle of the Park. It starts to flow around the middle of June. It ceases running in November. The sandy riverbed is left with only a few pools, which may hold water up to the next rainy season. The major tributaries of Dinder River are khor Galegu and khor Masaweek. Other smaller streams are Kennana, Suneit, Heneifa, Abu Khamira, El Qisar and many others. The runoff from the Ethiopian highlands usually leads to seasonal accumulations of streams that either joins Dinder or Rahad rivers.

B.1.3 Climate

The climate of the Park is characterized by two seasons: the hot and humid rainy season (May-November) and cool and dry season (December-March). Butting and Lea (1962) associate the rainfall of the central Sudan with that of the West African System, which is derived from South Atlantic and Congo air masses, with little or no Indian Ocean influence. The isohyets run from west to east until they turn first to northeast and then east and southeast, around the Ethiopian highlands. Dinder National Park therefore lies in the zone of northeasterly winds, in which rainfall decreases to the northeast. Consequently the decrease in the mean annual total is of the order of 30mm for every 20 km and this decrease in rainfall is the main reason for the marked zonation of the vegetation of the Park. The northeastern part of the Park has the least rainfall (600-800mm), which gradually increases with distance towards the southeast of the park (800-1000mm). Unfortunately no meteorological station has ever been installed since the Park was established. It was only in 2001 that the Dinder National Park Project installed a meteorological station. The amounts of rainfall of the Park were estimates based on the rainfall of the nearest meteorological stations in Damazin, Singa and Gedarif (Table 8).

The effective rains in DNP start in May in the southeast and in June in the northeast. The normal rainy season is from May to November. The peak is in August. During the rainy season, the maximum temperature is approximately 30^{o}C and the minimum is approximately 20^{o}C. As the rains gradually subside, the temperature also gradually rises until it reaches a maximum of 36^{o} C. On the other hand, the relatively cool months of December, January and February are followed by a general rise in temperatures that average 38^{o}C in March, with an average humidity of 60-65%. The maximum temperature sometimes exceeds 40^{o}C in April and May and then drops suddenly by the first rains of the new season. Table 9 summarizes some climatic characteristics in DNP.

Table 8: Mean Annual Rainfall of Damazine, Gedarif and Dinder from 1951-1999

	Damazine			Gedarif			Dinder rainfall interpolated from Gedarif and Damazine		
Year	Annual Rainfall	5 years average	Mean	Annual Rainfall	5 years average	Mean	Annual Rainfall	5 years average	Mean
1950	-	-	-	714.10	-		112.00	-	
1951	710.10	-	-	-			-	-	
1952	560.90	-		575.40	576.00	575.70	695.00	646.60	670.80
1953	814.90	736.64	775.77	563.50	550.10	556.80	734.00	635.40	684.70
1954	903.60	725.04	814.32	55.00	595.50	325.25	557.00	659.80	608.40
1955	683.70	734.22	708.96	584.70	575.20	579.95	656.00	620.20	638.10
1956	662.10	676.10	669.10	696.90	580.50	638.70	675.00	591.20	633.10
1957	606.80	612.92	609.86	473.70	586.80	530.25	497.00	617.40	557.20
1958	524.30	617.48	570.89	590.10	557.60	573.85	589.00	611.20	600.10
1959	587.70	647.26	617.48	588.40	538.20	563.30	688.00	619.00	653.50
1960	706.50	682.50	694.50	438.80	558.20	498.50	625.00	666.00	645.50
1961	811.00	755.42	783.21	599.90	588.80	594.35	696.00	694.20	695.10
1962	783.00	781.30	782.15	573.70	582.10	577.90	732.00	680.20	706.10
1963	888.90	775.90	832.40	743.30	614.30	678.80	730.00	694.80	712.40
1964	717.10	772.82	744.96	555.10	617.70	586.40	618.00	695.20	656.60
1965	679.50	772.24	725.87	599.30	635.40	617.35	698.00	689.60	693.80
1966	795.00	743.66	769.33	617.00	596.90	606.95	698.00	668.60	683.30
1967	780.10	739.74	759.92	662.50	576.10	619.30	704.00	660.60	682.30
1968	746.00	751.88	748.94	550.50	559.80	555.15	625.00	638.60	631.80
1969	697.50	724.42	710.96	451.20	546.40	498.80	578.00	619.00	598.50
1970	740.20	698.56	719.38	518.00	537.50	527.75	588.00	609.20	598.60
1971	658.30	687.52	672.91	549.70	546.90	548.30	600.00	608.40	604.20
1972	650.80	676.78	663.79	618.00	598.30	608.15	655.00	640.00	647.50
1973	690.80	680.58	685.69	597.80	617.00	607.40	621.00	660.20	640.60
1974	643.80	702.86	673.33	712.00	635.50	673.75	736.00	668.80	702.40
1975	752.00	701.74	388.47	607.70	635.70	621.70	689.00	660.20	674.60
1976	769.70	686.78	728.24	642.00	633.70	637.85	64.30	660.00	362.15
1977	645.20	685.48	665.34	608.80	634.70	621.75	64.30	660.00	362.15
1978	616.00	710.86	663.43	602.80	634.90	618.85	620.00	672.20	646.10
1979	637.30	710.48	673.89	775.30	638.20	706.75	830.00	674.20	752.10
1980	886.10	710.54	798.32	545.40	658.40	601.90	656.00	691.80	673.90
1981	767.80	725.18	746.49	658.70	634.30	646.50	653.00	673.20	663.10
1982	645.50	712.06	678.78	710.00	543.60	626.80	700.00	589.00	644.50
1983	689.20	634.24	661.72	482.10	583.50	532.80	527.00	589.60	558.30
1984	571.70	595.40	583.55	322.00	572.60	447.30	409.00	574.40	491.70
1985	497.00	576.38	536.69	744.70	500.10	622.40	659.00	529.80	594.40
1986	573.60	583.92	578.76	604.00	500.30	552.15	577.00	559.40	568.20
1987	550.40	623.22	586.81	242.10	588.00	415.05	477.00	618.00	547.50
1988	726.90	653.58	690.24	582.90	513.40	548.15	675.00	601.60	638.30
1989	766.20	693.56	729.88	761.30	443.40	602.35	706.00	645.60	675.80
1990	650.80	751.30	701.05	371.90	619.90	495.90	573.00	682.80	627.90
1991	773.50	765.70	769.60	753.90	658.80	706.35	797.00	700.60	748.80
1992	839.10	762.66	800.88	629.40	633.60	631.50	663.00	727.40	695.20
1993	796.90	843.70	820.30	777.30	664.20	720.75	264.00	709.00	486.50
1994	751.40	824.56	787.98	635.40	719.20	677.30	840.00	709.00	774.50
1995	1055.60	801.60	928.60	524.80	651.20	588.00	552.00	707.60	629.80
1996	677.80	809.88	743.84	729.10	607.20	668.15	726.00	694.60	710.30
1997	724.30	824.86	774.58	589.30	636.30	612.80	656.00	677.20	666.60
1998	840.30	-	840.30	557.50	-	557.50	699.00	-	699.00
1999	826.10	-	826.10	780.70	-	780.70	753.00	-	753.00

Table 9. Summary of some climatic conditions in DNP

Climatic conditions	Values
Absolute recorded maximum annual rainfall	967mm / year
Absolute recorded minimum annual rainfall	450mm/year
Long-term annual average rainfall	850-550mm
Rainiest months	July, August, September
Maximum average temperature	45^{o}C
Hottest months	April, May, June
Minimum average temperature	12^{o}C

Source: Sudan Meteriological Corporation

B.1.4. History and Archaeology

Dinder National Park is one of the oldest parks in Africa. It was established in 1935 following the London Convention of 1933 for the conservation of African flora and fauna. Before the establishment of the park, people inhabited the area. Human settlement in the Dinder region dates as far back as the pre-nineteenth century. Samuel Baker (the British Explorer) described Dinder area as fairly heavily populated, when he visited it in 1861 (Ali, 1986). However, in the mid-and late-1880's, a massive outward migration occurred, either to support and defend the Mahdist revolution (1885 – 1898), or due to the notorious famine of 1888. In his visit to Dinder area in 1898, Harrison found the area devoid of people but noticed the remnants and traces of earlier human settlements (Mohammed, 1999). However, resettlement of the area intensified in the early 1960s through immigration from western Sudan and West African countries because of famine and the severe droughts of the 1980's (Suliman, 1986). A large number of these immigrants have settled along the banks of the Rahad and Dinder rivers. The tribal structure of these immigrants shows a multiplicity of tribes: Masaleat, Burgo, Dago, Fellata, Houssa, Salahab, Halween, Rezaigat, and many other smaller tribes. The area where they continued to dwell during the dry seasons to utilize the available water and grazing resources has also attracted nomadic pastoralists. The other two factors that accelerated the influx of human populations into the Dinder area are the unplanned and uncontrolled expansion of mechanized rain-fed agriculture. This created a good market for wage labour, thereby attracting increasing numbers of workers who settled seasonally or permanently in the vicinity of the Park. (Moghraby and Abdu, 1985).

The second factor is the Land Registration Act of 1905, which confirms that all land, with a few exceptions, belongs to the public. Consequently, the Native Administrators and Tribal Leaders, as a means of consolidating their own powers and authority and to extend their influence over their respective domains, distributed traditional agricultural lands to migrants and encouraged them to settle in their respective area. By 1983 the boundaries of the park were extended by some 20 kilometers. Ten villages

consequently fell within the new boundaries. Before the massive immigration of human populations to the Dinder area as described above, Dinder National Park was reputed to have contained a rich biodiversity in both flora and fauna. Animal species like elephant, hippopotamus, Tora hartebeest and the Nile crocodile were teeming in the Park.

However, the status of the animal species populations has been greatly affected by the various activities of the communities living around and inside the Park. Although the ecosystems inside the park are still intact, the populations of larger animal species are steadily and rapidly declining through poaching. Species like Soemmering's gazelle and giraffe, flagship species, have disappeared. Tiang is almost reaching the point of extinction.

Most of the Mayas' (Meadows), which maintain many ungulate species in terms of water and grazing resources, have been silted up and have become unproductive. Some of the Mayas' feeder channels have been blocked resulting in not receiving water directly from Dinder River or from khors Galegu and Masaweek. As far as the tourist industry is concerned, there is no development done in the Park to attract or encourage tourism. DNP is only little known both on the national, regional and international levels. Despite the modesty of infrastructure and accommodation, a good number of both nationals and expatriates visit the Park in the dry season each year.

Archaeology

The region of the rivers Dinder and Rahad had been, until recently, an unexplored area. Preliminary investigations carried out in 1997 and 2002, along these rivers and their drainage systems, have revealed an abundance of archaeological sites. These are situated at Gueisi and nearby localities. Within the Dinder National Park the sites are apparently closely associated with Mayas such as Abdel Ghani, Ras Amir, Gererrisa and Farsh El Naam. Mainly surface finds consist of grinding stones, Archer's looses and spindle whorls. On the basis of these finds, the sites are tentatively dated to the late Meroitic period, that is, the first to the fourth centuries A.D. Similar dates can be assigned to other sites located along the river Rahad and further to the east at and around Jebel Abu Sabika. Near the latter locality sites of rock paintings and engravings were also found. The Meroitic dates for the sites agree with others obtained from excavations in the vicinity of Sennar.

The Dinder finds, however, are significant in another respect. They revealed the considerable geographical extent of the Meroitic Kingdom and opened new possibilities for the investigation of its relationship with the kingdom of Axum.
Archaeological work along the Dinder and southern Blue Nile regions in general is also pertinent to the question of Fung origins, which is one of the most complex problems in the medieval history of the Sudan. So far, the only remains attributed to this period were excavated at Abu Geili across the Blue Nile from Sennar. Additional sites of the Fung period are highly likely to turn up along the Dinder River.

The early prehistory of the upper reaches of the Nile Basin remains poorly understood. Some implements of Middle Paleolithic and Neolithic ages have been collected at Jebel Geili. Further research in this field is required for a better understanding of these cultural developments and their connections with others further to the north.

One of the most challenging questions of research in the region is that concerning the history of Early Man. The earliest human skull so far discovered in the Sudan comes from Singa on the Blue Nile. As far back as 1936, Leakey, the leading authority in this field, pointed to the potential of the area, together with western Ethiopia, in linking up developments in East Africa with the Nile valley in Egypt.

B.1.5 Soils

Holsworth (1968) and Dasmann (1972) have described two types of soils in DNP: the vertisols and entisols. The former, which are the most extensive in the Park, are dark, heavy clays and "self-ploughing" soils often known as the black cotton soil. They crack deeply during the early dry season. The entisols dominate the eastern limits of the Park towards the foothills of the Ethiopian plateau and along riverbanks. This type of soils occurs in patches of sandy loam and sandy clay. They intersperse with the vertisols.

B.1.6 Water Resources

The Rahad and Dinder rivers are the largest tributaries of the Blue Nile. They both drain parts of the Ethiopian highlands. They have nearly the same lengths, identical hydrology and comparable volumes of annual flows (Table 8). River Rahad flows through the northern boundary of DNP, while the Dinder River flows through the centre of the Park (fig. 7).

The catchment area of the Dinder River is around 16,000 km^2 and has average annual discharge of about three billion cubic meters. The channel traversing the Park ranges from 150 to 400m in width and is one to nine meters in depth. The river has a seasonal character. It starts surging in June, peaking around the middle of August each year. It ceases flowing sometime in November. The sandy riverbed, thereafter, is left with numerous pools, some of which may retain water throughout the dry season.

(a) Mayas

These are wetland meadows found along the flood plains of the rivers. They have been formed due to the meandering character of the channel and the nature of flow of its waters. They occupy low-lying basins, meanders and oxbows. They are generally crescently shaped with slight and /or no clear banks.

The hydrology of the mayas is not very clear and more in-depth studies are required. (Abdel Hameed *et al,* 1999). Mayas vary in area from less than 200m^2 up to 4.5km^2. Their use for grazing has been extensively studied by El Tom (1982), Abdel Hameed (1983), Hashim (1987) and others. They have been, consequently, classified as productive and non-productive habitats, based on their carrying capacities and water retention potential.

The work of Abdel Hameed *et al* in 1996 and 1999, on the hydrology and drainage systems of the Dinder River and its tributaries forms a strong baseline to any further investigations. Ali (2001) has recently looked into the hydrology of the Park.

Table 10: Annual Discharges, Discharge rates and Flood duration for Dinder and Rahad Rivers

Year	Discharge ($10^9 m^3$)		Discharge Rate (m^3/S)		Flood duration (days)	
	Dinder	Rahad	Dinder	Rahad	Dinder	Rahad
1972	1.502	0.585	0.585	89	114	115
1973	1.734	1.050	201	106	100	115
1974	1.838	1.229	156	107	137	133
1975	1.611	0.840	158	80	118	120
1976	2.003	0.839	209	80	111	121
1977	1.467	0.865	129	78	132	128
1978	2.430	1.117	230	83	118	139
1979	1.327	0.738	138	70	111	122
1980	2.137	1.033	210	91	118	131
1981	1.957	1.199	244	108	93	129
1982	1.009	0.546	131	61	89	103
1983	1.503	0.600	153	67	114	104
1984	0.303	0.251	44	29	80	102
1985	2.387	0.997	256	86	108	135
1986	1.058	0.693	100	64	123	125
1987	1.450	0.666	130	59	129	130
1988	4.126	1.403	376	106	127	153
1989	1.908	0.846	221	85	100	116
1990	1.342	0.571	160	66	97	101
1991	1.382	0.888	120	89	133	116
1992	1.373	1.175	122	88	130	155
1993	1.676	0.834	142	71	137	152
1994	2.428	1.025	210	64	134	185
1995	1.274	0.896	114	83	129	125
1996	1.656	0.783	118	50	163	182
1997	1.046	0.992	83	71	146	162
1998	2.248	1.201	186	82	140	170
1999	2.861		181		183	
2000	1.013		91		129	

Source: Ministry of Irrigation and Water Resources

The mayas receive their waters through:

a. Direct rainfall
b. Sheet flow
c. From the Dinder River and tributary feeder channels, or from channels flowing through. A good indicator here is the occurrence of fish in years of high river flow.

(b) Drainage System

Abdel Hameed *et al* (1996) stated, " The basic drainage system in the Park is a dentric tree-like drainage pattern" (Fig. 7). The paper outlined the main drainage systems as follows:

Khor Galegu

Khor Galegu is a cardinal tributary of the Dinder River. The system includes at least 40 Mayas, the largest of which is Ras Amir, 4.5 km^2 in area and 13 km northeast of the camp at Galegu. In older maps it was referred to as Lake Ras Amir. It rarely dried up before 1970, and since then, it became less perennial, drying up, haphazardly every few years. The second largest maya in this expanse is Farsh el Naam, 22km east of the series of mayas known as the Godaha. It has an area of 1.6 km^2. Like Ras Amir, conditions have become more erratic and generally less perennial, after the mid-1980s droughts. The Godaha are a chain of eleven small mayas. The third Godaha, in the downstream direction, is the largest. It has an area of about 0.2 km^2. These small mayas are all connected, in series, to the adjacent khor Galegu, with well-defined channels.

In the upstream reaches of khor Galegu, the mayas are less well known due to the inaccessibility of the terrain. El Gammam El Affin, Hasa Heisa and El Mallwi are names of some of the wetlands there.

Khor Masaweek

The khor is also a large tributary of the Dinder River. The prominent mayas in this drainage system total 11 in numbers. Sambroug is the largest, with an area of around 2.3 km^2. It flows through the crescent shaped wetland.

The Eastern bank of the Dinder River

At least 12 mayas span this reach. The most conspicuous are Ein Es Shams (≈ 1.8 km^2); Mayat Musa, Simseer, and Al Abyad.

The Western bank of the Dinder River

There are at least 13 large mayas along the western bank of the river. The most conspicuous include Gererrisa, about 2 km^2 and 5 km north-west of Galegu camp, El Dabkara, Beit El Wahash (3.6 km^2) and Simaya, 25 km south of Galegu camp.

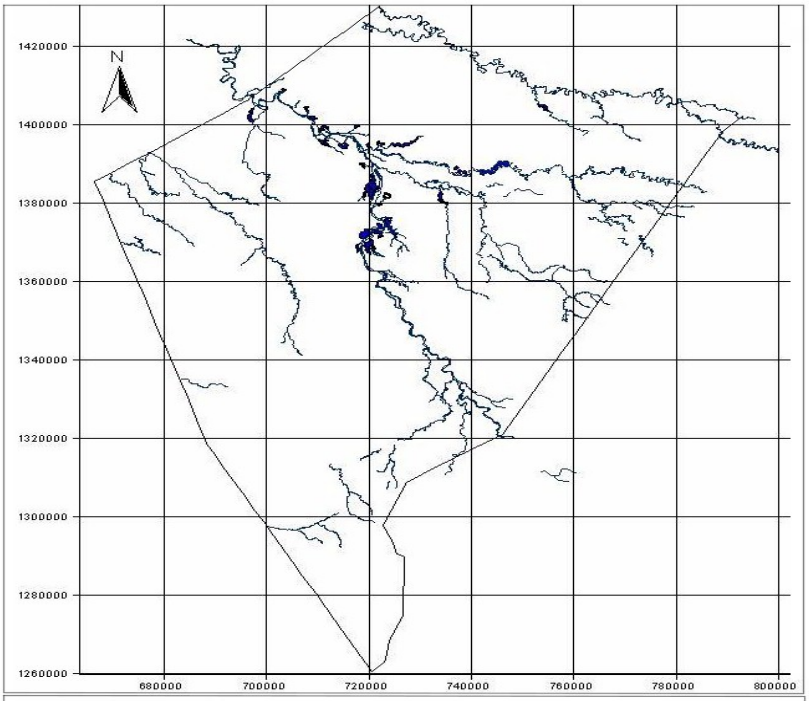


Figure 7: The drainage system of Dinder National Park

Other drainage systems

There are numerous other less known mayas, off the beaten tracks, along the various tributaries of the Dinder River essentially khors: El Atshan, El Atesh, and Kennana. The tracks along these khors are difficult and often impassable. Traveling on a recently opened road from Ras El Fil, at least four significant mayas were readily accessible (Nimir and Abdel Hameed, 2002, personal communication).

Dry season Pools on the Dinder river

As has been stated above, a number of pools remain on the sandy bed of the Dinder River after it ceases to flow, in the dry season. Birkat el Tamaseeh, El Gezira Um Urrug, el Hunnu el Azrag, el Zommati and el Tabia are only a few. Very little is known about their numbers, locations and volumes of water retained. One thing is certain, however, it is a dynamic state of affairs, seasonally and annually. This is due to the torrential nature of the river flow. Some get silted up, like the one called el Dabkara. New ones are probably created.

The pools are rich in fish and waterfowl. Occasionally small crocodiles are observed in some of the larger ones. Monitor lizards are not uncommon. The pools are of pivotal importance as a source of water for birds, wildlife, trespassing livestock, poachers,

honey collectors and so forth. This water is the lifeline to the villagers of Magano who are allowed to settle at el Tabia in the dry season. Occasionally in lean years when mayas dry up completely, those pools become the only source of water in the area.

Ground Water

The area of the Park is dominated by the Al Atshan formation tapering off towards el Tabia, underlain by shallower Basements outcrops. The water bearing formations, in the river Rahad area, lie in the superficial deposits along the banks of the river. Along the Dinder River copious quantities of high quality water could be tapped from the superficial deposits of the river terraces.

At this point in time, the installed facilities are limited to three boreholes (at Galegu, Ras Amir and Gererrisa) and two hand pump at el Seneit and el Abyad. The borehole at Galegu is 8m deep while that at Gererrisa is 16m, Ras Amir being 60m deep. Deep boreholes could go down to 70m while slim boreholes (hand pump operated) can draw water at less than 50m.

However, there seems to be differences of opinion as to the volume and accessibility of ground water in the area. Mukhtar (pers.comm.)* advocates that ground water supplies are abundant and readily accessible all over the area of the Park.

A recent geophysical survey by the Project, along the northwestern borders of the Park contradicts this conclusion (Nimir, pers. comm.)+

In general terms, the water budget of DNP has never been worked out. Only trends have been addressed and only in broad terms. It must be strenuously stressed, however, that the key of the management of the Park is the management of its water resources. To develop the water resources is to develop the Park.

The rivers

Runoff is a coefficient of rainfall. It is suspected by many that Global Warming might induce a decrease in rainfall over Ethiopia, in the magnitude of 15%. That would be interpreted into a 30% decrease of river discharge. It should be remembered that the Ethiopian highlands contribute as much as 84% to the total annual discharge of the Nile system.

As it stands today, the Dinder River is going through a trend of decreasing volume of annual discharge. The trend seems to have persisted throughout the past 20 years. In the 1970s the annual volume of discharge of water was around 3 billion cubic meter. It has declined to around 2 bcm. In 1985 it was down to 0.6 bcm (Abdel Hameed *et al* 1996).

As stated above, the number, locations and retained volumes of water in the timely period have never been quantified.”Timely” is the term used by the Nile Irrigation Engineers referring to the availability of water for agriculture at the set season.”Untimely” is the contrary term.

* A Mukhtar,ex-director, National Water Corporation,Khartoum +HCENR

Mayas

Besides being an important source of water in the dry season, mayas are the only source of green fodder at that time. Productive mayas are covered with mat-forming palatable species such as *Cynodon dactylon, Ipomea aquatica, Kyllinga and Brachiaria spp*.

Degradation in the catchment areas and repeated fires increased rates of erosion and eventual siltation of beds of mayas. Mat-forming grasses were replaced by unpalatable annuals like *Sorghum* spp. and eventually by trees. The decrease in the annual volume of discharge of the river and consequently the maximum water level is one of the main causes behind the dryness of many mayas.

B.1.7. Habitat and Ecosystems

***Acacia seyal-Balanites* Ecosystems**

The *A. seyal-Balanites* ecosystem is a woodland or wooded grassland, dominated by the species of *A. seyal, Balanites aegyptiaca,* and *Combretum hartmannianum*. This ecosystem occurs extensively on deep, cracking clay soils (vertisols). In relatively flat areas *A. seyal* predominates, while *C. hartmannianum* occupy the depressed areas, and *B. aegyptiaca* always occupies the higher ridges. Undulations in the topography and variations in soil types result in patches of mixed or pure stands of *Combretum*. The associates are *A.seyal fistula* and on the edges of watercourses are the *A. sieberiana, Ziziphus spina-christi* and *Z. abyssinica*.
The understory of the woodland is composed of tall annual grasses (2-3m high) such as *Sorghum sudanensis*, *Pennisetum ramosum*, *Setaria incrassata*, *Hyparrhenia spp*. and *Aristida plumosa*. These grasses are intermingled with herbs, mostly composed of different species of *Compositae, Acanthaceae*, and *Convolvulaceae* spp. The common ones are *Celosia argenitia, Vernonia, Cassia* and *Hibiscus spp.*

Hakim *et al* (1978) have subdivided this ecosystem into three major communities, based on the relative amounts of rainfall and topography: Community I covers the area north of Khor Galegu and east of the Dinder River. This community, which is the driest, falls on the optimum zone of *A. seyal-Balanites* and shows the best performance of the two tree species. The average density of *A. seyal* is 2700 trees/ha and of *Balanites aegyptiaca* is 500 trees/ha. (HCNER-WRC, 2001).

Community II covers the area south of Khor Galegu and east of the Dinder River. It is the wettest of the three communities, because of being closer to the foothills of the Ethiopian plateau. Trees are healthy and vigorous. In more cases the average density of *A. seyal* is 3 000 trees/ha and that of *Balanites aegyptiaca* and *Combretum* spp. is 600 trees/ha.

Community III. Covers the area west of the Dinder River and is intermediate in precipitation between communities II and I. The average density of *A. seyal* is 1800 tees/ha and B. *aegyptiaca* is 500 trees/ha (HCNER-WRC, 2001).

The *A. seyal – B. aegyptiaca* ecosystem is swept by fire frequently every dry season. *A. seyal* and *B.aegyptica* are fire resistant. The vegetation of the floor of the woodland is often removed by fire and the clay soil left bare. The dominant perennial grasses in

most areas had been replaced by annual species. The tall wild sorghum grass (*S. sudanenis*) and *A. plumosa* are widespread.

The Riverine Ecosystems

The riverine ecosystem occurs on the silty banks of Dinder River and Rahad River. The forest is a multilayerd vegetation, dominated by *Ficus sycomorus; Hyphaene thebaica, Acacia sieberiana; Stereospermum kunthianum; Tamarindus indica*; and *Combretum hartmannianum*, associated with *Z. spina-christi, Gardina lutea*, and *Pilostigma reticulatum*. The main grasses include *Bekeropsis uniseta*; *Eragrostis tremula*, and *Sorghum sudanenis* with different species of forbs and climbers form the ground floor layer.

The composition of the riverine forest changes gradually as one goes southwards. *Hyphaene thebaica* begins to thin out from the riverine forest and the soil progressively shows a finer and higher texture. The southern extreme of this ecosystem is dominated by *Anogeissus leiocarpus* and C. *hartimannianum*. Broad-leafed trees increase towards the Ethiopian borders and these are represented by *C. hartmannianum*, *Terminalia browni*, *Boswellia payriffera* and *Adansonia digitata*. This area has more rainfall, the clay soil becomes rocky and areas of sandy soil appear more frequently. Perennial grasses dominate over the annuals in this zone of which *Andropogon gayanus, Hyperrhenia ruffa* and *Setaria incrassate* are the major grasses. The high rainfall results in the growth of creepers such as *Caparis tomentosa*, and climbers such as *Cissus quadrangularis*; epi-phytes like *Lorauthus* sp.; lichens and mosses.

The Mayas Ecosystems

The most striking feature of DNP is the presence of Mayas. Because of the meandering of the river and due to the nature of water flow, erosion and deposition processes, a large number of mayas and pools were formed along the flood plan (Dasmann, 1972). There are about 40 major mayas and pools that form parts of the Rahad and Dinder drainage system as described above.

The bed of Maya Ras Amir is almost devoid of vegetation, except for a few herbs and scattered shrubs. There is a borehole that pumps water to the beds of the mayas when they dry up. It serves as a good habitat for waterfowl when it is completely full with floodwater.

Maya Ein Es Shamis used to maintain a large biomass of wild ungulates in the early seventies. At present it has almost completely been silted up and therefore loses its ability to hold water till the end of the dry season. The vegetation on these mayas comprises *Sorghum* spp. and "*el sorrib*" (*Chamaecrista nigrieans* syn. and *Cassia nigrieans*), as newly reported invading plants.

Like Ein Es Shamis, Maya Musa has also been partially filled up by sediments. Maya Simseer is covered with *C.dactylon* and burnt Sudan grass. It seems to have regained its capacity of holding water, after a relatively long period of dryness. Many warthogs use it heavily by digging up the soil in search of tubers and roots.

Maya Heneifa is also severely degraded through sedimentation. Many seedlings of *Z.spina-christi* and *A.seyal* have already invaded the bed of the mayas. *Sorghum*

sudanensis and *Hibiscus* sp. are in the periphery. Maya Al Abyad is also unproductive because it has also been invaded by *Z.spina-christi* and *S. sudanensis.*

The most productive maya in the park is Simaaya. It has an area of about 2.505 km^2 and has never dried up since 1984. Its vegetation includes *E.stagnina*, *C. dactylon, Kylliga sp., Bracharia* sp. and *I. aquatica*. The standing crop of green forage and fish supports a large number of ungulates and birds throughout the dry season. However, the new invader "*el sorrib*" is advancing from the east towards its centre. The maya is the last stronghold of the Tiang *(Damaliscus korrigum*) in the area. The other species that frequent the mayas include reedbuck *(Redunca redunca*), Oribi *(Ourebia ourebia*), Warthog *(Phacochoerus africanus)*, Ostrich *(Struthio camelus*) and many birds species feed on small fish, like the Marabou stork *(Leptoptilas crumeniferus).*

Beit el wahash is a very large round-shaped maya. It is completely silted up and therefore is dry every dry season. It is covered with *Sorghum sudanensis*. Gererrisa is also a large, round-shaped maya with a small island located at the centre. "*El sorrib*" has also invaded it from the eastern side and along the channel from the bore well. It is also a productive maya. *Cyprus* spp., *Nymphia* spp and other water-loving plants are found in the centre of the maya.

El Dabkara, with its large catchment area surrounding it has a feeder channel which acts as a drainage. *A. nilotica* and *Z.spina-christi* have established themselves inside the maya associated with *Mimosa pigra*. It is still productive. Many reedbuck, oribi and warthog use it heavily in the dry season.

Several mayas have been degraded and thus have become non-productive. The accumulated sediments have raised the beds of these mayas (Beit el Wahash, Mayat Musa, Farsh el Naam, Ein Es Shamis, el Godaha, etc) and silted up their feeders. Hence, their capacities to hold floodwater have been reduced.

In the productive mayas and river pools many species of fish and amphibians are vividly abound.

B.1.7.1 Flora

Many descriptions of the vegetation of the Park have been given by different authors, Smith, (1949); Harrison and Jackson, (1958); Holsworth, (1968); Dasmann, (1972). According to Smith (1949), "the distribution of tree species is influenced by the combined effects of rainfall; soil texture; and topography". Harrison and Jackson (1958) give a general classification of Sudan Vegetation in which the Dinder area is included in the *Acacia seyal- Balanites* Savanna alternating with grass area zone, and *Anogeissus-Combretum hartmannianum* savanna woodland zone. The description given by Dasmann (1972) differs from the rest in that Dasmann has classified the vegetation of DNP into four categories*: Wooded grassland; Open grassland; woodland; and riverine forest*. Hakim *et al* (1978) and Abdel Hameed *et al* (1996) recognized three types of ecosystems: *A. seyal- Balanites*, riverine forest, and the Mayas (Meadows) ecosystems.

B.1.7.2 Fauna (Mammals, Birds, Fishes, Amphibian, Reptiles and Insects)

Dinder National Park was reputed to have hosted a variety of wildlife species in the past: mammals, birds and reptiles, the latter being mostly crocodiles. In his hunting report to Dinder area, Harrison (1953) mentioned the abundance of elephants *(Loxodonta africana*), giraffes *(Giraffa camelopardalis*); black rhinoceros (*Diceros bicornus)*; hippopotamus *(Hippopotamus amphibius),* Tora hartebeest *(Alcelaphus buselaplus tora*); Cape buffalo (*Syncerus caffer*); Sommering's gazelle *(Gazalla soemmeringi*) as well as other species of ungulates. See Appendix 2 for the mammal list.

The Park supports large numbers of animals during the dry season and lesser numbers in the wet season (Dasmann, 1972). Species like tiang (*Damaliscus lunatus tiang)*, Bohor reedbuck (*Redunca redunca*), waterbuck (*Kobus ellipsiprymnus defasa)*, roan antelope *(Hippotragus equines*), oribi (*Ourebia ourebia)* and ostrich migrate to wet-season ranges (higher grounds) during the rainy season (Fig. 8). Elephants are believed to migrate from Ethiopia to the southern part of the Park during the rainy season as has been indicated by their tracks in the dry season near Magano and Jebel Halawa.

The Nile crocodile *(Crocodilus niloticus*), monitor lizards and many species of snakes represent the reptilian diversity. The report of Harrison (1953) was later confirmed by Forbes (1950) and Bernatizik (1959). Python, monitor lizard, and various species of snakes represent reptile species that occur in the Park. Crocodiles were said to have been in abundance in the past. They are rarely seen nowadays. Poachers have drastically reduced pythons and monitor lizards in numbers.

Dinder is host to abundant colourful starlings (*Spreo spp*), bee-eaters (*Merops* spp), sunbirds (*Nectarinia spp*), herons (*Ardea spp*), egrets (*Casmerodius* spp), rollers (*Coracias spp*.) and many others.

Among the more common and interesting birds are the following (Dasmann, 1972 and Nikolaus, 1987):

Bustard, (kori)	*Ardeotis kori*
Bustard (Lesser)	E*upodotis senegalensis*
Egyptian goose	*Alopochen aegyptiocus*
Guinea-fowl (tufted)	*Numida meliagris*
Hadada ibis	*Hagedashia hagedash*
Sacred ibis	*Theskiornis aethiopicus*
Marabou stork	*Leptoptilos crumeniferus*
Pink-backed Pelican	*Pelecanus rufescens*
Sudan dioch	*Quelea quelea*

See Appendix 3 for the complete bird list.

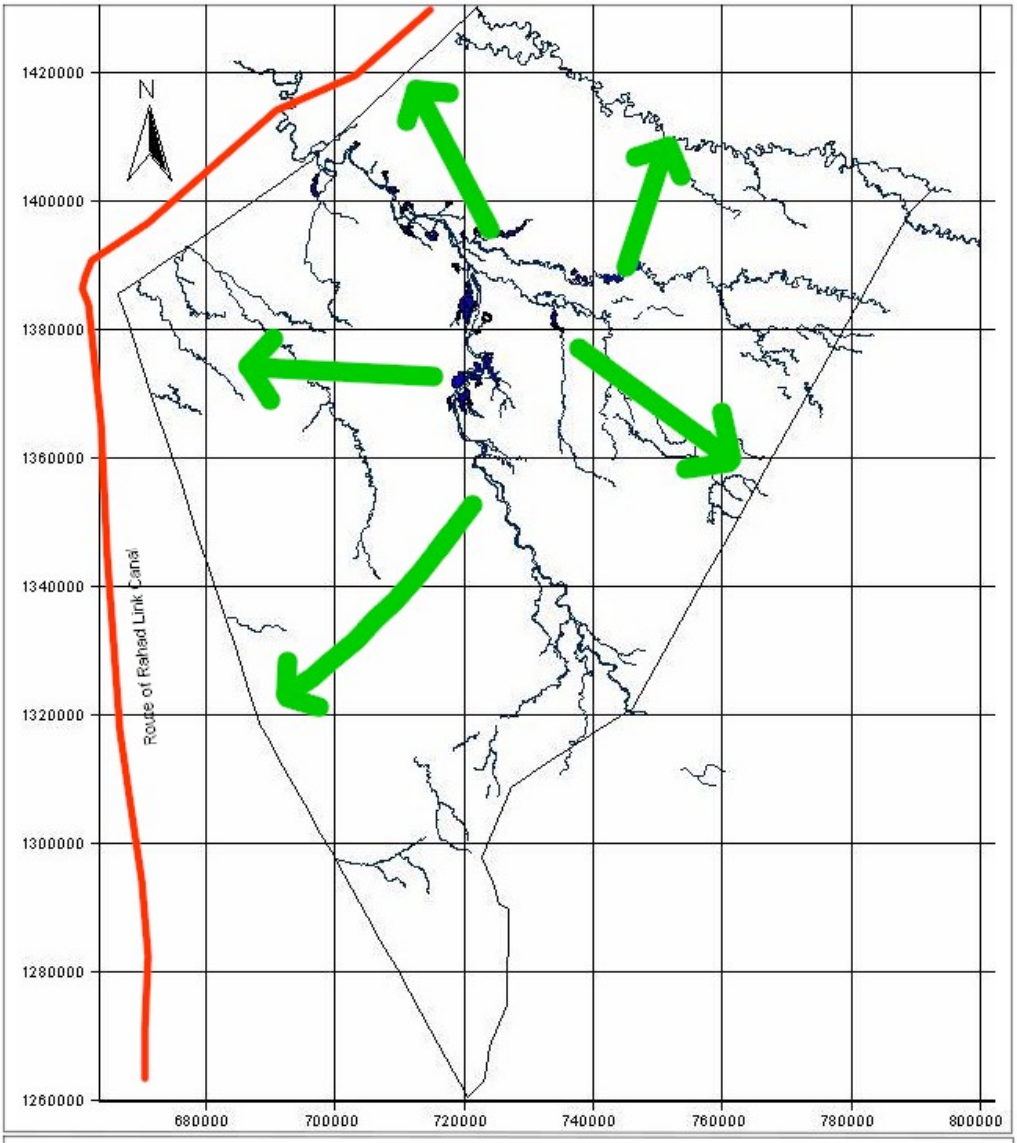


Figure 8:Migratory routes during the wet season in Dinder National Park

B.2 The Importance of the Park

The global significance of DNP arises from its geo-physical location. DNP lies along the transition ecotone between two floristic regions: the Ethiopian highland plateau and the arid Saharan Sudanian biomes. The park also lies along the boundary of two major faunal realms i.e. the Palearctic and Ethiopian region. DNP is also situated along the north-south flyway of migratory birds. Thus the protection of the park is of global importance as it provides a refuge for large number of migratory birds and protects endemic species, which live in the region or are permanent inhabitants of the park.

The DNP is a biosphere reserve within the UNESCO network of protected areas since 1974, which is meant to integrate local communities in the conservation and sustainable use of biodiversity. The DNP is also a proposed RAMSAR site. The recent archaeological discoveries in DNP could enhance its significance as a cultural site. DNP also has an indigenous tribe the "Gumuz" which has been living in the park since 1912.

The demands for efficient and immediate utilization of natural resources are increasing worldwide, especially in tropical countries with fast growing human populations. As a result, many national parks, like Dinder National Park (DNP), are subject to many outside influences. To survive these external pressures, DNP should be managed in ways that convey real benefits to the local and national human communities. There are many ways in which DNP can bring valuable benefits to the communities living near the park. Only a few will be discussed below.

(i) Wild Products

The communities living around and within DNP could be allowed to make use of several species of wild plants and animals for food, traditional medicine as well as for commercial purposes.

(ii) Tourism

DNP could further be developed to facilitate the growth of tourist industry. Local economies can benefit considerably through the sale of handicrafts and through local employment. At the national level, tourism could bring valuable foreign exchange into the country, and at the regional or local level, stimulate profitable domestic industries, hotels, restaurants, transportation systems, souvenirs, handicrafts and guide services.

(iii) Recreational Facilities

Local communities and many other domestic and foreign visitors can benefit from the recreational facilities of DNP. These benefits will become even more valuable since DNP is the nearest park to the central big towns. It is also much closer to the Middle East and European countries than the Central and Southern African National Parks.

(iv) Educational Facilities

Dinder National Park is a valuable site for school and university students to gain practical education in the fields of biology, ecology, geology, socio-economics and so

forth. Such uses can extend to, and ultimately benefit, a large proportion of the local populations.

(v) Research and Monitoring Facilities

Humans have much to learn on the subject of how to better use tropical environments. Many of our present agricultural practices result in soil degradation. Much applied research still needs to be done on natural tropical ecosystems. Dinder National Park is one of the excellent natural sites for such studies on the national as well as on the global levels. The data and information from such research can be used in monitoring trends in comparable ecosystems.

Wildlife Research Center (WRC), Institute of Environmental Studies (IES), Juba University, Khartoum University and University of Sennar are all involved in conducting research, holding seminars for graduating students in topics related to various wildlife issues. Generally, the subjects covered include habitats, ecology, population counts and dynamics as well as natural and man-made problems threatening the park. A few studies included socio-economic and management issues. Research carried out by these institutions had traditionally focused on aspects that were identified as academic priorities. While this approach has made significant contributions to the greater body of scientific knowledge it has made a very limited contribution to the management of critical problems.

There is a need to direct research efforts towards subjects that actively assist the management of the park. Areas of research priorities should be directed by the management needs.
The factors that make animals of the Park migrate during the rainy season are not properly understood. However, there are three possible reasons.
Firstly, the heavy clay soil becomes sticky and, therefore, impedes animal movements in the wet season. The second possible reason is the presence of abundant biting flies (*Tabanidae*). These flies bother the animals during the wet season. The last reason may be that some wild ungulates prefer areas with short grasses since these grasses are more nutritive than tall-matured grasses (Bell, 1970).

Since the establishment of DNP in 1935, some wildlife species have disappeared from the Park. These include elephant, black rhino, hippopotamus, tora hartebeest, giraffe, crocodile and Soemmering's gazelle. There are two probable reasons for this: human interference with the ecosystems of the Park (poaching) and / or natural factors such as persistent periods of drought and frequent outbreaks of diseases. At present species like tiang, roan antelope, buffalo, and waterbuck have drastically been reduced in numbers.

Before independence in 1956, no efforts have been made to census the animal species in the Park on a systematic basis. Minga (1971) made pioneering counts on nine of the main mayas of the Park. He counted a total of 5 613 large game during the period of March –April 1971. Again Dasmann (1972), Abdel Salam (1985), Abdel Hameed *et al* (1994), Kuol (1989) and Kano (2000 and 2001) conducted road and maya counts in the Park. Even though the methods of counting were not identical in objectives as well as not equal in intensity and extent of coverage, their efforts are worth noting.

To visualize the trends of animal population dynamics during the past years, Dasmann's road counts of 1972 have been chosen as the base for comparison with those subsequently recorded by other researchers (Tables 11 to 14). According to Dasmann (1972) the most common animals in the Park were reedbuck, oribi, tiang, and waterbuck. From the figures presented, it is clear that the numbers of each species have been and are still declining. Comparing populations of 1972 and 2001, it seems that reedbuck populations have declined by 72% oribi by 68%, and waterbuck by 85%. Tiang is, at this point in time, rarely seen in the Park, which is an indication that they have almost disappeared. Buffalo and roan antelope are following suit.

Table 11: The Strip Transect Count of Wild Animals in DNP at June 2002 (HCENR,2002)

Transect	Species												
	Reed Buck	Oribi	Warthog	Ostrich	Waterbuck	Singa Gazelle	Green monkey	Patas monkey	Baboon	Bush buck	Monitor lizard	Mongoose	Roan antelope
Galegu-RasAmir	62	14	7	-	-	-	-	19	21	-	-	-	-
Shari-Haran	28	7	41	-	11	-	-	-	116	-	-	-	-
Galegu-Haneifa	11	6	9	-	-	-	-	1	15	2	-	-	-
Gererrisa-Dabkara	176	9	12	25	-	-	1	1	71	-	-	-	-
Galegu-Farsh el Naam	61	13	35	11	-	8	-	2	70	-	-	-	-
Galegu-Haneifa	159	25	6	-	-	4	-	1	1	2	1	-	-
Ein el Shamis-el Seneit	14	17	14	17	49	4	-	-	-	8	-	-	-
Galegu-Al Abyad	10	-	50	-	-	-	-	-	-	10	2	1	1
Total	**521**	**91**	**174**	**53**	**60**	**16**	**1**	**24**	**294**	**22**	**3**	**1**	**1**

Table 12: Counts of Wild Animals at Pools in DNP, June 2002

Mayas	Reedbuck	Oribi	Warthog	Ostrich	Water buck	Singa Gazelle	Green monkey	Patas monkey	Baboon
RasAmir	9	-	9	36	-	-	1	-	-
Ein el Shamis	12	9	3	2	18	5	-	7	6
Maya Musa	3	-	-	14	-	-	-	-	-
Dabkara	83	-	29	-	-	-	-	-	-
Beit El Wahash	154	14	36	-	-	-	-	-	-
Simaaya	2	1	126	-	-	-	-	-	-
Haneifa	7	3	2	4	-	-	-	-	-
Al Abyad	-	-	11	27	-	-	-	-	-
Gererrisa	26	5	24	-	-	-	-	-	-
Total	**296**	**32**	**243**	**83**	**18**	**5**	**1**	**7**	**6**

Source: (HCENR), 2002)

Table 13: Total estimated Number of Wild Animals in DNP. (1972-2001)

Species year	Reedbuck	Oribi	Tiang	Waterbuck	Roan antelope	Bushbuck	Buffalo	Greater Kudu	Red-Fronted gazelle
1972	118677	23037	8742	10239	465	233	-	-	-
1983	67604	4374	-	1590	397	795	5965	-	-
1989	94528	26880	9248	8736	224	2016	300	-	396
1994	34400	9900	3300	1200	3600	-	500	-	-
2000	5824	2683	21	1344	85	-	358	-	17912
2001	33401	7366	-	1524	762	2038	-	1524	635
2002									

Source: Dasmann (1972), Abdel Salam (1983), Kuol (1989,1994), Kano (May, 2001) and HCENR(2002)

Table. 14: Number of Wild Animals Counted in Road Count in DNP (May, 2001)

Transect	Reedbuck	Waterbuck	Bush buck	Oribi	Red fronted gazelle antelope	Roan antelope	Greater Kuku	Baboon	Patas Monkey	Grivet Monkey	Warthog	Mongoose	Civet cat	Ostrich	Bustard
Galegu-Farsh el Naam	17	-	-	1	-	-	-	11	1	-	7	-	-	13	1
Galegu-Ras Air	13	-	-	6	-	-	-	13	3	-	-	-	-	-	-
Galegu-Ein Es Shamis	20	-	1	3	-	1	-	15	2	2	5	1	-	-	-
Galegu-Mayat Musa	5	2	2	2	-	3	-	14	2	12	-	-	-	-	1
Galegu-Moh. Dafalla	35	-	4	2	-	-	-	28	1	1	3	-	-	-	2
Galegu-Gererrisa	65	6	1	11	762	2	-	48	1	1	10	-	-	1	-
Gererrisa-Dabkara	14	-	6	3	-	-	-	96	9	5	3	-	-	-	-
Galegu-Mayat Samaaya	13	-	6	1	-	-	-	90	-	8	6	1	1	-	-
Al Abyad-Al Tabya	10	-	4	20	5	-	12	126	13	8	18	-	-	17	-
Galegu-Sambroug	71	5	-	9	-	-	-	55	1	-	50	-	-	20	-
Totals	263	13	24	58	5	6	12	496	33	37	102	2	1	51	4
Estimated Population	23401	1524	2038	7366	635	762	1524	54064	4081	4499	12954	254	127	6477	508

Source: HCNR – WRC (2001)

Fish

The productive mayas in DNP contain large quantities of fish during the dry season, for example, in Simseer, Samaaya, Gererrisa and Ras Amir. The most important species include "garmut" *(Clarias laser*), "*nook*" (*Heterodox niloticus*), "*gurgur*" (Y*nodontus* spp) and "*bulti*" (*Tilapia niloticus*). Birds, like herons, pelicans, Marabou stork, fish eagle and waterfowl, feed upon them. Illegal fishing, by local communities surrounding the Park, takes place every dry season.

Amphibians

Frogs and toad species mostly represent these. They are preyed upon by small cats, owls and other bird species, along the riverbed and at the edges of the productive mayas.

Insects

There are various species of insects in the Park, only a few of which have been surveged. The riverine ecosystem harbours specialized species of insects such as the small mound builder *(Trinarritermas geminatus*), and the great mound builder *(Macro termites)*, which are preyed upon by the pangolin *(Mains temminck),* Aardvark *(Oryceteropus afer*) and other species of insectivores. The mounds are mostly found in high frequency in the southeastern part of the Park.

The other species that is prevalent in the Park during the wet season is the *Tabanus* fly.

The insect species that is of economic importance to the local communities living around and within the Park are the bees. These insects make many beehives in the hollow of trees. When the season is ripe, some individuals from the local community enter the Park illegally to collect honey. These individuals are, sometimes, the cause of uncontrolled fires in the Park every dry season.

Finally, sand fly is prevalent in the whole of Dinder area especially when humidity is high. It is the host of the parasite that causes kalazar (leshmaniasis).

B.3. Human settlements

B.3.1. Indigenous Community

The population of Magano Mountain village was known to exist at the southwestern boundaries of the park before the Park was established. The community is an indigenous population that depends mainly on rain-fed agricultural crops and domestic livestock, mainly goats.

They settle inside the Park in the dry season largely due to the scarcity of water in the wet-season settlement. They construct temporary straw huts during their stay in the Tabia area, near the main game post in the southeast part of the Park. At the onset of the rainy season, usually in June, they return to their village. At this time of the year, the wildlife personnel at Tabia post periodically burn their huts as well as those of the

Magano residents, as a means of preventing poachers and other intruders from using the huts.

When the Park's boundaries were extended in 1983, the Magano population was directly affected by the new extension. Instead of being located outside the Park's boundaries, the village is now situated well inside the Park. Consequently all day-to-day activities of the Magano inhabitants are practiced inside the park since then. (Awad *et-al,* 1992).

B.3.2 Socio-Cultural and Demographic Setting

The population of Magano traces back their history to 1912. The founder of the place was El Hidirbi Yousif Abu Aggla, who after leaving his original area, settled in Magano. The population is not from a single ethnic group. Originally the area was under the authority of the *Hamaj* tribe, since the times of the Funj Sultanate (five centuries ago). The dominant group now is the *Hadarba*. They, by virtue of their descent from the founder are the elites of the Magano Community. They affiliate themselves to the *Hamada* tribe, which is one of the dominant Arab nomadic tribes in the Blue Nile area. The *Hadarba* claim that their historical homeland is el Zomati, well inside the declared boundary of the Dinder National Park.

Size-wise the Gumuz are the second distinctive ethnic group inhabiting the Magano Mountains. Ethnically, the population of the Magano Mountain Community belongs to four major tribal groups: *Hamaj, Funj*, *Gumuz* and *Abu Ramala*. The percentages of these tribal groups make 82.9% of the population. The rest belong to the *Halloween, Agallen, Nuba* and *Dinka*. The *Hamaj* is the third significant group. They are the decendants of the Funj in the kingdom of Sennar and who, historically, inhabited this area and then found their way to the Magano village. The Gumuz have their distinctive dialect and cultural practices, yet this has been subdued by the dominant culture of the Abrmlaween (Hadarba). This materializes in the dialect of the Hadarba being the medium of communication. It also has another cultural manifestation, that is, the dominant music is the *Bajindo*, which pertains to the Hadarba culture.

Although the Gumuz have their own cultural performances, yet the *Bajindo* remains the sole music that accompanies most of their rituals. A popular type of Islam is adopted among the Magano Community. However, the Gumuz are more or less pagans, yet acculturated with Islam.

B.3.3 Kujur (Myth)

As has already been stated the Magano community has built its own system of beliefs. This manifested itself around certain taboos and prohibitions. Water is a cardinal issue for the Magano community. It decides their settlement and movement. They accordingly move in the dry season deep inside the Park, at Tabia, where the river retains a permanent pool. Their rainy season's source of water for domestic usage is "*khartoush*" well. Myths having dominated the mentality of the public and water being a vital issue, the foundation of the well is surrounded with taboos and prohibitions.

Long ago the people experienced shortage of water. The story says "Once the great founder, El Hidribi, at a time when the shortage was at its peak, was slamming with his stick at the mountain; he by chance, found a crack on the mountain. He followed it to the bottom and found that it is a source of water. He went and confabulated the "*Kujur*" who said that this must be akin to "Jinn" work. The "*Kujur*" advised that this water could be used, however, with certain prohibitions and taboos".

As women are the water collectors in this and other communities, these taboos are related to them. For instance, women who have menstruation periods are not allowed to collect water. It is narrated that the sister of Hidirbi was in her period and she asked her girl friends to fetch water for her. They refused teasingly; the *Jinn* snake appeared and killed her. She disappeared and everyone believed that she has broken the taboos and hence has been sanctioned by the *Jinn*.

Again, along the same topic of purity, if a woman is accused with a sinful relation with men, she is forbidden to fetch water. The guardian snake would not allow her to do so by stretching and covering the mouth of the well.

The *Kujur* is the one who controls bees, their existence and production of honey. He is the one believed to decide on the movement of bees and the season of honey collection. Normally a decent quantity of the best honey collected, is entrusted to someone to hand it to the *Kujur*. If this amount, for a reason or another did not reach the *Kujur,* or if he is not happy about the quantity given to him, he would not openly complain. He, on the other hand, is believed to punish the community by depriving them, for successive seasons, from bees and, hence, honey. This goes on until the community discovers the reason behind it and makes its remedy. The *Kujur* has to be compensated; the community has to pay a fine that consists of goats, tobacco, salt, spices and so forth. This issue of *Kujur* has its connotations: (i) Absolute believe in the outstanding abilities of the *Kujur*, and (ii) The economic exploitation of the *Kujur* to the people.

The *Kujur* is the holy man of the community who is believed to heal, make rain, attends and blesses ritual performances, contains pests, cares for bees and so on. Myth plays an important role in the life of the Magano population (about 300 individuals). Although this community is of recent origin (1912), yet it created its rites and symbolic life, which is, weaved around myth.

The *Kujur* is of a mythical origin. The myth says: "when the women went to fetch water, they found a motherless lactating child near the river. They brought the child to the village and consulted the Sheikh and hence the *Mangil* of what to do about the child. The child was taken care of by the family of Hangog Abu Gash. The myth continues to narrate; the child transforms itself into a bearded-man with a pipe. Some of the women saw this incident and told the men who in their turn told the *Mangil*". "The *Mangil* asked some men to make a hide and watch the child from a distance and if this story proved to be true, they have to throw at him seven eggs. It happened accordingly and the child remained in the form of the bearded man. The *Mangil* again decided that he should get married to one of his custodian family. Ever since them, he and his descendants were crowned as the *Kujur* of the group and the custodian family

members as his "*hiran*" who mediate between him, the Sheikh and the rest of the group".

Gadaa El Naar is a ritual that is of economic and political significance. The month before the harvest of corn, first crop harvested, is a month of taboos. The *Kujur* prohibits the community to set fire outside the houses for domestic purposes or otherwise, if it is proved that one of the group has broken these taboos, he is fined by the *Kujur.* On the last day of the prohibited month, at mid-night, all the community gathers at the foot of Magano Mountain holding fire sticks. The Sheikh counts up to seven and the community echo after him, and then they toss the fire sticks far away. The *Kujur* attends this ceremony but from a distance. The economic significance of *Gadaa El Naar* is that it is an announcement of the commencing of harvest. Fire is symbolic of hunger. The community believes that the *Kujur* and his "*hiran*" control food and hunger. At the end of the rituals of *Gadaa El Naar*, the people start eating and drinking Marissa (Local beer), dancing with the *Bajindo* up to cockcrow.

B.3.4 Land Use and System of Production

There is no land scarceness. Village land, under all different uses including cultivation, is under communal tenure. Crops are produced under shifting cultivation practices, whereby a land holding is cultivated for a number of years, after which it is left to rest. Meanwhile a new plot of land adjacent to the old one is put under cultivation which is usually done by felling of trees and clearance of land.

The main crops cultivated in this area are sorghum (Dura), sesame, beans, pumpkins, okra and cucumber. Other crops include maize, cabiscum and groundnuts. Farmers care more for securing their stable food crop, so that sorghum ranks as their staple crop. There are other activities that include rope making, bed making and casual labour in nearby agricultural schemes.

B.3.5 Livestock

Livestock raising stands as an important productive activity of the population. Table 15 illustrates that goats are raised by 55.2%, poultry by 65.5%, donkeys by 13.8% and sheep by 6.9% of the population. Goats and sheep are kept for their meat, cash returns, milk as well as the social significance in bride wealth, while donkeys are used for transport. Poultry are mainly used for festivals and cash return.

Table 15 Livestock Ownership among Magano Population.

Livestock	Goat	Donkey	Poultry	Sheep
Number	16	4	19	2
%	55.2	13.8	65.5	6.9

Source: Awad *et al* (1992)

B.3.6. Impact on Natural Resources by Magano Population

B.3.6.1. Hunting Activities

The community of Magano village hunts small animals like the rock hyrax, porcupines, guinea fowls and cane rats. This is done more or less on subsistence level rather than commercial hunting, because their customs and rituals are very rich with myth related to wild animals.

B.3.6.2 Energy

Fuel wood is the main energy source used by the inhabitants. The collection of firewood in the past was from around Magano village. Now women walk for about 10 km in search of firewood. The most preferred trees that are used as fire wood production in order of preference are: *Acacia seyal*, *Combretum sp*. and *Anogeissus sp*. The above-mentioned species of trees are now not very frequent in their occurrence compared to the other species in the area. It is, therefore, obvious from the distance the women walk for firewood collection, how these tree species have been drastically affected, and if this practice continues at the present rate, these species will disappear in the near future.

B.3.6.3 Grazing of Livestock

The Magano population used to graze their animals in an area about three kilometers west of the village, but at present they are forced to graze their animals up to six kilometers away, on the west and east of Magano. In the dry season, while in Tabia, they used to graze their animals within their temporary camp, not more than half a kilometers away, but now they herd the animals for a distance that may exceed three kilometers away from Tabia .The animals have to drink from the Tabia water-hole. Consequently the perennial grasses and herbaceous plants in Magano and Tabia have been depleted. The grazing resources at present are largely the short-lived and less nutritious annual grasses.

B.3.6.4 Fire and Trees Felling

Fires are lit for land preparation or for cultivation and for honey collection. Fires are usually ignited during the dry season. With the absence of fire lines they may continue burning for days. The adverse effects of fire are manifested in the severe damage of perennial grasses, shrubs and even trees in addition to the damage of viable seeds.

Felling of trees is practiced to increase the land under cultivation or collect honey from large trees. However, expansion in agricultural land is usually practiced when the land under cultivation is exhausted and its productivity declines. The expansion of agricultural land is prohibited east of Jebel Jerabo, which is about five kilometers on the eastern side of Magano.

The irrational felling of trees may adversely affect the vegetation cover of the area leading to soil degradation and the disturbance of the soil-moisture balance.

B.3.6.5 Dom Palm Leaves

The population collects the Dom palm leaves *(H. thebaica*) to make beds, small stools, ropes, local mats and handicrafts. They collect the leaves of young trees mostly in the sapling stage in the form of bundles. The *saaf* (leaves of Dom Palm) in Magano is present around the mountains. The Tabia area is devoid of the young saplings of *(H. thebiaca*). The *saaf* is collected not only for local use, but also for commercial purposes, which place a continuous pressure on the palm tree and endanger its existence.

B.4 Human Settlement Around the Park

When visiting the Dinder area in 1898, Harrison noticed that the area was devoid of human presence, but remnants and traces of earlier human settlements were evident (Mohamed, 1999). The resettlement of the area was intensified by immigration from the famine-stricken areas in western Sudan and West African countries together with the severe droughts of 1980s (Suliman, 1986). West African Muslims used to pass through the area in their pilgrimage journey to and from Mecca, and many of them decided to settle in the area permanently. A large number of these immigrants have settled along the banks of the Rahad and Dinder rivers.

The influx of populations into the area has been further exasperated by two additional factors: (i) The introduction in 1950 and the subsequent unplanned and uncontrolled expansion of mechanized rain-fed agriculture, which created a soaring market for wage labour, and thereby attracting increasing numbers of workers who settle seasonally or permanently in the vicinity of the Park. Mechanized schemes gradually encroached closer and closer to the Park, reaching a distance of less than 10 km. Their distance form the Park's boundaries were 27-28 km in 1985 (Moghraby and Abdu, (1985). (ii) Recognizing that according to the Land Registration Act, of 1905, all land, with limited exceptions, is public land, native administrators and tribal leaders distributed traditional agricultural land to migrants and urged them to settle in the area in quest for consolidating their own powers and authority and extending their influence over the area.

As a result of this population influx, existing villages continued to grow and new settlements adjoining the Park were established during the latter half of the twentieth century, i.e. no less than 20 years after the establishment of the Park, and some villages, like Um Sagiet and Um Bagara, were established as late as the mid 1980's.

When an additional area of 2630 km^2 was added to the Park in 1983, many villages consequently fell inside the Park and the others became closer to its new boundaries. However, most studies and surveys concentrated on the villages situated along the Rahad River. There are 10 inside the Park and 38 outside it. Villages inside the Park are: Ain El Gamal, Um Kakar; Nour el Madeina; Hanou el-Shateib; El-Hanon el-Azrag, Um kura west; El- Gammam west, Hilat Hashim, El-Khairat; and Um Salala. Most of the Rahad villages outside the Park are within a distance of less than one kilometer from the boundaries of the Park.

Adjacent villages in Sennar State have not received adequate attention because they fall at a distance of more than 10 km from the Park. Likewise, the adjacent villages of the Blue Nile State were not adequately studied because of security reasons. It is worth noting that most of the Park's villages have witnessed a tremendous increase in population size and economic activities.

The tribal structure of the communities living around and within the Park illustrates a multiplicity of tribes. Those from western Sudan, constitute 43% of the villages population, followed by Arab tribes (20%), West African tribes (13%)and Nilotic tribes account for about 8% (Mohamed, 1999). The Masaleet come first among the tribes, making up to 30.5% of the population then follows the Burgo (17.5%) the Dago (11.9%), Fellata (6.9%), Dugul (2.1%), Dinka (1.3%), Nuba (1.2%), Messairia (1.02%) and Rashaida (1.2%), (HCENR, 2001).

B.4.1 Pastoralists – Nomadic Groups

In parts of the Park the Nomadic Groups tres pass during the dry seasons to use the available water and grazing resources. This again attracted more nomadic pastoralists. The large numbers of livestock that roam the Dinder area belong to these nomadic pastoralists who emigrate during the dry season from the three States as well as from other areas like the White Nile, the Butana and Eastern Sudan.

Nomads are strongly attached to their animals, which provide a multiplicity of functions for them, for example, source of food and cash, means of transport, source of raw materials for handicraft and social status. Thus they can do everything they can to feed and water their herds. The only place to get these resources is Dinder National Park. The consequences of large numbers of livestock entering the park are the over-grazing on the maya and the transmission of diseases.

B.4.2 Land-use (Agriculture-Livestock)

B.4.2.1 Agriculture

Agriculture is the main economic activity in the region. It is of two types: traditional rain-fed and gerif cultivation.

In the traditional rain-fed agriculture, a variety of crops are grown (Table 16). Table 17 shows the area of agricultural land owned by households. The average area per household is about 19 feddans.

In Magano the average household agricultural area is only 5 feddans. About 24% of the surveyed Rahad households are landless. They rent land to cultivate. Local leaders who assume the responsibility of land distribution own large agricultural lands.

Table 16 shows that most of the cultivated area is put under dura as the main stable crop and sesame as the main cash crop. The productivity of the two crops is quite low. Besides dura, households consume varying proportions of the other crops: 50% of the cow peas, 27% of the pigeon pea , 26% of the millet, which is the second stable crop, and 19% of the groundnuts.

Table 16: Crops Statistics, 2000 Season

Variable	Crops						Total
	Dura	Sesame	Millet	Groundnuts	Pigeon peas	Cow-peas	
Area cultivated (Fed)	1444.8	1311.9	224.5	72.8	49.0	13.1	3116.1
% Total area cultivated	46.4	42.1	7.2	2.3	1.6	0.4	100
Production (Sacks)	1797	1094	219.5	126	78.2	9.3	3324
Productivity (Sack/fed)	1.2	0.8	1.0	1.7	1.8	0.7	-
Consumption (Sacks)	911.5	15.5	55.3	21.8	23.7	4.7	1032.5
Sold (Sacks)	792	1015.5	138	79.5	50.5	4.7	2080.2
Started (Sacks)	77	15.9	8.7	17.0	2.0	0	120.6
Other uses (Sacks)	16.5	47.1	17.5	7.7	2.0	0	120.6
Average Price (SD/Sack)	3585.7	3585.7	2666.6	2886.6	7820	?	-

Source: HCENR – 2001

Table 17: Agricultural Land and Household owners, 2001

Area (feddan)	Owners, %	Who cultivated in 2000, %
Zero	23.7	14.4
1-15	42.3	58.8
16-30	13.9	15.5
31-45	5.7	7.2
46-60	7.7	2.1
61-70	1.0	1.0
71-85	1.0	0.5
. > 85	4.6	0.5

Source: HCENR – 2001

B.4.2.2 Gerif Cultivation

Gerif land is the land that stretches along the riverbanks and from which floodwater recedes i.e. flood plain. It is thus quite productive since soil fertility is annually renewed by floodwater and has a high rate of water retention. All Rahad villages inside the Park possess gerif land, with Um Kura west having over 46% of all gerif lands while Um Salala has only just over 1%. Crops produced here are mostly high-value vegetables and fruits (Mango, guava and paw paw) as well as beans. 71.3% of gerif land owners have their own financial resources while 16.4% got finance through the *"Shail"* system with merchants, 7.2% obtained finance from friends and relatives, and 5.1% from banks in the 2001 season. During this season 71% of the gerif land was cultivated by its owners, 23.2% left fallow, 4.8% rented and 1% cultivated in partnership.

After harvest the gerif land is usually rented out to nomads .The crop residues are a valuable resource, in the dry season. This is an added reason for animal herds to enter the Park.

B.4.2.3 Animal Husbandry

The permanent residents keep limited numbers of domestic animals (goats, sheep, donkeys, chickens and sometimes cattle). They mostly favour small animals and poultry because of convenience. Almost 90% of the surveyed settlers have no cattle at all. Only 1% possesses 15 goats and sheep. The per village number of animals in the surveyed Rahad villages varies between zero and 500 with an average of 107 for cattle, between 10 and 30,000 (an average of 1367) for sheep. Between 15 and 500 and an average of 221 for goats. Between zero and 10 and an average of 2 for camels and between zero and 500 and an average of 33 for donkeys (HCENR, 2001).

It is only the rich households that own cattle. Settled villagers generally keep their animals in their vicinity. Animals graze first on the natural pasture around the villages, and then they move into the traditional and mechanized rain-fed farms to feed on crop residues and sometimes they move into the Park.

B.5 Problems and Threats to the Ecosystems and Biodiversity

There are many problems and threats to the ecosystems and biodiversity of Dinder National Park. These problems and threats are all related to various human activities by the communities living around and within the Park and also by those who are living in large towns.

B.5.1 Mechanized and Traditional Rain-fed Farming

Both the mechanized and traditional rain-fed farming are causing a great deal of harm mainly to the migratory wildlife species. The wet seasons habitat of these wildlife species have been largely occupied by mechanized rain-fed farming. The vegetation of these wet season habitats has been cleared to give way for the production of various crops. When animals come to their wet season habitats, they are considered as vermin and therefore are shot at sight. This is one reason why the populations of tiang and roan antelope have drastically been reduced. The meat of game species killed is used “illegally”for feeding the labourers who work on the farms.

B.5.2 Hunting and Poaching

Illegal hunting and poaching inside the Park are common activities both in the wet and dry seasons. It has been, and still is, the practice to close the Park and pull out all staff at the start of the rainy season. The few game scouts who remain at Galegu then patrol the wet season ranges of the Park's animals. This leaves the Park wide open to poaching. The magnitude of illegal hunting or poaching can be judged from table 18.

Table 18a: Number of Violations Inside DNP Committed by Rahad Villagers

Year	Herd/ Animal (H/A) no	Gum collectors	Poachers	Trespassing	*Saaf* and honey collectors	Fishing	Weapons (Possession)
58/59	-	-	15	-	-	-	-
59/60	9 H	59	2	-	-	17	-
60/61	-	144	2	-	6	-	-
62/63	2 H	82	3	-	-	-	-
64/65	-	-	18	-	-	6	-
65/66	-	-	-	-	-	-	-
66/67	-	6	9	30	-	-	-
67/68	9 H	150	-	48	5	-	-
69/70	-	-	5	-	85	-	-
73/74	135 A	11	65	15	4	33	-
76/77	270 A	-	10	8	36	29	
80/81	422 A	-	55	96	-	27	25
1985	-	-	-	-	-	-	-
1986	4 H	-	27	-	-	-	47
1987	9 H	-	18	-	-	-	4
1988	31 H	-	29	-	-	22	5
1990	36 H	-	5	-	-	2	-

Source: Ministry of Interior, 1990

Table 18b: Illegal activities in Dinder National Park 1998 to 2003:

Year	* Cattle	* Camels	Livestock tresspassing (Number of cases)	Honey Collection	Fishing	Wood Collection	Palm trees Collection	Weapons Confiscate	Poachers	Vehcile entrance	Numbers of Livestock Caught inside the park		
											Sheep	Goats	Dondye
1998	2	5	37	7	7	12	4	8	4	0	0	0	0
1999	5	0	45	7	3	0	2	2	2	0	7822	877	57
2000	0	24	6	2	10	2	1	4	2	0	1535	158	4
2001	1	4	4	0	1	3	1	0	0	0	3006	354	16
2002				Note Availavle									
2003	6	11	7	1	0	22	1	5	0	7	4984	648	36
Total	14	44	95	18	23	36	10	15	12	7	17347	2037	113

Source: Ministry of Interior

In 1969 some inhabitants from Bandagheu poisoned a waterhole in the Park. As a result, several hundred animals were killed in order to make biltong for sale (Dasmann, 1972). Several game scouts have lost their lives at the hands of poachers inside the Park. Species like tiang, which used to be in thousands, have drastically been reduced to less than a hundred or and species like buffalo and roan antelope are reduced to a few hundreds.

B.5.3 Fishing

A few individuals from the communities, living around and within the Park, do illegal fishing in the productive mayas like Ras Amir, Gererrisa, Simseer and Samaaya. The species of fish available in these mayas are: "garmut" *(clarius lazera*), "noak" (*H. niloticus*), "bulti" (*T. niloticus*) and "gargur" *(Synadontus. spp*). These are locally sold, as dried fish, at the local market centres of the communities, the rich merchants and farmers buy most of this dried fish for feeding the labourers during the rainy season.

B.5.4 Honey Collection

Honey collection starts in the dry season, usually in the months of January to March. During this period the Park's personnel sometimes start many fires for one reason or another. Furthermore poachers and honey-gatherers usually cause many uncontrolled fires. The densities of tree species that are less resistant to constant fires give way to species that are resistant to fires, like *A. Seyal* and *Balanites*. The constant removal, by fire, of litter accelerates erosion. Repeated and uncontrolled fires will, therefore, change the composition of the vegetation and this in turn would affect the distribution of wild animals in the Park.

B.5.5 Tree-felling and Wood Collection

Cutting of trees, either the whole or parts, is a common activity around the boundaries of the Park. The local communities cut trees for many reasons. Trees may be cut for poles, which are used for building the huts. Branches that are not within reach of camels and goats are cut for browsing.

Trees are also cut-down for the production of charcoal, which is used as a source of fuel and income. Therefore, the trees of the area around the Park have been reduced to shrubs. The species of trees targeted are all species of *Acacia* and *Balanites*.
Sometimes villagers collect the dead wood that is also used as a source of fuel. However, repeated fires usually consume most of the dead wood and consequently most of firewood is acquired by cutting down live trees to dry up and later used as firewood. This activity again affects the biodiversity of the Park.

B.5.6 Non – Wood Products

There are two main non-wood products that are utilized by the communities around and within the Park. The first is the "*Saaf"* which are young leaves of the dom palm. These are used for making mats, baskets, honey pots and handicrafts. Some of the manufactured items are for household use and others are for sale. *Saaf* has also social functions and is of symbolic significance being weaved and tied around the hand and leg. It is perceived as a protection for spouses and circumcised girls against evil eyes. It is also used to protect the corpse from rotting until it is buried.

The other non-wood products include the wild fruits and other special parts of both plants and animals that are used for food and medication (Table 19). The wild fruits that are eaten include the dom palm, "Nabag" (*Ziziphus* spp.), "Lalob" (*Balanites*), and "Tebeldi" (*Adansonia digitata*). Some are sold in the local market centres.

Table 19 Wild Plants and Fruits used for Medication

Disease	Plant or Animal used
Malaria	*Tamarindus indica* and *Acacia nilotica.*
Fever	*Acacia nilotica* fruits *Acacia complycantha*
Rheumatic Fever	*Balanites aegyptiaca* and *A. commiphora* sp.
Stomach pain	Special type of plant roots *A. complycantha*
Minor Wounds	*Nauroea* sp. roots.
Jaundice	*Acacia seyal*
Toothache	Special type of plant roots.
Gonorahea	Special type of plant roots.
Fractures	Special type of plant roots.

B.5.7 Livestock Trespassing

The sedentary villagers keep limited numbers of domestic animals, usually small animals because they are less demanding. After the harvest the mechanized and gerif farmlands are leased to the nomads to graze their livestock on the crop residues. When the crop residues have been exhausted, the park, consequently, becomes an attractive area for large herds, during the dry season. Thus the herders will take serious risks and transgress on the park. Special mention is to be made here of the aggressiveness and high violence potential of the Umbararu tribesmen. They constitute a heavy burden on the limited grazing land. Signs of over-grazing have been evident in a number of mayas.

B.5.8 Fires

Fire assumes a significant role in the clay plain area of the Sudan along the 16-inch isohyet. All of the Dinder National Park lies above the 16-inch isohyet and is subject to frequent and often intense burning. Fire starts as early as mid-September (Dasmann, 1972). Thus fires start in the park before the Park personnel start to open the roads. Many of the fires originate and are admittedly set outside the Park by nomad herdsmen, agriculturalists and others, seeking to reduce the grass cover in order to improve access and visibility and to provide green perennial grasses for livestock. Other fires are set inside the Park by poachers, trespassing nomad herdsmen and honey gatherers. There is nothing the Park staff can do to control these fires without reliable means of transport and without fire-fighting equipment. They are forced to let fires burn on. The fact that the use of fire has a long history does not mean that the role of wildfire is necessarily good. The Park, at present, exhibits a variety and distribution of vegetation caused by repeated wildfires. Ideally, fire can be used as a management tool at the time and in the place needed to achieve Park's objectives. Some areas in the Park need to be burned annually to allow animal

viewing by visitors or to maintain areas of open or wooded grassland in their present condition.

In summary, the impacts inflicted on the Park are made by all who intervene in the Park to use its resources. These stakeholders include nomadic pastoralists and settled animal raisers, traditional rain-fed and gerif cultivators, mechanized rain-fed farmers, charcoal makers and firewood collectors, collectors of other minor forest products, poachers, fishermen and craftsmen. These activities, especially grazing, cultivation, tree felling, poaching, and fire setting tend to reduce the nutritional quality of wildlife forage and to reduce biodiversity, that is to say, put in jeopardy the very function of the Park.

B.6. MANAGEMENT STATUS

B.6.1 Administration and Other Related Governmental Issues

The wildlife resources, including the protected areas in their various forms in the country, are being managed by the General Administration for National Parks and Wildlife Conservation. The Administration Falls fully under the Ministry of Interior.

The Administration setup is of two main sections: the Administrative section which deals with the financial aspects, logistics, recruitment, promotions etc. The other section is the technical section which deals with wildlife utilization, anti-poaching, public awareness, and the National Parks unit and research activities in the country. The last unit is centralized. All said units function as policy designing bodies. The implementation is done by the Wildlife Units in the various states of the country. There are twenty six states in the country among which over 60% are covered by the presence of the Wildlife Forces with exception of some portions that the forces are not operating due to prevailing wars.

Since the establishment of National Parks in the Sudan in the middle of the 1930s, they have been managed with emphasis on law enforcement , depending fully on patrolling programmes. There were neither scientifically based policies nor pre-planned actions to enhance the adequate and smooth management. The only Park that had a management plan was the Southern National Park, which is located in the southern Sudan. Therefore the main activities of the Park authorities could be summarized in the following activities, taking Dinder National Park as an example.

- Conduct patrolling programs with special consideration to high wildlife populated areas and areas of special significance. (Mayas).
- Open roads using the very limited resources (one Motor Grader), which is not even operating at the present.
- Guide tourists and other official visitors (no interpretation given to tourists simply because there are no trained personnel to conduct such activities).
- Operate the water pump machines (Gererrisa, Ras Amir).
- Construct temporary huts that are made of local materials.

Generally the Park management was based on anti poaching as the main objective. That has resulted in the increasing enmity between the Park administration and the

local people. That misunderstanding has led at certain periods to casualties and death of people from both sides as a result of a lack of policies to gain the support of the local communities and involve them in the Park management.

The existing Wildlife law of 1986, which is a continuation of the subsequent amendments of the 1935 Wildlife Ordinance and which serves as the main legal code for the conservation of wildlife resources does not contain the modern concepts of Biosphere Reserves which consider Parks as places for man and nature, bearing in mind that Dinder National Park has been a Biosphere Reserve since 1979.

B.6.2 Personnel

The total manpower of the Dinder National Park is 280 men of which 17 are officers and the rest are non- commissioned officers and (game scouts). The Park manager with his supporting staff are stationed at Dinder town, which is 160 km away from the park. The rest of the manpower are located within the Park and in various game posts.

Table 20. Qualifications of the Officers

NO.	QUALIFICATION	NO	POSITION
1	MSc Wildlife Science	1	Assistant
2	B.Sc. Forestry Science	1	Manager
3	LL.B Law	1	Staff
4	B.Sc. Wildlife Science	2	Staff
5	B.Sc. Environmental Studies	2	Staff
6	B.Sc. Geology	2	Staff
7	B.Sc. Geography	2	Staff
8	B.Sc. Library and Documentation	2	Staff
9	Sudan School certificate	7	Staff
10	Non	1	Staff

The training status of non Commissioned Officers is basically military training and the educational qualification of most of them are below secondary school certificate. A few can write in Arabic and most, if not all, do not speak English (Table 20).

B.6.3 The Existing Infrastructures and Facilities

The Park Head Quarters is located in the Town of Dinder; therefore most of the permanent facilities are at the Head Quarters.

B.6.3.1 Buildings in the Head Quarters

1. Offices	05
2. Officers houses	04
3. Other houses	13
4. Stores	02
5. Fire arms and ammunitions stores	01
6. Rest House	01
7. Officers rest House	01

B.6.3.2 Buildings in the Park

The Park does not have any permanent buildings with the exception of one store found at Suniet Entrance Gate. The rest of the buildings are temporary constructed from grass and timber.

B.6.3.3 Transport Facilities of the Park

Land cruiser, poor condition	4WD	04
Land Rover, fair condition	4WD	01
Tractors, poor condition		04
Mitsubishi pickup,good condition.	4WD	01
Truck, out of commission.		01
Motor grader, out of commission.		01

B.6.3.4 Communication Facilities

Long range radios system fair condition.	05
Short range radios system fair condition.	05
Mobile telephones (Thuryia) good condition.	02
Satellite dishes.	03
Office telephone lines good condition.	01

It should be mentioned that the GEF funded project is improving the present infrastructure by constructing five fully self containing chalets in Galegu, that can accommodate at least ten visitors and a complete services attachment and electrical generator and solar energy that can cover the tourist camp site. These facilities have not yet been handed over to the Park authorities.

B.6.4 The Finance

Before 1992 when wildlife was not yet attached to the unified police forces under the Ministry of Interior, the central Ministry of Finance and Economics used to release a portion of the Wildlife Budget including the requirements of the National Parks. Immediately after the unification of the Police forces things dramatically changed. **There is no regular financial support from Government to run the National Park** with the exception of regular payment of salaries and provision of limited supplies of petrol and the donations paid by the Minister from time to time and which are never enough for the Parks' management. Therefore the park started depending on the revenues obtained from the sale of the confiscated livestock. The ideal budget for proper operation of park management is the budget that is estimated by the Park manager and which is based on the actual annual needs to maintain a National Park and it's biodiversity.

B.7 The Legislative Framework (Law enforcement)

The existing Wildlife law is the 1986 is the main legal code for wildlife conservation in the country. The law serves in the flowing forms:

- The law acts as a management tool whereby in some articles provision of powers to the wildlife personnel to be authorized to eliminate any wild animal

when it proves to be of danger to livestock in the surrounding villages or to avoid the spread of disease.
- The law serves tourism by provision of guidance and protection.
- The law allows promotion of the research activities in the Parks.
- The law prohibits any activities that could cause disruption in the ecosystems.

The normal procedure for the inaction of the law or amendments of its articles is done by the National Assembly by an initiative from the Director General of the Wildlife who acts as the technical advisor to the Minister of Interior, who will then submit the case to the Council of the Ministers and then to the National Assembly for endorsement.

The Ministry of Interior represented by the legal affairs Directorate which acts as the legal advisor to the Minister. The Wildlife Administration is the implementing agent for the Wildlife law. The powers of the Director are delegated to the states Directors.

The Wildlife law is implemented by other related bodies such as the Sudan Customs Forces at National and International Entrance points.

The implementation of the Wildlife law is carried out in the following forms:

- **Central law enforcement (**anti poaching unit**):**

This unit is centralized and is responsible for patrolling Wildlife areas around Khartoum state being the highest area of law violation. It can very well operate in any area in the country when requested to do so, and that includes National Parks.

- **Check points:**

These are fixed points located at Entrances. These are points that enter Khartoum state whereby inspection of goods is carried out looking for wildlife or their products.

- **Mobile teams:**

These are teams that inspect Markets and souvenir shops in the local markets and in Hotels.

The weak points of the existing wildlife law:

- The general principle objective of the law does not include the modern concepts of the Biosphere Reserves which are being looked at now as places for people and natural resources.
- The law does not consider local people and communities as part of the Environment of the Park.
- The penalties in the law are very harsh and ranges from fine, confiscation and imprisonment.
- The law has concentrated on enforcement and application of force, which have proved not to be effective, but have resulted in adverse results such as loss of lives from both sides, the Park personnel and the local communities.

B.8 Dinder National Park GEF & UNDP Project Achievements and Limitation

The Dinder National Park project was submitted by the Higher Council for the Environment and Natural Resources in collaboration with the General Administration for Wildlife and National Parks Conservation to the Global Environmental Facility GEF.

- The project aims at the maintenance of the Biodiversity of the Park .
- Sustainable utilization of the Park resources through involvement of the local communities in the Park management.

The project components

Core Zone:

This component is concerned with the establishment of administrative policy that insures the conservation of the Biological Diversity of the Park and that consist of the following.

1. Management plan, which contains all basic information that assist in designing an appropriate scientific management for the Park resources and involvement of local communities in the management of the Park.
2. Training of officers in wildlife fields and proper approaches in how to deal with local communities (Table 21).
3. Development of the basic infrastructure and this involves provision of drinking water, establishment of permanent buildings, establishment of permanent camp sites and maintenance of the Mayas and provision of appropriate maps and fire breaks network.
4. The project also encourages research, specifically in the Ecological and Biological fields, that could be supportive for the sustainable use of the biodiversity of the park.

Buffer zone:

This component aims at the followings:

1. Promotion of local people understanding of the Park and its importance.
2. Promotion of living standards among local communities.
3. Training of the local communities in various related aspects.
4. Drawing of land use plan in the buffer zone.
5. Establishment of money generating projects that assist the local communities.
6. Rehabilitation of forests in areas that have been deforested .

The project achievement:

1. Abdel Ghani Maya has been excavated to increase its water holding capacities.
2. Water measurement poles have been fixed in Mayat Abdel Ghani, Gererrisa, Simmaya, Farsh Elnaam, Ein Es Shams and Mayat Musa and Mayat Abdel Ghani.

3. A meteorological station have been fixed in Galegu game post and rain gauges on five different locations.
4. Hand pumps have been established in Galegu, Ras El Feel, Farsh El Naam, and El Abiad for provision of drinking water.
5. Sixteen camels two motorcycles and one motorboat were bought to assist in patrolling and game scouts were trained to use them.
6. An International Consultant was hired to assist in drafting of the management plan for the Park.
7. Radio communication systems were installed in Galegu and Dinder Town and mobile units were also provided.
8. Field guides were provided (Mammals and Birds) also Binoculars were made available to the Park Administration.
9. Different items were bought such as four 4X4 trucks ,one lorry, audiovisual equipment, GPS, computers office furniture and, table, and beds,. …etc.
10. Permanent buildings are being constructed in Galegu camp equiped with solar energy and diesel generator.

Achievement in the buffer zone:

1. A socio economic study was conducted in twenty-six villages inside and outside the Park and many parameters were determined such as date of the village establishment, the relationship between the tribes etc.

2. An educational program was carried out to promote the local understanding about the Park's importance. In phase one, twenty-one villages out of 35 were covered.
3. The targeted population for public awareness was 9 286 individuals, 34.13% being children, 41.81% males and 23.9% females.
4. Executing the public awareness campaigns 44 035 person were involved. Other training aspects in resources management were also conducted involved wildlife personnel, army forces and villagers in Umbagara and Tabia. About 30 meetings and lectures were conducted using different media methods such as Videos, visits and lectures and that covered 21 villages.

Table 21. Wildlife Personnel Training

TRAINING TYPE	PARTICIPANTS
Wildlife basic	25 Officers
Wildlife basics	30 Scouts
Wildlife census	20 Scouts
Meteorological station operation	30 scouts
Camels ride	24 scouts
Environmental awareness	02 scouts
Motor boat use and motorcuycle	80
Conflict management	02 Officers
Rural development	02 Officers
Computer	04 officers
Internet	01 officers
Camps management	20 Scouts

Table 22. Local People Training

TRAINING TYPE	TARGETED GROUP	NO. PARTICIPANTS	PLACE	DATE
Local leaders	Village local leaders (8) Villages	41	Galegu	May 2001
Public awareness	Public relation officers (3) states	22 (20 males)	Dinder town	June 2001
Honey farming	V.Cs (3 states)	21 (13 Villages)	Dulaeb Mugadi	March 2002
Feasibility studies	V.Cs Geary	28 (25 males	Aradeba El Tegani	April 2002
Local v.c training	V, cs (3 states) 15 committees	32 (30 males)	Galegu	May 2002
Women training	V, Cs and women	60 females	Galdok, Shebana, Umbaggara East +West	May 2002

The Revolving Fund Projects

The project managed to establish communal development programs, such as:

- Financing gas cylinders and stoves project.
- Individual project financing.
- Communal forest establishment.

- Detailed study on pastrolism in the three states.
- Boreholes drilling
- Establishment of solar energy units in schools and health centers.

Constraints

- The limitation of funds compared with activities laid out in the project document.
- The seasonality and the shortness of the dry season that affects implementation of plans.
- Transfer of some park manpower causes instability, which in turn is reflected in the planning process.

C. The Management Plan

C.1. Planning Philosophy and Approach

Philosophy is a system of personal ideals and principles, and must depend heavily on concepts of morality that provide direction and motivation to wildlife managers who believes that wildlife management is significant and valuable to our society (Bailey 1982). This belief is based on a strong appreciation of wildlife and nature that contribute to the quality of life for all people. Hence conservation of wildlife in Dinder National Park should be practiced not for immediate reward, but mainly for future benefits to communities, region and the nation.

The establishment and management of protected areas is one of the most important ways of ensuring the conservation of natural resources. National Parks by definition should be secured from unrestricted use of their resources. The philosophy of resource use is based on a widely accepted principle of social responsibility that is derived from what is quality life. Quality living requires that individuals choose from a variety of life experiences and opportunities. A diverse environment including wildlife is necessary to provide these opportunities. A society's ability to provide such opportunities is determined by its resources, knowledge, attitudes and conservation, all in a close relationship to population size.

There are many approaches, but for Dinder National Park, the ecosystem approach and the Biosphere reserve approach are ideal.

The ecosystem approach is a strategy for integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (UNESCO, 2000). Thus, the application of the ecosystem approach will help us to reach a balance of the three objectives of the Convention on Biodiversity; conservation, sustainable use and the fair and equitable sharing of the benefits arising of the utilization of genetic resources.

The philosophy and actions associated with the ecosystem approach have many reserve concepts. Like the ecosystem approach, the Biosphere Reserve concept considers all principles important in the effective management of ecosystems.

The balanced approach to biodiversity conservation can be achieved through the ecosystem approach and through efforts to involve all sectors of society in the conservation and management of biological diversity in Dinder National Park, as being one of the main objectives of the Dinder Project. The Biosphere Reserve concept is one way of involving people in biodiversity conservation. This approach links ecology with economics, sociology and politics. Performance and achievement are evaluated on a regular basis and the views and desires of local communities remain paramount.

The management of the Dinder National Park since its establishment in 1935 under the existing national policy and legislative framework did not integrate the ecosystem or/and the Biosphere Reserve approaches. If our planning philosophy recognizes local populations, with their cultural diversity, as an integral component of the park ecosystems, then such approaches would promote solutions to reconcile the conservation of biodiversity with its sustainable use. In the Dinder National Park, most of the threats to biodiversity and ecosystems come from the local communities in and around it.

Hence, zonation, which is an essential part in the biosphere reserve approach, could be applied with the philosophy to integrate the ideas of both conservation, traditional ecological knowledge and resource management know-how, also consider the expected change in the way that societies use their rural environments and their natural resources. When zones are articulated, the transitional areas of the Park are supposed to accommodate adaptations to change and society's call for sustainable development and use.

Such an approach is a holistic positive one because it would promote the successful integration of biodiversity, conservation, protection, and sustainable development with benefits to local people.

A need exists for new forms of institutional co-operation and links between different levels of economic and political decision-making towards landscape management.
The rights, social choices and interests of indigenous peoples and local communities should never be underestimated since they are important stakeholders. Provide the chance to manage the ecosystems of the Park for their intrinsic values and for the tangible and intangible benefits for humans. Seek a good quality of life for the Dinder people by means of development of income-generating schemes as a principal vehicle for encouraging alternative and sustainable land-uses. Place a social and financial value on ecosystem services towards justifying conservation measures. Explore and demonstrate ways in which conservation and rehabilitation can be combined in a sustainable way with management (e.g. reforestation, fisheries management).

C.2 The Plan Objectives

Overall development objective: The conservation of biodiversity in the park by encouraging species conservation and the sustainable use of resources through the integration of local communities in the utilization and management of the natural resources of the park.

Objective 1: Conservation of biodiversity of the park through development and implementation of the management plan for Dinder National Park.

Objective 2: Long-term sustainable conservation of biodiversity in the park by encouraging species and habitat conservation and maintenance of the park as a coherent system.

Objective 3: Long-term sustainable management of the Transition Zone through the integration of the local communities living inside and along the borders in the sustainable utilization and management of the natural resources of the park.

C.3 Planning method

The management plan is developed in consultation with the Wildlife Administration, and all other stakeholders. Action plans for the next five years are included. Activities will be monitored and evaluated and feedback will be useful in development of the following action plans.

C.4 The plan endorsement

The plan will be translated into Arabic and disseminated to all stakeholders prior to official endorsement by the Director of the Wildlife Administration.

C.5 Zonation (Fig.9)

Since our planning philosophy recognizes people with their cultural diversity as an integrated component of the ecosystem, the zonation pattern should promote the successful integration of biodiversity conservation, protection and sustainable development with benefits to local people.

The plan should set the limits of acceptable use that each zone could tolerate. Dinder National Park has three distinct ecosystems:

1. The riverine ecosystem composed of multi-layered forest, which varies in depth according to local conditions of soil and relief. It occurs along the banks of the Dinder River and river Rahad and the large seasonal streams and khors.
2. The drainage system of the park, with its dendertic pattern, includes the levees (geref), meadows (mayas) and kerrib land forms which developed along the river's course, constitutes a very important ecosystem.
3. The woodlands "Daharra" ecosystem constitutes the remaining area of the park. With regards to these ecosystems, the zonation pattern is delineated as follows:

C.5.1 The Core Zone (A)

It is determined by the drainage system and habitat type. It includes the riverine and maya ecosystems. As shown in Fig (9), this zone will include the riverine ecosystem of the Dinder River, khor Galegu, khor Masaweek and khor Kenana. It includes also the area of Daleib Mugadi, and the Daharra between the The Dinder River in the east and khor Galegu. All mayas will be included in this zone. It will however, include areas of special (historical / cultural) use i.e. Galegu Camp site for tourism, El Suneit

and Al Abyad as wildlife forces camps and Al Tabya (for dry season use by Magano indigenous community and Magano village).

In addition to the activities and goals set above, limited management interventions will be practiced such as maya improvement, road construction and research plots. To establish species habitat requirements, habitat management will be restricted to selected areas. Others will be left to evolve naturally. Other activities such as patrolling, recreation tourist sight seeing, fishing in some selected pools will be allowed.
Roads will demarcate the boundaries of the core area.

C.5.2 The Buffer Zone (B)

It will include almost all the woodland "Dahara" ecosystem (except those included in the core area).

Limited activities will be carried out, on a pilot basis, under the strict supervision of the Forces. Removal of dead wood, collection of forest products, fruits, honey, etc, will be practiced in small-scale experimental plots before expanding into large areas. All these activities will be to the benefit of the village communities. Development and management of this zone would be directed to the range and forest management.

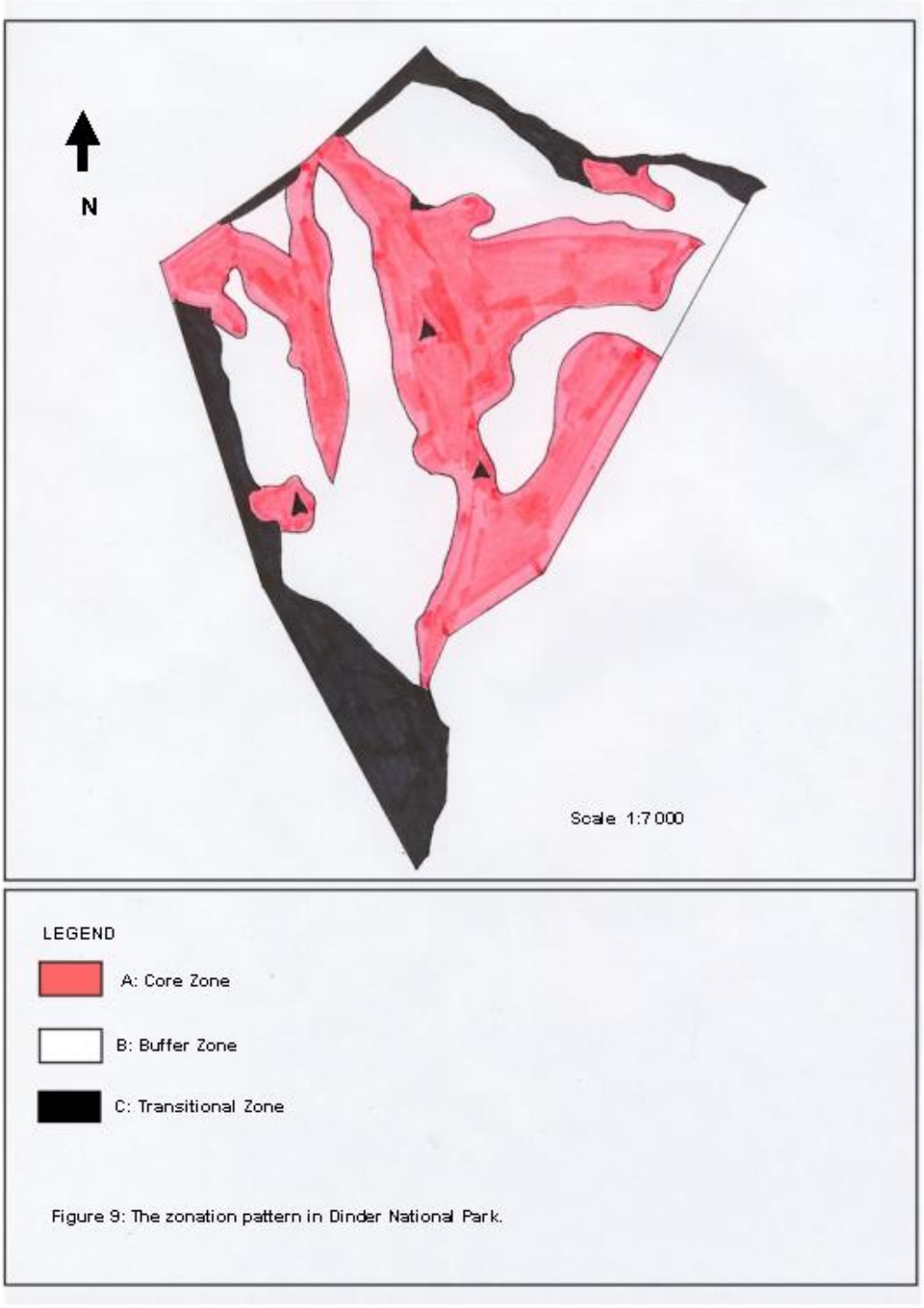


Figure 9: The zonation pattern in Dinder National Park.

C.5.3 The Transitional Zone (C)

This zone will extend along the western bank of the river Rahad (except Daleib Mugdi core area), including the 10 villages within existing boundaries of the park. Areas along the river Rahad should be treated in a two-dimensional prospective. The first dimension concerns the ten villages within the boundaries of the park.

The second dimension concerns the 28 or more villages on the Eastern bank of the river and who depend partly for their livelihood on the resources of the park. For this reason five kilometers on each side of the boundary line will be designated for this zone. This should also apply to the other boundary lines towards suneit- along the western and southwestern boarder, including El Gari village. The Kadalou area within

its scattered resident villages will be included in this zone for practical reasons rather than rigidly following the above ecosystem selection criteria.

Limited activities, agreed upon with the village communities, will be carried out under the supervision of the Wildlife Forces. New income generating activities will address sustained harvest of forest products as well as limited subsistence traditional agriculture. Activities will also include range improvement in certain pilot areas for controlled livestock grazing.

C.5.4 The Transfrontier or Peace Park Zone (D)

It is proposed that zones B and C officially run only to the Ethiopian border at this point. It is further proposed that a commission is to be formed to negotiate with the relevant Ethiopian authorities in order to officially join the wilderness area to the east of DNP with the DNP as a large cross border protected area. This would protect the historical migration routes of the elephants, which are at this point, badly affected by unplanned land-use practices.

> On 11 July 2003 all members states of the African Union (AU) met in Maputo, Mozambique represented by the Heads of State. This meeting formally adopted **The African Convention on the Conservation of Nature and Natural Resources.** Article XXII (2) of this convention states :
>
> *a) Parties shall develop disaster preparedness, prevention and management programs, and as the need arises hold consultations towards mutual assistance initiatives;*
>
> *b) whenever a natural resource or an ecosystem is transboundary, the Parties concerned shall undertake to cooperate in the conservation, development and management of such resource or ecosystem and if the need arises, set up interstate commissions for their conservation and sustainable use;*

Since both the Republics of Sudan and Ethiopea adopted this convention this now forms an ideal point of departure to facilitate such a Trans-boundary Protected Area.

C.6. Management Programs and Actions

The management programs and actions fall under three areas, namely habitat management, law enforcement and administration, and socio–economic development programs of local communities within and around the park.

C.6.1. Protection and Conservation

C.6.1.1 Boundary Demarcation

The Dinder National Park was gazetted in 1935. Since then the boundary was not clearly demarcated. The Dinder National Park GEF project surveyed and delineated the Park's boundary using GPS devices in the year 2002 and superimposed these on detailed maps, provided by the survey authorities of the country. Benchmarks (beacons) made from cement and iron bars, 1m in height, were used in 500m

intervals. Beacons, 1.75m in height, were placed in 1000m intervals. The Park's boundary is clear and well defined.

Maintenance of the demarcation should be carried out as follows:

- Maintenance and annual monitoring of the beacons.
- Establishment of a graded road alongside the boundary marks. This will facilitate monitoring and function as administrative road as well as a firebreak.
- Replacement of damaged signs.
- Creation of game posts along the boundary, especially in areas with high density of inhabitants.

C.6.1.2. Road Construction -Working Trails

The park is connected to Dinder town by a seasonal unpaved road. Another road connects the park with Roseries city and a road also connects the Gedarif state with the Park at Um Kurra village.

The present internal framework of roads is as follows: -

1. Galegu-Suneit Road (main gate northwards)	30 km
2. Galegu –Al Abyad	30 km
3. Galegu-Tabia (by-passes Al Abyad)	70 km
4- Galegu -Rass Alfeel	42 km
5. Galegu- Um Kurra	45 km
6. Galegu -Bandghau	55 km
7. Galegu –Al-Ebaik	75 km
8. Galegu -Karsh Alfeel	105 km
9. Galegu –Fazra	123 km

The ideal roads for any National Park could be categorized into three types:

(a) Administrative roads

These are roads that connect game posts to the Head quarters (HQ) and are mainly used for transportation of logistics between the posts and the HQ of the park. They function as patrol roads. These should typically be durable roads, which are accessible to all types of vehicles.

(b) Tourist roads

These are specially designed to maximize game viewing, such as those leading to the Mayas. In Dinder Park they can also be routed to pass around the Mayas, to minimize disturbance to the animals. A network of tourist roads, spanning approximately 250 km will be designed to cover selected areas.

(c) Trails

These are designed for a walking experience. They should be short and narrow, have a low environmental impact, passing along edges of interesting mayas and birds watching areas. A total length of 20 km of these trails is suggested in areas that could not sustain the other types of roads.

Recommendations

Administrative roads

The existing roads are acceptable. A circular road is desirable. Its length is estimated to be approximately 400km. Additional roads to effectively connect the game posts are suggested. These are as follows:

- Two roads that pass east and west of khor Galegu up to Jebel Halawa
- A road from Jabel Halawa to Umkurra, passing through the river Rahad area
- Beit Al Wahash to Sembaroug road
- Dabkara to Beit Al Wahsh road
- Galegu to Tabia road, on the east and west banks of the river Galegu
- Gererrisa to Tab Alkok road
- Tab Alkok to Magano road

Tourist roads

These are to be established to facilitate tourist game viewing. They will likely end at game viewing points. Three will be established.

Trails

1. From Galegu to Al Godahat area; may continue up to Ras Amir.
2. Trail from Galegu to Abdel Ghani
3. A walking trail from Abyad to Siammaya

C.6.1.3 Game Posts

The Park has about twelve game posts that have been there for several years. Some of them may require re-location to meet the proposed functions they have been designed for:

1. *Suneit game post* at the northern entrance gate - can remain as it is
2. *Al Abyad game post* is in the middle of the park, on the western bank of the Dinder river - should be kept.
3. *Tabia* in the extreme south east – location is suitable
4. *Ras El Feel* at the Rahad river – location is suitable
5. *Magano game post* in the north west - acceptable
6. *El Gary game post* on the western bank – suitable

7. *Um Kurra post* on the eastern bank - appropriate (Rahad Villages)
8. *Karsh El Feel* - acceptable
9. *Bandagau game post* - appropriate
10. *Beit El Wahash* - suitable
11. *El Ibaik game post* – suitable
12. *Galegu main game post* - temporary

The proposed thirteen Game posts that will be established along the boundaries in the four blocks, will have standard construction and facilities:
Each Block will have

- Huts 07
- Kitchens 03
- Toilets. 03
- Water Hand pumps. 01

The reasoning behind reshuffling of the game posts is the establishment of the most effective patrolling system and avoidance of the presence of the game posts in the middle of the Park. There are thirteen suggested game posts. They will preferably be located on the periphery of the Park, except the main post in Al Abyad, which will be designated as the Administrative post.

For Administrative control, each Block will have a main post and two sub-posts. The Block commander in charge will be stationed at the main post, and will visit each post on a periodical basis for supervision and monitoring.

C.6.2 The Headquarters Buildings and Facilities

To maximize efficiency, the HQ should consist of the following facilities:

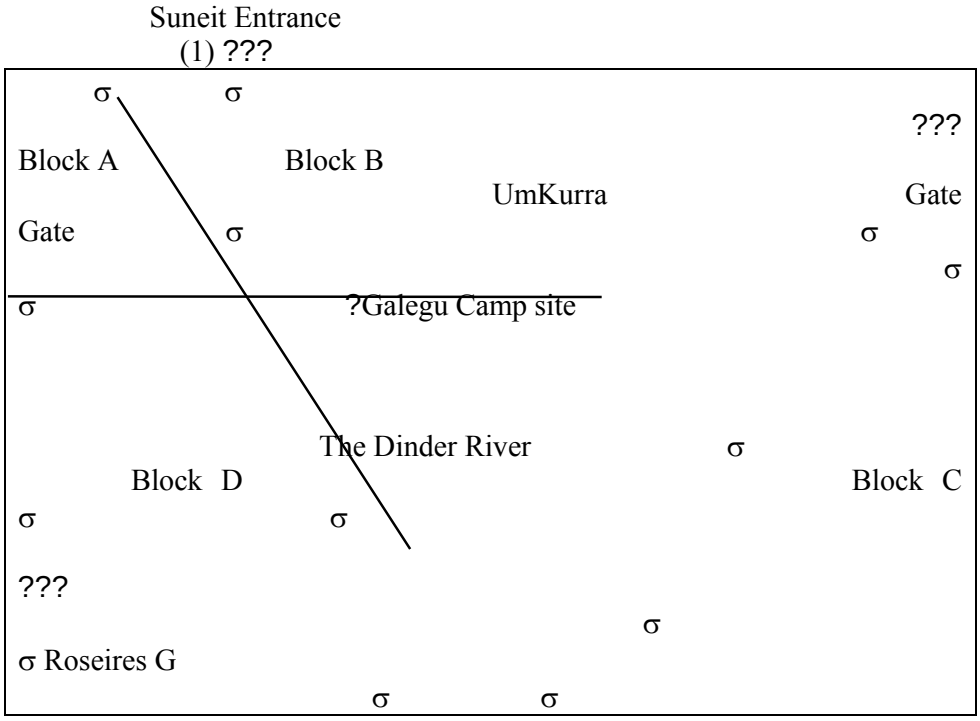
TYPE OF FACILITY	NUMBER
Office	7
Fuel Station	1
Workshop	1
Stores	2
Wells	2
Conference hall	1
Restrooms	6
Houses (Senior type)	7
Houses (Junior type)	10
Community Center	1
Museum	1
Communication Center	1
Dispensary	1
Long range radios	2
Short range radios	3
Walky talky	30

Entrance Gates

As discussed above, there will be three Entrance Gates, which include the existing Suneit Entrance point. Additional gates will provide easy access for tourists from Gedarif state, to enter the Park from the Umkurra Entrance Gate and tourists from Blue Nile State will use the Roseires Entrance Gate (Fig. 19).

Each Entrance Gate will have the below facilities:

- An office
- A tourist Information Desk.
- Visitors Hall.
- Two toilets.
- Two bath rooms.
- Clinical facility.
- Hand pump.
- Long range Radio.
- Solar Energy facilities



Key

σ Game posts

??? Entrance Gate

Fig. 10: Sketch Map Indicating the Proposed Four Blocks

C.6.3 Patrolling System and Camel Patrols

The ideal patrolling system is as follows:

The area of the park will be divided into four equal sized blocks of approximately 2,500km². Each block will have a main post with at least two sub-posts. In each block there will be at least two 4WD cars and a minimum of seven camels. The estimated number of scouts at the main post is 15 and five at each sub-post. The total manpower, excluding the officer in each Block, will be 25 game scouts. Each block is to be patrolled and covered comprehensively once every two weeks, under normal conditions. In case of any reports of illegal activities the frequency of patrolling can be increased.

Radio communication systems will be provided to each Block. These include two short-range radios and one long-range radio. Ten walky talky radios per block will be provided.

Reporting System

Each block will report to the head quarters on a daily basis, reflecting on the general conditions in the block in terns of animals sighted, the Maya conditions, the wildlife law violations etc.

Entertainment

There will be scheduled rotational entertainment programs for the game scouts in each block. Transfers and short leave will be implemented.

C.6.4 Law Enforcement Anti-Poaching Unit

The aims of patrolling, is law enforcement and to prevent illegal practices such as felling of trees, hunting, fishing, collection of dead wood and honey, and grazing of live stock etc. Game posts will control encroachment of villages and farming activities into the Park.

The anti-poaching unit should be coordinated from the Park HQ. The unit must be fully equipped, mobile and be able to operate around the whole Park. Its function is to develop action strategies for law enforcement operations and to act as a supervision agent to law enforcement in the blocks.

C.6.5 Communication System

A state of the art long-range Radio communication system is needed in each block, to facilitate contact with Head Quarters and the Administrative posts. Short-range radios are necessary for internal communication within the block. Walky talkies are essential for coordination amongst the patrolling teams. Every vehicle in the Park must have a long-range radio system to facilitate communication and coordination amongst cars, game posts and Head Quarters.

C.7 Habitat and Wildlife Management

C.7.1 Management of Natural Ecosystems

Management activities serve to improve the status of the wildlife resources and address the needs of people who utilize this resource to the benefit of all. Changes in demographics and economic conditions need to be addressed and new foundations laid down. The management of natural forests can be adjusted towards improved balance between man and nature, in and around the Dinder Park. This balance will create new solutions for the needs for domestic energy, creation of jobs in rural areas, sustainable use of natural resources, improving and modernising agricultural production methods and setting up stable forms of co-existence with animal production (Flandez and Quedrago, 1994).

The management practices should include:

- Effective and voluntary participation of the rural/village forest management groups.
- Evaluating the forest potential, including the establishment of the dendrametric and ecological parameters that should determine the final form of the management and administration plan.
- Fuel wood supplies should come mainly from dead wood, collected from the plots planned to be burnt.
- The traditional uses of forests as a source of medicinal plants, fruits etc, should be practiced in limited plots, in the buffer zone.
- There are many areas (towards the Rahad river and the El Suneit area) where the original vegetation has been removed and can be rehabilitated close to its original state. There are various methods to reestablish the forest cover and to shade the grass beneath the canopy, such as
    - ❖ Seeding *(Acacia seyal, A. sieberiana* etc)
    - ❖ Planting of small seedlings (1 meter height). The area must be protected from fire.
    - ❖ Young trees also need protection from herbivores.
    - ❖ Prevent vegetation removal and disturbance of nesting birds.

C.7.1.1 The fresh water habitats

- These habitats should be conserved and protected to preserve its fish species and other aquatic fauna and flora.
- All forms of fishing activities should be banned in the breeding grounds and natural nursery areas formed by the floating reeds and macrophytes.
- Fishing activities can be practiced in pools and mayas which dry up totally before the next flood season, using only traditional gear i.e. baited lines, gillnets not exceeding 15m to 20meters in dimension with mesh size not less than 60mm.
- The fishing season must be restricted to the period between October and January.
- Recreational fishing can be practiced in some mayas and pools. (e.g. ElTabia,Ras el feel), depending on the season.

- Destructive fishing methods should be prohibited These include:
    a. Unbaited longlines
    b. All poisonous natural or synthetic products
    c. Beach seining
    d. Monofilament gill and trammel nets

C.7.1.2 Harvesting of Plant products

Harvesting can range from collection of seeds for storage and ex-situ propagation, to agro-forestry and varying degrees of use between the two extremes.

- Fallen leaves and dead wood should not be removed from core-areas. This is very essential for microhabitats.
- Cutting of fodder for livestock from core or buffer zone should not be allowed.
- Cultivation and agro-forestry in core and buffer zones is prohibited.
- Keep fixed quotas in 40 000m² (4ha) areas, selected in the specified zone.

C.7.1.3 Collection of products will be allowed on the following basis:

- Identification (rare and endangered plants not allowed).
- Collection of seeds or tubers for ex-situ propagation.
- Collection of fruits (dom, nabag, laloob) for human consumption.
- Collection of medicinal herbs (e.g. *A. camplycantha* roots in areas of pure stands as part of thinning the communities).
- Cutting of palm leaves
- Cutting of poles for construction (only in woodlots in transitional zone) must be carefully controlled, kept in the prescribed zones, restricted to limits and in good rainy seasons only).
- The Park's authorities should decide on permissible levels of harvesting and when it is allowed, depending on the amount of products available in the fixed plots.
- Harvesting should be carefully controlled in the following ways
    - ❖ Kept within prescribed zones.
    - ❖ Restricted to limited time spans and in at specific times.
    - ❖ Kept within fixed quotas.
    - ❖ Appoint a trained forester in the park.
    - ❖ Inventory and monitoring of resources at these sites should be on a regular basis.

C.7.2 Management of over-abundant population

- Theoretically populations in the wild cannot become over-abundant. If they do periodically, natural checks on population numbers (limited resources) climate, disease, predation or dispersal should act to control the population size. Apart from destroying their own habitat, increasing numbers of one species may have deleterious effects on the habitats of other species or on other management objectives, in this protected area. The management decision

should be taken after careful ecamination and monitoring of each case independently.

C.7.3 Meteorological and hydrological Records

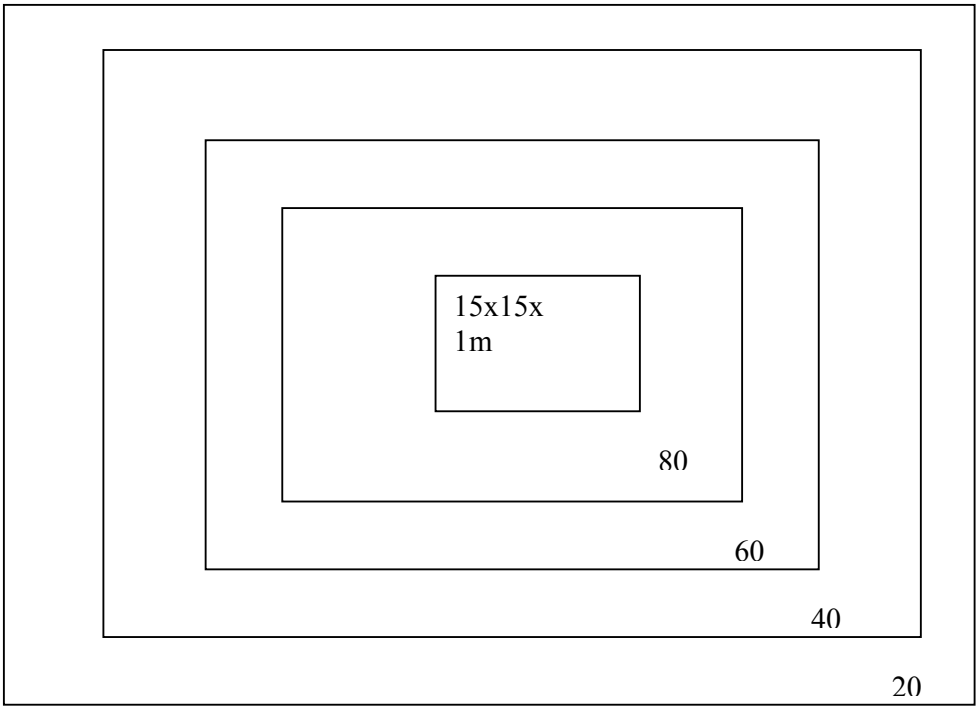
- Previously there were no meterolgical records because of a lack of a metrological station in the park. However, the Project has installed a standard meterolgical station. Records could now be taken on daily basis, for temperature and rainfall.
- There are no hydrological stations on The Dinder River save that in Dinder town. The Ministry of Irrigation records can be readily obtained by the Park authorities.

C.7.4 Mayas and Pools Management

- Mayas and pools are critical areas for wildlife and birds.
- The biomass of wild ungulates and birds ,which are supported by many mayas, has decreased as a result of degradation or siltation of some of the important mayas, thus reducing their capacity of holding water in the dry season.
- Quick measures are needed to improve these habitats to increase their water retention capacity through revitalization programs.
- Excavation of the beds of these mayas is vital. The choice for key mayas is based on the following criteria: proximity to park H Qghydrology, and the rate or condition of deterioration .
    - Mayat Abdel Ghani,
    - Simmaya
    - Gererrisa
    - Beit el Wahash
    - Ein Es Shams
    - Mayat Musa
    - Haneifa
    - Ras Amir
    - Abyad
    - Semsir
    - Sembroug
- Action will only be taken for the three bottom listed mayas only when the roads for patrolling are constructed, to deter any illegal use of improve mayas by herdsmen or poachers.

- The rehabilitation of mayas might involve the removal of some trees which were not present before the process of siltation and dry up of mayas (e.g., Abdel Ghani and El Dabkara).
- Excavation of the Maya beds will be carried out in patterns of squares (see Fig. 11). The depth would be one meter at the center square and decresased by 20 cm for each following square.. Excavation would be done after conducting topgraphic survey of the maya so as to locate where excavation can be done. Execavation of the center of Abdel Ghani Maya has already been done in 2003 (Phase 1).
- Opening up the blocked feeders (phase II). This would depend upon the availability of necessary equipment e.g bulldozers.
- Cleaning of the feeders from the fallen trees that trap sediments (e.g. Samaaya).
- Mechanical removal of the invading plants such as El Sorrib while it is green before it sheds its seeds. (Gererrisa, Ein Es Shams and El Simaaya).
- Detailed hydrological studies for some important mayas (Beit El Wahash, Gererrisa, Musa and Ein Es Shams) are needed before any interventions are undertaken.
- Maintenance of hydrological regime will improve the condition of the mayas
- Logging should not be permitted near the vicinity of water channels and catchments areas to prevent possible gully erosion.
- Water channels can be improved with check dams to retard flow and trap sediments e.g at the confluence of khor Galegu and The Dinder River.
- Prescribed burning should be done around the mayas to facilitate game-viewing.
- Rehabilitation of mayas outside the park and in the Transition zones should be conducted for the controlled use by livestock during the dry season. This would minimize the illegal trespassing of livestock. Use of improved mayas should be decided by the WCGA in consultation with the pastoralist union and local authorities.
- The present wells in Ras Amir and Gererrisa should be maintained for use in the dry seasons.

Fig. 11. Schematic Plan for Revitalizing Mayat Abdel Ghani. *



*Blocks are contoures in relation to the core which will be excavated down by one meter . Each concentric side becomes 5m longer towards the outside and 20cm shallower.

C.7.5 Removal of Invaders

- The presence of exotic or alien species in a protected area is generally contrary to the management objectives of that area. Cutting or debarkings are often used for removal and control of exotic and invading plants.
- *Chorchorus* spp is invading the grazing areas specially around the mayas and depressions. It may be necessary to use a selective weed killer for *Chorchorus olitorious* but in a restricted and controlled manner, applied over small test plots before using it in a large area.
- Be sure that the measures when employed against the target species , are not to be harmful to other plants or animals.
- Grazing by domestic animals as a management tool can be used in the transitional zone (around villages only). Grazing in this case may be useful for reaching a desirable level of ecological succession and can help to maintain open grassland to attract and encourage wildlife.
- Absolute control over grazing rights must be exerted as soon as the desired level is reached. The management authority must have the right to stop the practice.

- The effect should be carefully monitored (no transfer of diseases or invasion of alien or exotic species).

C.7.6 Fire Management

- The damage of uncontrolled fires on the vegetation, and probably on small animals, is enormous. Only very few trees are resistant to fire like *A seyal* and *Balanites* spp. There is a need for fire lines to reduce the hazards of fires. Controlled burning should be selective and only carried early or at the end of the wet season.
- The uncontrolled burning practiced now should be abolished. Nevertheless burning could be used to clear roads after establishing fire lines.
- Fire should be used in a restricted mode as a management tool. Each of the main vegetation units is to be divided into four sub-units that will be burnt when the standing fuel load is above 4 ton per hectare. Fires should not burn in a regular time-frame and not in blocks.A mosaic fashion is the preferred way. This practice will affect the range in many ways. First it will check thickets development second it will help to control the undesirable plant species, third it will help clear the dead parts of the perennial grasses and fourth it will innitiate the development of new perennials. The development of lush perennial grasses will facilitate the use of the woodland by game animals and relief the pressure imposed on the Mayas.
- Sometimes the bottom of the feeders carry dense cover of untouched perennial grasses. If these sites are to be of benefit, prescribed burning every four years is recommended. This is to prevent sedimentation of the feeders and produce a cover of attractive tender perennial grasses.
- No burning should be induced on the vegetation on the slopes and banks of the seasonal water channels.
- Clearing and widening of administrative roads should be conducted immediately after the rainy season. All the roads must end at a natural barrier.
- Reliable quantitative and qualitative data on the productivity and potentiality of the different ecological sub-zones that the park encompasses are not available. Establishment of 100 m x 100 m exclosures at each vegetation type will pave the road for reaching such goals. They will function as yardsticks to monitor plant succession. Metalic posts and wire mesh are to be used in construction.

Proposed firebreaks:

Firebreaks are mainly constructed to restrict the spread of wild- fires but will not prevent their occurrence. Due to the nature of the park and the unavailability of equipment and other facilities, the present patrolling roads should be used as fire breaks. This implies an increase in their width and length. Accordingly the following can serve as fire lines:-

1. Galegu-El Suneit Road(28km):
   It goes south – North runs almost parallel to the Dinder River. It needs to be widened and the road diverting to Mayat musa should be opened.
2. Galegu-Um Kurra(35km).

Need to be widened

3. Galegu-Ain El Gamal (26km).
4. Galegu-Sembroug(30km).
   Only five kilometers are partially cleared. It also needs to be widened. If it should work as a fire break, it must be opened up to Sambaroug.
5. Galegu-Gererrisa (5 km).
   Need to be widened.
6. Gererrisa-Ras El Feel (21km).
   Should be cleared and widened.
7. Galegu-Al Abyad (30km).
   Not cleared for along time. The area is dissected by some khors that form natural fire barriers.
8. El Karta (boundary) Road (130km).
   This will protect a large area and prevent the spread of fire form outside the park.
9. El Garri-ElTabia road (62km) goes west-east. It protects a large area. Need to be cleared.

New roads should also be opened around mayas for game viewing as well as acting as fire lines.

C.7.7 Range Improvement

Range condition had been determind (HCENR-WRC, 2002) by quantifying the parameters such as:

- Vegetation composition
- Plant density.
- Frequency.
- Bare soil
- Vegetation cover.

- Determination of such parameters in the different units, once every two years, is essential to determine the range condition and consequently specific long-term management measures can be planned according to the range trend.
- It had been noticed, from the previous survey, that most of the range resources trend are underutilized, except for the mayas that are severally grazed (by trespassing livestock) especially towards the end of the dry season. Early annual burning has lead to the disappearance of many of the perennial grasses and forbs with weak performance of the remaining perennials. The result is a range predominated by annuals.
- Prescribed burning will help to remove the dead parts of the plants and eradicate the reedy herbaceous vegetation. Perennials will substitute annuals and increase the productivity of the mayas.

- **Grazing by livestock as a management tool: -**

This is generally incompatible with the aims of a protected area, because it may introduce exotic plant species, which have not evolved with the natural environment. The introduction of cattle under most management regimes (in Africa) has resulted in a sedentary gregarious species that has a marked influence on the local habitats and competes seriously with wild herbivores. Sometimes grazing by livestock may be

permitted in a protected area as a temporary concession in times of drought –but has serious ecological effects. (IUCN-UNEP, 1986).

For this reasons: -

- Grazing should not be permitted in the core area and buffer zone.
- In transitional zones, grazing if allowed in some units, should be under strict control such as – herdsmen should not be allowed to hunt, light fires, burn land to improve the short term grazing.
- The effect of grazing by livestock should be carefully monitored to ensure that the Park does not be affected ecologically.

C.7.8 Re-seeding and Reforestation Programs

- Natural regeneration is preferable under normal circumstances.
- Seed collection can be practiced at specific times of the year according to the phenology of the plants.
- No exotic plants are to be introduced.
- Some thinning of *A. seyal* could be done according to standard management practices, in dense pure sands in the buffer zone.
- Bare areas, which were previously under cultivation, will be restocked with Acacias and Heglig. This is very important for strengthening the effect of the buffer zone.
- Eroded areas need to be reforested with native trees, as found in the specific zone and ecosystem.

C.7.9 Watershed Management

Wild land watershed management consists primarily of protection against deterioration that can result from deforestation, grazing, fire and other uses of the land. According to Abdel Hameed *et al* (1997), the problem of surface water availability in the park can be considered as water resources development problem and Watershed management problem**.**

Regarding the watershed, certain management programs are to be considered:

- Identification of watershed characteristic by monitoring of the sediment deposits and erosion rate and the problems associated within some selected sites (see below)
- Delineate the main observed erosion points at riverbanks.
- The exact location is indicated by three observation sites, with at least four marked trees, representing a site in each drainage system. (Dinder, Rahad and Galegu).
- Man's activities greatly accelerate the process in some areas near the villages. Roads and Trails too have great potential impact upon sediment and erosion. The precipitation they receive becomes surface runoff, which quickly concentrates into drainage ways and ditches.

- Consideration should be given to areas where roads and trails pass on part of the drainage system, especially over the feeders of mayas (e.g. Beit El Wahash and El Simaaya). Permanent bridges, culvers or fords can be constructed wherever possible.
- Dead organic debris and litter exhibit the twofold action of resisting and reducing the erosive forces. These can be removed from the feeders but not from the slopes.
- A flood control structure can be constructed just upstream of khor (e.g. Galegu) confluence point to raise the flow level and fill all or part of the mayas in this system.
- Natural vegetation of the banks is enhanced, to insure banks stability.

Selected sites for erosion management (Abdelhameed et al 1999) are:

1.	Debkera (Berkat El Tomsah) Location	12.34.29 N35 02.37 E
2.	Khor Galegu	12 35.779 N 35 01.386 E
3.	Southern bank of Dinder River	12 35.77 N 35 01.00 E
4.	Al Abyad	12 22.83 N 35 00.93 E
5.	Wad El Hag	12 44.45 N 34 52.48 E
6.	East bank of Rahad river	12 51.75 N 5 09.65 E
7.	Aradeibet Tigani Village	12 48.72 N 35 16.15 E
8.	Khor Galegu (behind the camp)	12 35.17 N 35 01.22 E

C.7.10 Wild Animals Inventory and Monitoring

- The need for Inventory-Identification of different species that occur in the park is of paramount importance.
- Monitoring-population trends over time will prove to be invaluable as a basis for long-term planning.
- Data should be collected on ecologically dominant species as well as on rare and endangered species.
- Monitoring of the size and age-structure of the population and whether the population is stable-declining or increasing-following the methods of Mosby (1963), Caughley (1977) and Riney (1989).
- Repeat sampling at the same time of the year and at the same localities every year.
- Inventories can be made in new areas for reptiles and small mammals.
- A number of useful techniques can be applied:-

  1.Census of populations, by direct observation methods

  2.Estimates by road counts .

  3.Maya counts should be conducted annually to indicate the degree of use of the maya and the distribution of wild animals as related to condition of the mayas in the specific season.

  4.Indirect methods for counting the animals by:-

- Signs
- Tracks
- Droppings
- Nests
- Dens

5. Estimate of the breeding populations. Numbers of off- springs produced for specific species as measurement of reproductive success of the species and will check the population stability (increase or decrease).

- Monitoring biological resources to identify trends or change and to check the effectiveness of management programs.
- Monitoring productivity of fish in mayas and pools on annual bases so as to follow up the methodology indicated in the Ecological Base-line Report.
- Analysis of data to see if the changes are serious and to advice on any appropriate revisions in management practices.
- Special attention should be given to threatened species (Tiang, Roan antelope, etc) and to over abundant species (baboons).
- Future programs to determine animals' home range, migratory pattern etc… using modern techniques (Such as wildlife telemetry and aerial survey).
- Cyper-tracking, radio tracking and GIS are useful efficient techniques. Their use should be implemented.

C.7.11 Bird Monitoring

- About 91 species out of the 115 species observed in the park, in the past few years, are residents and the rest are palaeoarctic migrants (HCENR-WRC, 2001).
- Annual surveys (both seasons if possible) are advised to compare density and diversity with previous years and with historical data.
- Regular inventory and monitoring of the bird and waterfowl species in the park especially at the beginning and the end of the dry season. Occurrence in the major mayas and pools will indicate and check status of the wetlands.
- Regular monitoring of the feeding, roosting and nesting sites.
- Avoid fire in the breeding sites of the weavers (the area between khors Masaweek and Galegu).
- Special attention is to be given to the movement patterns of endangered species (eg. bustards) and migratory routes of Ostrich.
- Protect freshwater habitats from fishermen.
- Boreholes are needed in the major mayas when they frequently dry up towards the end of the season.
- Control the extent of utilization of fish resources by the game scouts and local people.

C.7.12 Management of Rare and Endangered Animals

- There should be regular assessment of the ecological

  Requirements of various species and all year round needs.

- Special studies are needed to understand the population dynamics of endangered species such as Tiang and Roan antelope before any

management practices can be adopted i.e identify the limiting factors for that species in the environment

- The conservation of species and populations may demand different strategies from those appropriate for the protection of ecosystems.
- Habitat management includes preventing fires, by instituting firebreaks and fire rotation and maintaining permanent watercourses.
- Extending or increasing protection to migration corridors.

C.7.13 Wildlife ranching and utilization

- The development of commercial breeding of wildlife species (through rearing and ranching methods) can help ease pressure on wild populations and can even prove benefit to the local populations (by restocking). Moreover such commercial enterprises can help justify the continued interest in the protection of the wild populations on which the industry is ultimately dependent.
- Establishing rearing and farming stock for the local communities around the park under control of the Park authorities creates job opportunities.
- Under strict control and within the regulations for trade and permits some numbers of egg and young will be removed for captive rearing projects.
- Link farming and utilization closely in endeavors of protection of wild populations.
- Develop a control system that makes it difficult for wild stock to be illegaly captured and used in trade as farmed animals.
- Buffalo and Roan antelope are recommended for immediate consideration in communal breeding programs.
- Breeding of wild animals require building up of expertise and acquiring the neccary equipments.

C.7.14 Sites of Special Consideration

*** Sites in the Core area that require special regulations: -**

- The main camp at Galegu and Birkat el Tamasih game outpost.
- El Tabia pools; fishing activities by the indigenous community will be permitted.
- Plots with trees for production of honey should be demarcated under strict controls. They will not to be cut down.
- Special allocated sites for reseeding and reforestation programmes.
- Tourism, camping and sight seeing observation posts will be constructed near wetlands and mayas.
- Magano village need special management programmes under the strict control of the Park authorities.

C.8 Administration

Institutional setup

The wildlife conservation general administration (WCGA) is the department in charge of wildlife resources management in the country .The administration has undergone various changes and was historically attached to different Ministries and directorates.

That situation had at some point made the Administration to fall under two unrelated Ministries .One Ministry was responsible from the technical work and the other for the administrative aspects. This created a lot of instability in the performance of the Administration. Today the wildlife portfolio falls fully under the Ministry of Interior. This has in a way improved and activated its role in resource conservation, although it is far from being ideal for the following reasons:

- The Ministry of Interior is not fully acquainted professionally with the importance of the wildlife resources.
- The Ministry has its priorities, which rarely includes wildlife conservation.
- Transfers among the Unified Police officers has seriously affected the Administration by the large number of officers transferred from Police to Wildlife with almost no basic training on wildlife or even awareness on relevant issues.

To address the above issues the Council of ministers decided to establish a National Council for Protected Areas. The above council will have members from all Natural Resources Departments as well as other stakeholders related to Protected Areas. The Council should have a technical steering committee to advise the Director of Wildlife.

Representatives in the States will report to the Director and his deputies at the Head Quarters.

The parks will be managed by Park managers who report to the Head Quarters, and have nothing to do with the provincial governments.

The staff selected to work in National Parks must have a strong background in Natural Resources Management and/or related subjects.

The council will have access to International, Regional, Governmental and Non Governmental Organizations that can cooperate in the management of the Parks in the country.

C.9 The Proposed Park Administrative Structure

The Park will require Officers in the following fields:

1-**Park Director** (**Manager):**
He will be in charge of the administration and implementation of the set policies .He is the over- all responsible person. He must be a competent candidate and well informed in the field of Wildlife Management and must have a long experience in natural resources management. He should also be a good Administrator.

2-**Assistant Director for Research:**
The person in charge of research programs and activities in the Park to be answerable to the director. He should have good experience in research and must have a graduate qualification related to that field.

3-**Assistant Director for Engineering:**
A specialized person that will be responsible for maintenance of Mayas, Roads, Wells, Building, Roads and all maintenance of equipment and other relevant activities. He must be a qualified Engineering.

4-**Assistant Director for Socio-economic Affairs:**
The person responsible for Public relations development and Environmental Education. He should maintain a positive relationship with the local communities towards conservation of the wildlife resources.

5-**Assistant Director for Finance and Administration:**
The Person responsible for financial and administrative work of the Park (Salaries, Wages, Logistics and others).

6-**Assistant Director for Anti poaching:**
Responsible law enforcement programs, action plans and follow-up the implementation. He represents the Administration in Courts.

7-**Assistant Director for Tourism:**
The person responsible for management of tourist camp sites, tourist guides and other related tourism facilities.

These posts should be filled by either Wildlife Officers if they meet the basic requirements, or by appointments of qualified personnel from outside the Forces.
The senior staff will be selected as stipulated above .The junior staff posts will be filled by the present Wildlife Manpower and the numbers of needed officials will be determined and selected either from the existing manpower of the Park or be completed through secondment from relevant governmental agencies.

Supporting Staffed:

- Non Commissioned Officers in the four Blocks x25 =100 scouts
- Research Unit = 04
- Administrative and Financial Unit = 07
- Anti poaching Unit Scouts = 100
- Water pumps Operators = 05
- Clinic Service personal = 05
- Mechanics and assistants = 03
- Drivers = 10
- Tourists Guides = 10
- Medical person = 03

C.10 Vehicles and Equipment Administrative Section
Vehicles

Manager	01
Research Unit	01
Finance and Administration	01
Engineering Unit (one Lorry and a Land Cruiser)	01
Socio economist	01
Tourism Unit	01

Clinic	01
Anti poaching Unit	03
Four Blocks	08
Motor Grader	01
Bull dowser.	01
Roller	01
Motor Boat (out board engine)	01

Total One Lorry and 18-4WD Vehicles one Motor Grader and one Roller.
One Bull dowser. 0ne out-board engine.

Equipment:

GPS

Anti-poaching	06
Posts	13
Head quarters	09
Total	**28**

Binoculars.

Anti poaching	10
Game Posts	10
H.Q.	05
Total	**25**

Field Guides. (Mammals, Birds, Plants, Reptiles)

Anti poaching	03 of each Field Guide
Game Posts	13 of each "
H.Q	07 of each "
Library	05 of each "
Total	**28** of each "

C.11 Training

There would be a comprehensive training program for the officers in park management (In-service training, and other academeic training in the Sudan and abroad)

The training will be in:

- Basic Wildlife management techniques
- Ecological aspects
- Botany
- Mammology
- Ornithology
- Tourism Interpretation
- Field equipment operation
- Animal Behavior
- Other related Sciences.

These in-service training courses are to be conducted either in the Park by joint efforts between the Administration, the Wildlife research unit and High Institutions relevant to resources management.

Advance studies would be done abroad by requesting sponsorships from donor countries and Non Governmental Organizations. The Sudan Government will also need to promote the training of wildlife staff. Game scouts will be locally trained in the country. Visits and exchange of information with other parks in the region will be organized Employment of graduates from relevant universities will be desirable. Local training for anti-poaching unit will be carried out. Local training to the staff in how to use GPS, Cyber tracking, GIS and other techniques will be conducted.

C.12 Camp Sites and Signposts

It is proposed that the park HQ should be shifted from Guesis town to the Suniet game post at the north entrance of the park. The shifting of the park is suggested for the following reasons:-

- Minimize the distance to the Park for senior administrators.
- Activate supervision of the Park's personnel
- Cuts down expenses of traveling
- Narrow the gaps between local communities and the Park's administration by creating good public relations
- The presence of the manpower through out the year
- Back up teams will be close to the operations areas

Galegu is the main permanent camp site and the main game post at the present time. The main game post is to be removed and relocated in Al Abyad Game Post while Galegu Camp will be kept mainly as a tourist center.

Some temporary dry season camp sites are to be established in Ras Amir, Simmaya, Gererrisa and with very limited facilities such as toilets and bathrooms and a fence, made from local materials. Three more areas for such operations will be determined. Other areas can be, suggested based on the experience gained.

Signposts are essential means that act as administrative tools. They are considered among tourist facilities. The administrative signs indicate names of places in the park (Game posts, areas of significance, Maya ...etc) and show their distance as well as their direction, that makes travelling in the park easy and secure. The interpretative signs indicate names of plants communities (Tree, Shrubs, Grasses, etc.). The signpost would be written in Arabic and English. They are to be placed along the roads and at the junctions in clear areas for easy identification and they should be annually maintained and replaced in case of damage etc.

The sign post are preferable to be made from cement to avoid damage by water and termites.

C.13 Public Relations, Education and Interpretation

C.13.1 Public Relations

Good public relations are very vital in any organization and business. In these two categories the persons managing the business or organization deal with the public so that your goods or organization are bought and known by the public. Good public relations, therefore, has certain principles some of which are cited here as examples as far as the management of Dinder National Park is concerned.

C.13.2 Honesty and Truth in Deed and Statement

Every organization, business and agency has a reputation as does every individual. To be successful in the objectives of the agency, an agency must have a good reputation and public confidence which must be earned. Sound management policies and commendable performance in building a solid foundation of good- will are vital, and hence a prerequisite for good public relations.

Problems and conflicts in an agency are often the result of misunderstanding between the agency and individuals or groups concerned with the agency. With mutual understanding, many of the problems between management and customers, or natural resource organization and user, cease to exit.

C.13.3 Good Public Relations is a Prerequisite of Success

No person or business will succeed very long or to any extent if not accepted as a reliable source of the goods sold or services delivered. Many people as well as agencies are unsuccessful because of a lack of "people skills" rather than a lack of technical skills. In this context, public can be defined as "a group of two or more people with a common interest."

C.13.4 Public Opinion is Based on Culture and Environment

The basis for all public relations is the way that people act and react. The way we act as individuals, or as groups, mainly is a result of our culture. The society influences behavior, progress and constraints. Culture is the man-made environment that consists of customs, traditions and beliefs, all of which influence man's actions and feelings.

Culture is constantly changing as a result of alterations in technology, ideology and majority beliefs. Exhaustion of natural resources can be added to this list. An example will illustrate this point. Management of people (in their relationship with wildlife) can be viewed as an integral part of wildlife management. It can be manipulated separately or as part of a total system designed and managed to achieve a set of objectives. Wildlife agencies are often primarily game agencies. They do not operate at peak efficiency, they could do more, and do it better, using the resources they now have. Management of people therefore, is important in wildlife management. The lack of national or regional approaches in programmes, media, or methods has further retarded development in this area. Wildlife management, when done well, is a sensitive balancing of wildlife populations, habitats, and people. All these can be achieved through good public relations.

C.13.5 Adequate Communication

It is important for an agency or organization to inform the public of the good work being done as well as to determine services which are needed. This must be done to ensure understanding and appreciation. When correct information is not furnished or received, false impressions and conclusions often are reached.

C.13.6 Tools in Public Relations

The tools of public relations are advertisement, press and use of the media in general. The importance of communications and language in daily life and in the evaluation of man as a social animal cannot be overstated. Communication is a process that changes constantly. The result of good communication is understanding. Assuming the idea of conservation of natural resources is good, understanding will be achieved and then acceptance and good public relations will be the result.

C.13.7 Education As a Senegalese conservationist once said: "in the end, we will conserve only what we love, we will love only what we understand, we will understand only what we are taught!"

A national park may have fragile areas which need not be disturbed. Since the park will be visited by those who are seeking recreational experiences, environmental education should be considered as an objective for almost any type of management programme. Park personnel can play an important role through a broad programme to promote environmental education which becomes a necessary component of the management program. The plan usually involves the cooperation of schools, universities, publishers and organizations for assistance in communicating an environmental consciousness both within and beyond the park. Other educational uses often include the use of parks by groups from conservation organizations, writers, nature photographers and university-level environmental planning students. Environmental education programs may also be utilized to increase the public's knowledge and acceptance of park rules. Extension education, that is taking the park to the people, should become an important factor in park management.

Also in this programme, the Park's administration should provide information and visitor's orientation on the value of wilderness and ecosystem balance. Information on facilities, natural history, and rules and regulations should be made available to visitors. Information about the park should be given in the following ways:

(a) Visitors Centre

This is a place where visitors are received and welcomed to the Park. The centre should be as entertaining as possible. For instance, there should be sketch maps showing the different zones of the park, roads and magazines and pamphlets. Film and slide shows can be very helpful. Regulations and rules governing the administration of the park are given here.

(b) Library

The library should contain any documentation concerning the history of the park, the types of animal species, including rare and endangered species, found in the Park. If there are historical, archaeological and geological sites, information is given through pamphlets and magazines. It is always necessary to keep a record of visitors, their country of origin, sex and age and their recreational experience. The park manager should see to it that there is a place for publishing local news and events.

(C) Museum

Since Dinder National Park has some archaeological sites, specimens of materials used in the past by the inhabitants of the area, like the remains of pottery, grinding stones and so forth, could be displayed in a small museum. Handicrafts and souvenirs can easily be obtained from the villages surrounding the park. One of these could possibly the music instrument of the Magano people.

(D) Interpretation

Interpretation is another important component of protected areas' environmental education programme. It takes advantage of the area's natural resources and brings the visitor in direct contact with them. Interpretation translates the language of nature into the language of the ordinary human beings. It reveals meaning and relationships that will provide a greater understanding of natural and cultural systems to visitors. For this reason, facilities and service are provided in the park to stimulate visitor's interest and curiously. Interpretive prgrammes can utilize methods such as personal contacts between park interprators and other personnel with the visitors through nature walks, slide or film shows, publications, exhibits and recoded messages. Any of the above methods chosen as a means of presenting interpretive programmes and information to the visitor should include the role of the park in watershed protection, interesting relationships between certain plants and animals, genetic resources found in the park and how these resources may affect the human population.

C.14 Socio-Economic Development

C.14.1. Awareness and Community Development Activities

Awareness and purposeful development of the local communities is integral to the management of the DNP as a biosphere. This should address perceptions of environment, development and management of natural resources with due regard for the local socio-cultural context. Awareness is significantly enhanced by practical experience by means of actual engagement in project implementation. It is therefore necessary to involve the local communities as fully and as effectively as possible in all stages of development projects, particularly project identification, implementation and management. To this end local communities should be educated and trained in these processes to build, based on their previous experience and indigenous knowledge, and raise their capacity to manage development projects in an environmentally sound and economically feasible manner.

Awareness raising among, and development of local communities cannot be accomplished by the DNP's administration on its own. Rather, it is a joint responsibility in which the Park’s administration plays a relatively limited role. The

Federal government, the State authorities, local community organizations and the Park administration and NGO's should exert coordinated efforts in this respect. The primary objective of these efforts and activities should be the empowerment of these communities to depend more on themselves.

With respect to awareness raising, and in addition to the general role to be played by the Federal and State authorities(e.g. by formal education and mass media), and by the Park administration (e.g. by workshops, seminars, films, etc),focus should be put on building community-based organizations, and on enhancing the capacity of local educators and trainers. As for development projects, empowerment should aim at providing the local communities with resources outside the Park's boundaries to ease their pressures and degradational impacts on the Park. Such an empowerment may include the allotment of agricultural lands for the landless households, the reservation of grazing areas, provision of water resources for humans and animals, the establishment of community forests, the availing of clean and affordable alternative sources of energy, and the creation of small, income-generating activities/projects to diversify the sources of community income.

C.14.2. Sustainable Use Natural Resources

Utilization of natural resources on sustainable basis should carefully be regulated, managed and monitored in such a way as to ensure the strategic goal and objectives. All types of resource utilization have to be under the supervision and control of the Park Administration after reaching agreement on the details with the local communities and other users. Policies in this respect should encourage resource use through local committees and cooperative societies rather than by individual users.

Public access to the buffer and core zones has to be very limited and restricted to research, educational, management and tourist use. If, for practical reasons, special areas within the core zone have to be used for other purposes, then special supervision, monitoring and evaluation have to be arranged for these special areas.

Our current knowledge of the typology, distribution and productivity of the resources in the transitional zone is only partial, and more surveys and inventories are needed. Therefore, resources in this zone cannot be open for indiscriminate or extensive use. As a start, pilot areas can be selected for the utilization of some resources with the view of estimating their productivity and their overall impacts on the goals and objectives of the plan. Such piloting projects may start with the collection of dead wood and non-woody products, production of honey, fishing and tapping of gum. The results of the piloting will enable the Park Administration to decide what resources can be utilized, where, to what extent, by whom and under which conditions.

In the transition zone, designated resources will be open for use by local communities, but not without directives or restrictions. For example, grazing has to be controlled, e.g. through rotational grazing. However, the finite resources of this zone cannot support unlimited numbers of human and animal populations. It is necessary to prohibit the establishment of any new settlement inside the zone, and to watch out for excessive animal influx from distant regions. Local communities should be empowered to play a significant role in this respect.

In all cases, investment policy should be geared towards community development and welfare. Before being approved and if at all necessary, relatively large, profit – motivated investment should be carefully, objectively and adequately evaluated on the basis of its impact on natural resources. The ultimate objective of tourism in protected areas is the conservation of bio-diversity. This is done through sight-seeing, recreation, education and management of conservation. Sustainable hunting tourism in the transitional when properly managed can become a valuable and sustainable source of revenue. Priority at this point in time goes to tourism. Students will be given special attention. Next come businessmen and holiday makers. International tourists and the expatriate community cannot possibly be ignored or overlooked.

The Wildlife Forces have to adopt a clear policy and regulations towards tourism in collaboration with the other stakeholders such as the tourism authorities, Sudan-airways, local and foreign tourist companies, NGOs, local and federal governments etc. The policy should address issues such as:

- Should facilities be privately owned or leased.
- Locations and standards of tourist lodges.
- Numbers of tourists.
- Places to be accessible.
- Shared responsibilities outside and inside the borders of the park.
- Additional activities allowed-e.g. sport fishing, walking trails, camel trails and bird watching sites.
- It is suggested that the Forces allocate sites, on rental basis, to various tourist operators. This could be in the border transitional zone and by no means will this be allowed in the core zone.
- Tourist and operators will abide strictly by stipulations set by the Forces under the laws of the country and international standards.
- Tourist guides should be fluent in English with a reasonable standard of scientific and social training and knowledge.
- They should not be carrying guns, except if it is in the interest of the safety of guests.
- They should be equipped with communication facilities and should be trained in first-aid measures.
- Nature trails could be designated in hotspots in areas of special interest.
- Visitor centre to be informative to the objectives and characteristics of the park. It could be an outlet to cottage artifacts and local handicrafts. Scientific books, films and slides could also be made available.
- An airstrip is to be constructed in the transitional zone.
- An effective plan is to be formulated to attract all categories of tourists, local and international. Local media and a website could be instrumental.
- Links with European, African and Asian tour operators are imperative.
- Local and expatriate investors, especially from the African and Arab region, should also be encouraged under the present favourable investment laws.

C.15 Research and Monitoring

Information on the habitats and the natural and human driven processes is a valuable tool for management. Information is a prerequisite for planning management of the protected area. Information could also bring more support to the park in the form of increased tourism, scientific research and funding.

Research programmes should address immediate and long-term problems and needs. It must be stressed that immediate problems be given priority without losing sight of long-term goals. If poaching, logging or agriculture are the recognized threats to wildlife and their habitats, the need to know the extent of the problem and the effects on the fauna and flora becomes imperative. If the success of conservation efforts are to be monitored the need to determine animal densities and the extent of human encroachment should precede monitoring of any changes. Making inventories of basic information could be repeated and becomes a means of monitoring any patterns or trends.

Research does not have to involve difficult processes. Interesting questions are often simple. How many are there? Where are they found? What changes are there over time, or in the presence of certain types of disturbance.

It is essential, however, to have a clear vision of the information needed and the methods to be adopted to get it. Only well planned, well executed, well analyzed research will yield results that can confidently direct management actions and decisions. Standardized methods of research make it easier to interpret results for futher monitoring and comparison.

Typical long-term research programmes have two phases. Preliminary descriptive observation (making inventories) and an experimental phase (to explain trends). To make firm conclusion, it must be stressed, that a research programme must be carefully designed to address a particular question. Many research projects begin with unrealistic aims and are often far too ambitious.

Research problems should be clearly identified and priorities distinctly set. Research progeammes will only be approved when they fall within the set objectives and priorities. Needless to say that programmes will be problem solving oriented.

C.15.1 Institutional Linkages and coordination

The Dinder National Park (DNP) should have a permanent resident research unit. The research unit should be established by the wildlife Research Centre WRC of the Animal Resources Research Corporation of the Ministry of Research and Technology. A steering Committee should be jointly established by the WCGA and WRC, Juba and Khartoum Universities and any other relevant institutions. The steering committee will set priorities, discuss and approve yearly programmes and follow up on progress. Facilitation for visiting researchers will be arranged with the Dinder Research Unit. A library containing all research reports conducted in Dinder will be kept at the research unit.

C.15.2 Monitoring Programmes

Dinder Research Unit and the Park's Headquarters should devise a management information system that integrate the collection and transmission of information so that Park Management can be timely informed of what, when and how things have happened in the sphere of activity implementation, and base decision-making accordingly.

A well maintained Park management information system enhances adaptive management. To determine how activities relate to the park's management objectives, a set of indicators comprising qualitative and quantitative data on performance , has to be developed. To achieve a sound management information system the following is proposed :[1]

Basic guidelines to the development of indicators for the Management Plan monitoring programme:

1.**The objectives of the Management Plan at two levels:**

Level	Objective
1. Higher Council for Protected Areas	Environmental, natural resources and wildlife conservation.
2. Dinder Park Headquarters	1. Management capacity building. 2. Conservation of the park's ecosystems. 3. Involvement of the local communities in the park's natural resources sustainable utilization.

2. The target groups and direct beneficiaries of the Management Plan, their needs and expectations:

Target Groups	Needs and Expectation
1. Wildlife personnel	1. Development of wildlife management capacity in the planning, implementation and follow up. 2. Enhancement of law enforcement . 3. Enhance conflict transformation.
2. local communities	Widening the productive-base by exploring and introducing production alternative; revolving fund for example.

3. Anticipated changes attributable to the management plan:

Level	Anticipated Changes
1. Dinder Park Headquarters	1. Dinder Park ecosystems preserved. 2. Management capacity developed. 3. Conflict resolution/transformation tools and practices fostered.

4. Indicators:

[1] Monitoring Structure is adapted from "Result-Oriented Monitoring and Evaluation Report" UNDP Publications. United Nations Plaza NY10017. Handbook Series.

Parameter	Possible indicators	What the indicator shows
1. Performance	1. Daily records of minimum and maximum temperature, relative humidity, wind speed and evaporation rate 2. Annual records of rainfall gauges maintained. 3. Water levels in Mayas after the rainy season and River Dinder flood is registered using measuring poles installed in Mayas. 4. Measurement of vegetation in Mayas and woodlands is conducted every two years following methodologies in the Ecological Baseline survey reports. 5. Animal and birds censuses conducted every two years. 6. Park's visitor's records/registers maintained. 7. Park's violations registered to keep records of all arrests, and court rulings. 8. Monitor local communities around the park and update Socio-economic baseline data every 2 to 5 years. 9. Monitor the productivity of fish in Mayas and pools on an annual bases using methodologies indicated in the Ecological baseline survey reports. 10. Cost-benefit analysis; cost per unit of service and budget variance reduced.	1. Effectiveness: has the management plan achieved its purposes and brought about intended results. 2. Efficiency: how efficient is the management plan in acquisition and use of the park's resources.
Success	Capacities and abilities developed in the management of wildlife and natural resources	1. % recovery in the park's ecosystems. 2. Habitat, plant species and wildlife regeneration. 3. Changes in attitudes and opinion in part of local in favour of sustainable utilization of the park. 4. Park's personnel requirements for job safety and proper working conditions were satisfied.

The annual monitoring program which should be conducted by the Dinder Research Unit and the park head quarter should further include the following:

- Daily records of minimum and maximum temperatures, relative humidity, wind speed and evaporation rate.
- Records of rainfall in Galegu, Suneit, ElIbeik, Ras Alfeel, Magnu and ElGerri.
- After the rains and flood season water levels in mayas should be registered using measuring poles installed in mayas.
- Measurement of vegetation in maya and woodlands should be conducted every two years following methodology in the Ecological Base-line reports.
- Animal and bird census and population trends. Roads, mayas and pools count to be conducted every two years.
- Parks visitor records to include register of all visitor.

- Park violations register to keep records of all arrests, violations and court rulings.
- Monitor of communities living inside and around the park. Socio-economic base-line surveys and data updated every 2 to 5 years.
- Monitoring productivity of fish in Mayas and pools on an annual basis using methodology indicated in Ecological Base-line Report.

C.15.3 Basic studies programmes

The basic study programme is to include the following:

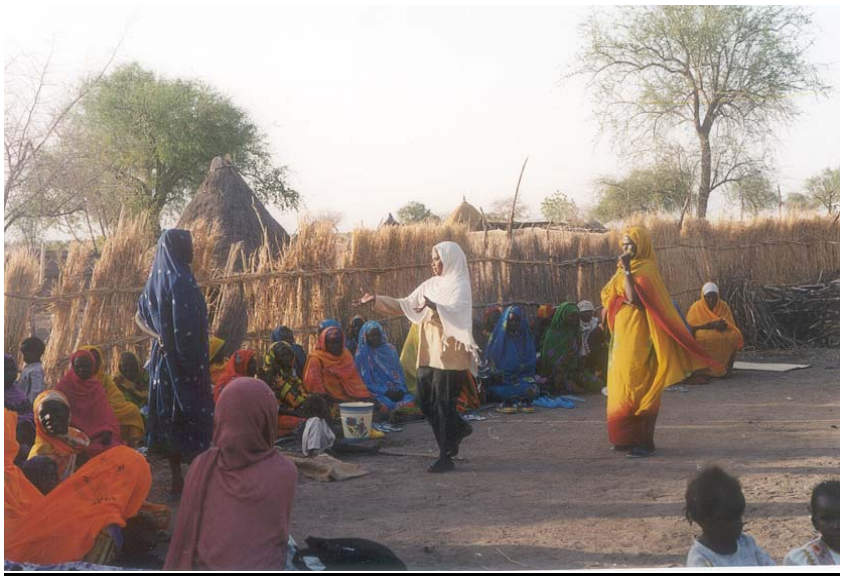
- Determination of sedimentation rates and follow up on maintenance in mayas such as feeder cleaning.
- Determination of carrying capacity of different habitat types and ecosystems.
- Habitat improvement measures.
- Fire management studies
- Feeding habits and behavior of different species
- Socio-economic studies of nomadic groups and other communities living in areas surrounding the park with emphasis on conflict resolution and community based resources management.

C.15.4 Post graduate studies

Post-graduate studies from universities and research centers should be encouraged to conduct their research in Dinder. However priorities should be set by the Dinder Research committee.

C.15.5 Documentation and dissemination activities

- Copies of all dissertations and research paper completed about problems in Dinder should be deposited at the Library of the Research Unit.
- A periodical or annual report should be produced and disseminated to relevant organization.
- The web site of Dinder Park should be updated to include all new research results.



D. Five-Years Management Work Plan

D.1 Specific Activities in Specific Zones

D.1.1 Habitat Management

D.1.1.1. Core Zone: (Immediate Activities)

Water Improvement in Mayas: (Phase 1)

The criteria used in categorizing the mayas in the priority order of water improvement are:

- Proximity to Galegu.
- Rate of deterioration.
- Importance for recreational or tourist use.

The following order is proposed in terms of priority as well as estimated cost for the reclamation of mayas:

(i) Abdel Ghani and Semmaya:	year 1:	$ 8,000
(ii) Mayat Musa and Gererrisa:	year 2:	$ 8,000
(iii)Ein Es Shams and Dabkara:	year 3:	$ 8,000
(iv)Beit el Wahash and Heneifa:	year 4:	$ 8,000
(v) Farsh el Naam, Simseer, Sambroug and Al Abyad :	year 4:	$ 8,000

Improvement of water in the above stated mayas will involve excavation on the Maya base to a depth of 1 m at various places after the contours of each maya have been mapped. The total estimated cost for water improvement on the mayas is US. $40,000.

The present boreholes in Ras Amir and Gererrisa should be maintained, for use when necessary. One or two new wells are recommended to be drilled at selected areas. The cost would be US$ 15,000.

Opening of the Feeder Channels: (Phase II)

Opening of the Feeder Channels which have been blocked will follow phase I. When the necessary equipment and machinery are available.

More studies are needed on Khor Galegu and its tributaries to determine its volume of water flow and the rate of sedimentation on the main Mayas. The cost of these studies is estimated at US$ 20,000. Ecological studies on Mayas regarding the utilization by wild ungulates, vegetation types, plant invaders and carrying capacities would be covered by the above estimated sum.

D.1.1.2 Buffer and Transition Zones

Mayas in both the buffer and transitional zones should be rehabilitated in the same manner as in the core zone. Viable mayas could be used by livestock, thus minimizing their trespassing into the core zone.

Recommendations:

- Surveying buffer and transitional zone of mayas with the aim of increasing and improving their water carrying capacities.
- Yearly survey of water pools in the river bed so that they can be managed and protected against exploitation by livestock and poachers.
- Monitoring the effects of grazing on the vegetation. The results could be used in developing a grazing system which is sustainable.

D.1.2. Firebreaks

Firebreaks of 20m in width should be graded to prevent the spread of fires to fragile areas. Controlled burning is important, but also important near Mayas to facilitate viewing by the visitors.

Burning should only be carried out in open woodland. Fires should not be allowed in the riverine forests. There should be some sort of equipment and tools for firefighting. Controlled burning should be in the late dry season. The cost for introducing firebreaks is estimated to be 50,000 US$. It is recommended that further studies be made on the changes of vegetation, specially the rate of *A seyal* increase in the park as well as on other important species, and particularly on endangered and vulnerable species. Studies on the quality and quantity of dead wood in each plant community should be done, comparing results with those of other areas. The result may either be correlated to natural or meteorological conditions.

D.1.3. Improvement of Wetlands Management

Improvement of wetlands management is essential for waterfowl, because some of the wetlands contain fish which are fed upon by some waterfowl. This would ultimately increase the use of wetlands by waterfowl.

Fisheries

As the communities within and around the park may be permitted to conduct controlled fishing in some Mayas, it is vital to set fishing seasons and defined fishing methods. The suggested fishing season is from October-January, particularly when some mayas begin to dry up.

D. 2. Adaptive management and Evaluation

The evaluation of the DNP plan will be based on:

The numbers and species composition of wildlife.

The habitat will be evaluated on the basis of:

- The density and species of plants.
- The frequency and extent of fires.
- The number, size and type of trespassing herds.

Personnel are to be evaluated on the basis of length of stay in the park, duties executed and results obtained, loyalty and dedication.

Community-DNP relations to be based on the degree and depth of friendly cooperation, activities and civil service indicators.

D.3. Consultation and coordination

D.3.1 Public Relations Unit

The administrative structure of the DNP would include a Public Relations Unit for consultation and coordination with other stakeholders and involved institutions and organizations. The Unit will be entrusted with:

(i) National promotion of the Park.
(ii) Confidence building with stakeholders.
(iii) Public awareness and training of local Communities.
(iv) Conflict resolution
(v) Capacity building for Park personnel

D.3.2 Council of Park Stakeholders

The Council will comprise, in addition to the DNP administration, Village Development Committees (VDCs) the Unions of Planned and Unplanned Mechanized Farmers, Traditional Farmers, Pastoralists and local community organizations and leaders and authorities of the involved States.

D.3.3 National Body

For consultation and coordination at the national level, a body is to be established with membership drawn from DNP, other parks, WCGA, various ministries concerned with resource management and the environment, HCENR, National Unions of Farmers and Pastoralists, NGOs, Universities and Ministries dealing with Research Education and Technology as well as members from organized business and tourism. This should become the **National Parks Board** of Sudan.

D.4. Community-Based activities

These activities are to be coordinated by the DNP, local community organizations the authorities at the National, State and Locality levels, and donors.

D.4.1 The activities and projects may include

i. Preservation and development of grazing lands.
ii. Improvement of agricultural techniques and implements especially for small holding farmers.
iii. Sustainable use of resources for community development.
iv. Revolving fund activities, especially for women.
v. Employment of local people in the park.
vi. Provision of health services, education, potable water, non-wood energy resources.

D.4.2 Proposed Community-based Programmes

The Dinder National Park Project (DNPP) has initiated a number of community-based activities in the three states surrounding the park (Gedarif, Sennar and Blue Nile). These activities were based on socio-economic surveys followed by sensitization and awareness campaigns that resulted in the establishment of Village Development Committees (VDCs) in 25 villages. Some of the VDCs were trained in PLA (Participatory Learning Approach), project preparation and simple feasibility studies to enable them to gain access to funds from the community revolving fund (DNPP).

All these efforts resulted in a gradual change in the perceptions of the local communities regarding the DNP and the park authorities. Some of the VDCs led local awareness campaigns to reach some of the villages, which were not included in the DNPP.

There is a need to consolidate the DNPP community-based efforts in order to reach the goal of direct involvement of the communities in decision-making on sustainable use of the natural resources of the park.

In the following pages, programmes are presented for each of the three states. Although some activities are similar, each state has its own unique ecological and socio-economic conditions.

D.4.2.1 Proposed Projects in the state of Gedarif

In capacity building within the Village Development Committees projects and activities should be initiated by the DNPP and the villagers would learn through participation. The following are recommended:

D.4.2.1.1 Awareness Raising

The Sudanese Environment Conservation Society (SECS) has assisted the DNPP in carrying out various environmental awareness raising and activities. Some of these activities were generated locally. There is a need for building the capacities of the VDCs in implementing awareness activities at the local level such as:

- Training in communication skills, conflict transformation, basic environmental and health principles, and the importance of the DNP.
- Training in the design and synthesis of puppets from local materials, preparation and implementation of puppet shows

Location: The River Rahad Area
Duration: 18 months
Cost: US$ 20,000

D.4.2.1.2 Training

Some of the members of the VDCs were trained in problem identification, PLA, project identification and implementation. More training is needed in the following areas:

- Management and organization
- Strategic planning (community action plans)
- Community mobilization
- Fund raising
- Training primary school teachers

Activities: Five training sessions
Location: River Rahad area
Duration: 12 months
Cost: US$ 14,500

D.4.2.1.3 Agroforestry

The River Rahad area has been devastated by forest clearance for cultivation. A pilot agroforestry activity was initiated in El Ebaik village by the DNPP, where trees were planted and irrigated in combination with vegetables. The vegetables provide additional income for the farmers in addition to improving the diet, which is usually based on sorghum and okra. Other villages have requested to be included in this initiative. Recommended activities:

- Training of VDCs in two villages in seedling production and tending in Bandaghau nursery.
- Planting tree seedlings in the nursery.
- Purchase of two water pumps.
- Planting of the tees and vegetables.

Location: ElFazra and Karsh Elfil villages
Duration: 12 months
Cost: US$ 20,000

D.4.2.1.4 Fisheries

Most of the people in the area rely on dried fish as a source of food especially for the agricultural labourers. The fish is partly supplied form the River Rahad in the rainy season and partly from illicit fishing inside the Park in the dry season. Fish cultivation will guarantee a steady stock of fish, supplement the diet and provide additional revenue for the VDCs. The excess water from the fishponds can be used for irrigation of crops and vegetables.

Location: Um Elkhair & Bandigaiw villages
Duration: 24 months
Cost: US$ 30,000

D.4.2.1.5 Provision of Butane Gas Cylinders

The DNPP provided 10 of the villages in the River Rahad area with 350 butane gas cylinders with stoves. The DNPP assisted in establishing a butane gas shop in Um Elkhair village. The demand for the cylinders is increasing. The cylinders were

provided from the revolving fund, where the beneficiaries repay the cost of the cylinder in monthly installments (6 months). The money is collected by VDCs and used for the village (Sanduq) to supply credit for other individual and community projects.

Activities: Distribution of 1,000 butane gas cylinders, 500 stoves and accessories.
Location: River Rahad Villages
Duration: 8 months
Cost: US$ 42,000

D.4.2.1.6 Provision of services for the Pastoralists

The pastoralists are marginalized. They pay taxes but they receive the minimum of services. Because there are neither pastures nor water points in the vicinity of the park, they trespass into the park in spite of the severe penalties facing them. The DNPP began working with the three states to guarantee the allotment of lands as pastures in modified land- use plans at the states level. There is a clear need to provide water and alternative pastures in the transitional zone on a share-cost basis with the pastoralists unions. Recommended activities:

- Excavation of three (Hafirs) along the River Rahad.
- Range improvement in collaboration with the Range and Pasture Administration.
- Position of veterinary services in stations along the stock routes.

Location: Along the River Rahad on the eastern bank (khor Abu Adar, Jebel Abu Sibaika)
Duration: 24 months
Cost: US$ 150,000

D.4.2.1.7 Game Ranching

It is recommended that a feasibility study is immediately undertaken into the establishment of Game Ranching in designated areas bordering the Park. Threatened and endangered species could be bred in some projects and general wildlife in others. Wildlife is as a rule more adaptable in agricultural marginal areas. Breeding programs of Cape Buffalo and Roan Antelope are recommended and can be exported at good prices in addition to the promoting of game ranching into other parts of Sudan.**(See also section C.7.13)**

D.4.2.2 Proposed Projects in the State of Sennar

In capacity building within the Village Development Committees projects and activities should be initiated by the DNPP and the villagers would learn through participation. The following are recommended:

D.4.2.2.1 Awareness Raising

The Sudanese Environment Conservation Society (SECS) has assisted the DNPP in carrying out various environmental awareness raising and activities. Some of these activities were generated locally. There is a need for building the capacities of the VDCs in implementing awareness activities at the local level such as:

- Training in communication skills, conflict transformation, basic environmental and health principles, and the importance of the DNP.
- Training in the design and synthesis of puppets from local materials, preparation and implementation of puppet shows

Location: Sennar State
Duration: 18 months
Cost: US$ 20,000

D.4.2.2.2 Training

Some of the members of the VDCs were trained in problems identification, PLA, project identification and implementation. More training is needed in the following areas:

- Management and organization
- Strategic planning (community action plans)
- Community mobilization
- Fund raising
- Training primary school teachers

Activities: Five training sessions
Location: Sennar State Villages
Duration: 12 months
Cost: US$ 14,500

D.4.2.2.3 Improving Agricultural Production (Rainfed)

Agricultural production is low; continuous cultivation coupled with mono-cropping has resulted in the loss of soil fertility. The low productivity leads to increased trespassing on the park by the communities to provide supplementary income.The following activities are proposed :

- Intensive agricultural extension to assist the traditional farmers in the adoption of improved agricultural practices.
- Provision of improved seeds.
- Provision of agricultural credit.
- Provision of tractors and accessories.

Location: Sennar Villages
Cost: US$ 170,000

D.4.2.2.4 Improving Agricultural Practices (Gedarif)

The "Gedarif" riverbanks are not fully developed in Sennar state. Presently only watermelons and cucumber are produced in the Gedarif area. The following is recommended to improve the state of affairs:

- Encouraging women to cultivate vegetables around their homes (Gubrakas).

Location: Um Bagara East, Um Bagara West and Um Sagit Villages
Cost: US$ 23,000

D.4.2.3 Proposed Project in the Blue Nile State

The Sudanese Environment Conservation Society (SECS) has assisted the DNPP in carrying out various environmental awareness activities. Some of these activities were generated locally. There is a need for building the capacities of the VDCs in implementing awareness activities at the local level. This can be done by:

- Training in communication skills, conflict resolution, basic environmental and health principles, and the importance of the DNP.
- Training in the design and synthesis of puppets from local materials, preparation and implementation of puppet shows

Location: Blue Nile Villages
Duration: 18 months
Cost: US$ 20,000

D.4.2.3.1 Training

Some of the members of the VDCs were trained in problems identification, PLA, project identification and implementation. More training is needed in the following areas:

- Management and organization
- Strategic planning (community action plans)
- Community mobilization
- Fund raising
- Training primary school teachers

Activities: Five training sessions
Location: Blue Nile Villages
Duration: 12 months
Cost: US$ 14,500

D.4.2.3.2 Rehabilitation of the Primary Schools and Dispensaries (South of Roseiris)

The dominant tribe in the south of Roseiris commisionary is the Kadalu tribe. The Kadalu community has suffered from the civil war that was rampant in the area in the period 1997-2001.

In the year 2002 they started to trickle back to their devastated villages. The DNPP and the Sudanese Environment Conservation Society has helped to relieve the severe food shortages in the area caused by the scanty rains in 2002. The Kadalu community lives in 17 villages and there is an effort extended towards the voluntary amalgamation of these villages into five villages to facilitate the provision of basic services.

Activities: Rehabilitation of five schools and five dispensaries.
Location: The villages of Kadalu (Abu Gaddaf, Jebel El Nour, Manchalang and Menza).
Cost: US$ 120,000.

D.4.2.3.4 Improving the Households Diet

The food habits of the Kadalu community have to be improved to improve their health, especially the children who in most cases suffer from malnutrition.

Activities recommended:

- Encouraging women to cultivate vegetables around their homes (Jubrakas).
- Establishing a pilot vegetable and fruit tree farm in an area of 20 feddans with the provision of a permanent source of irrigation.
- Provision of vegetable seeds and fruit tree seedlings.

Location: Jebel El Nour village
Cost: US$ 42,000

D.4.2.3.5 Provision of Potable Water

Most or the villages in the areas adjacent to the park rely on brackish seasonal water sources. This situation adversely affects the health situation in the area.

Activities proposed:

- Digging and installing of hand pumps in seven villages (Two pumps per each village).
- Training of the villagers in pump maintenance.

Location:

- Abu Gaddaf, Jebel El Nour, Menza, Mukla and Manchalang (South Roseiris).
- Dwaima and Tabia Elbaleelab (North Roseiris).

Cost: US$ 43,000

D.4.2.3.6 Provision of Services for the pastoralists

The pastoralists are marginalized. They pay taxes but they receive the minimum of services. Because there are neither pastures nor water points in the vicinity of the park, they trespass into the park in spite of the severe penalties facing them. The DNPP began working with the three states to guarantee the allotment of lands as pastures in modified land- use plans at the states level. There is a clear need to

provide water and alternative pastures in the transitional zone on a share-cost basis with the pastoralists unions.

Location: In the transitional zone
Cost: US$ 42.000

D.4.2.3.7 Game Ranching
This aspect should not be under estimated in its value to local community upliftment. See section **D4.2.1.7 and C.7.13.**

Table 23. Five Year Action Plan and Budget in US dollars

Year	Activities	Details	Budget
One	♦ Purchase of motor grader	One motor Grader	200000
	♦ Purchase of Bull dowser	One Bull dowser	300000
	♦ Opening of Existing Roads + Sliders	575km 20 Sliders	10000
	♦ Opening of Boundary Road	400km	8000
	♦ Establishment of Entrance Gate	One Entrance gate at Suniet	25000
	♦ Purchase of Vehicles Tractors and Unimogs	Five land cruisers 4WD 1 Tractors 2 Unimogs	500000
	Game Posts Establishment	**12 Game post one maintain post at Abyad**	18000
	H.Q Buildings	Offices, Junior type Houses, Workshop, Rest House Generator Stores, Well	50000
	Field Equipment	28 GPS, 05 Binoculars	15000
	Communication Facilities purchase	40 Walky Talkies 20 Long Range and 11 short Range Radios	60000
	Walking Trails Opening	20 km	3000
	Opening of Tourist Roads	150km	5000
	Training of Tourist Guides Training of Game Scout	20 scouts Various Fields Related to the Park Management	10000 7000
	Maya Maintenance	2 Mayas	40000
	Visitors Centre	Audio visual, Video Projector + T.V sets + Power Projector Herbarium	15000 6000
	Community Development Programmes Boat Purchase	Villages Around Rahad+Kadalo One out board engine	50000 60000
Total			**1392**

Year	Activities	Details	Budget
Two	• Entrance Gate Establishment	One gate at Um Kurra	25000
	• Training of Officers and Game scout	50% officers and 50% of game scouts in various fields	15000
	• Rehabilitation and Opening of roads	Existing and newly opened roads, trails E.T.C	20000
	• Purchase of Vehicles	Five 4WD land-cruisers	300000
	• Establishment of Tourist camps	3 camps	5000
	• Viewing point	3 Viewing points	2000
	• Purchase of Roller	One roller	100000
	• Library	Cupboards + Books	5000
	• Community Development Programs	All villages surveyed	50000
	• Maya Maintenance	2 Maya according to the priority	30000
	• HQ Buildings		50000
	• Purchase of Camels	14 camels	7000
	• Purchase of a lorry	One lorry	40000
Total			**649000**

Year	Activities	Details	Budget
Three	Entrance gate establishment	Blue Nile Site	25000
	Training of park personnel	50% officers + 50% game scouts	15000
	Roads and building maintenance		30000
	HQ Buildings		50000
	Purchase of camels	14 camels	8000
	Purchase of vehicles	3 x4 WD land cruisers	180000
	Sign post maintenance		5000
	Museum establishment		20000
	Maya rehabilitation	2 Maya according to priorities.	35000
	Community Development Programs		50000
Total			**418000**

Year	Activities	Details	Budget
Four	• Purchase of vehicles	4 WD land cruiser	250000
	• Head quarters building maintenance		20000
	• Machinery maintenance		30000
	• Clearing of boundaries road		15000
	• Game posts maintenance		10000
	• Rehabilitation of roads and sliders	Both Administrative Tourist, trails and sliders crossing rivers during the dry season	20000
	• Training of the park personnel	Officers and game scouts	15000
	• Community Development Programs		50000
	• Maya Maintenance		35000
Total			**445**

Year	Activities	Details	Budget
Five	Community Development Programs		50000
	Training Courses		15000
	Maya Maintenance		35000
	Roads maintenance		15000
	Equipment maintenance		30000
Total			**145**

BIBLIOGRAPHY

1. Abdel Hameed, S. M. 1985. Dietry overlap of Tiang, Buffalo, Reedbuck, Waterbuck and Sheep in Dinder National Park, Sudan . In proceedings of the 1986 International Range Land Development Symposium. PP. 127 - 138 .

2. Abdel Hameed S. M. 1989 . Successional trends in theVegetation of mayas in Dinder N. P. Sudan . (unpubl.paper) WRC. 19p.

3. Abdel Hameed S. M. 1990 . The effect of livestock tresspassing on wild herbivores of Dinder N.P. Sudan. (unpubl paper in Arabic). WRC. 10p.

4. Abdel Hameed , S. M, N. M. Awad , M. B. Nimir, S. A. Hakim, and I. M. Hashim.1994. Census of Large mammals population in Dinder N.P., Sudan. Workshop for Management Plan of Dinder.N.P. SECS - UNESCO. July 1994, Khartoum.

5. Abdel Hameed, S.M.1994 . Dropping counts of large mammals population in Dinder N. P., Sudan. (unpubL. paper). WRC. 12p.

6. Abdel Hameed ,S.M.,A. A.Hamid ,N,M. Awad, A.I .El Maghraby and O. A. Osman 1996. Landscape Ecological Vegetation Map of Dinder N. P. Accepted for Publ. in Wildlife and Nature. J. 12p.

7. Abdel Hameed. S. M, A. A. Hamid, N. M. Awad, O. A. Osman, A. I. El Maghraby, H. Hamid. 1995.Wildlife Habitat Assessment of Dinder N. P. by Remote Sensing Techniques. 2th Scientific Research Conf., El Behous J.Vol. 5: 41-55.

8. Abdel Hameed , S. M. 1995. Natural Reserves of the Sudan. Sub-regional Workshop of Biosphere Reserves in Arab Region UNESCO, Cairo- Egypt, June 27- July 10, 1995.

9. Abdelhamed, S. M, 1996. Biosphere Reserves in Sudan. Wildlife and Nature J. vol 14 (2) p 18-31.

10. Abdel Hameed, S. M., A. A.Hamid ,N .M.Awad, A. I. El Maghraby and O.A.Osman 1997. Watershed management in Dinder N.P. IUFRO. Conf., Tamper, Finland, Sept . 1995 . Agriculture and Forest Meterology J March 1997.Vol 84 No 1-2: 89-96 .

11. Abdel Hameed ,S.M. N. M. Awad, M. B. Nimir, S. A. Hakim, E. O. Ahmed & I.M. Hashim. 1997.Vegetational Succession and its effect on Wildlife Herbiovory in Mayas of Dinder N. P., Sudan. XI World Forestry Congress ,Anatalyia, Turkey, Oct,13-21,1997 in the proceedings Vol. 3 P. 347.

12. Abdel Hameed S. M. 1998. Biosphere Reserves in the Sudan. Regional Workshop for Site Selection and Management of Biosphere Reserves. UNESCO. April , 27- 30 , 1998 Dana / Jordon. (in Arabic) .

13. Abdel Hameed S. M. 1998. Mammal & plant species list for the Dinder & Radom Biosphere Reserves , Sudan . publ. in East Africa MAB Fauna & Flora programs., BRIM Bulletin,p.5. May 1998.

14. Abdel Hameed, S. M. & M. B. Nimir. 1999. Biosphere Reserves in Sudan: Between Theory & Implementation. (in Arabic) The Fourth Scientific Conf., National Center for Research. April, 6-8, 1999. El Behous J., Dec.2000., Part(2),Vol. 8(1): 480-506.

15. Abdel Hameed, S. M. & A. O. El Jack. 1999. Diversity in Wildlife Species & Ecosystems in the Blue Nile , Sennar, & Gedarif States. Biodiversity Project. HCENR/IUCN. 40p.

16. Abdel Hameed, S. M., A. A. Hamid, N. M. Awad, A. El Maghraby & O. A. Osman 1999. Assessment of Watershed Problem in Dinder N. Park. WRC. / UNESCO. 17 P.

17. Abdel Hameed, S. M. 2000. Protected Areas in the Sudan and their role as Biosphere reserves. Regional Workshop for Effective Management of Protected areas & Biosphere reserves for the Conservation of biodiversity. CEDARE. Damascus, Syria, 19 - 21 Sept. 2000.

18. Abdel Hameed S. M., N. M. Awad and A. A. Hamid 1999. Forest and Woodland Ecosystem in Dinder N. Park: A challenge to integrate Conservation. XXI IUFRO World Congress, Kula lumpur, Malayzia. Aug. 7-12, 2000. In proceeding Vol. 2 P. 112.

19. Arenst, P. and El Wasela, M. 1985. Present Status of Dinder N. P. Institute of Environmental Studies.Univ. of Khart.

20. Abu Shama, F. T. 1981. Dinder besieged. Sudan Environment 1 (2):4-5. Institute of Environmental Studies. Univ. of Khart.

21. Andrews, F. W. 1984. The vegetation of the Sudan pp. 32-61. In J. D. Tothill ed. Agriculture in the Sudan. Oxford Univ. press, London 974 p.

22. Awad, N. M., S. M. AbdelHameed and R. M. Hansen . 1983 . Keys to the Identification of plant fragements from Dinder N . Park Range Science Dept. Science Series No. 34, Jan. 1983,CSU.USA . 58 P.

23. Awad, N. M. and W. A. Laycock. 1986. Food habits of giraffe, roan antelope, oribi and camel in Dinder National Park Sudan. International Range lands Development Symposium. Florida. USA. In Proceedings pp. 116-126.

24. Awad N. M, O. S. Gutbi, A. H. Mohamadain, and H. Gobara. 1992. Indigenous population: Case of Magano population in Dinder National Park. WRC- LSDA 30p.

25. Awad, N. M. 1979 . Vegetational cover of Dinder N.P. (WRC unpubl report, in Arabic).

26. Bacon, P. J. 1982. An integrated Ecological study of Dinder National Park (unpubl. paper). Institute of Environmental Studies. Univ. of Khart.

27. Bailey, R. G. 1994. Guide to the fishes of the River Nile in the Republic of Sudan., King's College. London. Uni of Khart.

28. Baxter, D. 1981. Man and Ecology in Dinder. Envi. 1 (2): 5-7 Institute of Environmental Studies. Univ. of Khart.

29. Brocklehurst, H. C. 1931. Game Animals of the Sudan: Their Habitats and Distribution. Garney and Jackson, London, pp . 170.

30. Clark. J. and S. Clark 1978. Partial list of the birds of Dinder National Park.. WRC.(unpubl report). 5p.

31. Clark. J. and S. Clark 1977. Preliminary analysis of the daily activity pattern of Tiang in Dinder National Park. WRC.(unpubl report). 7p

32. Dasmann, W. 1972. Development and management of Dinder National Park and its Wildlife ; F.A.O. Rome No. TA 3113. 61p.

33. Dongola G. and B. Fadellala, 1985. Scarification treatment to enhance germination capacity in *A. seyal* seeds. WRC. (Unpubl paper)

34. Dongola, G. and B, Fadellala, 1985. Effect of fire intensity on germination of *Balanites aegyptiaca* seeds. WRC. (Unpubl paper)

35. Dongola, G. and B, Fadellala, 1985. Effect of fire intensity on germination in *A. seyal* seeds. WRC.(Unpubl paper)

36. El amin, H.M. 1990. Trees and shrubs of The Sudan. Ithaca press, Biddles Ltd. Guildford and Kings Lynn, England.

37. El Maghraby, A. I. and Abdu, A. S. 1985. The Dinder National Park Study area; final report, Institute of Environmental Studies. Univ. of Khart.

38. El Maghraby, A. I. and N. M. Awad. 2002. A guide to Dinder National Park, Sudan. (A book underpress).

39. Forbes, A. 1950. The Dinder Park and Shooting Parties in Early Years. Sudan Wildlife and Sport 1(3): 25-29.

40. Hakim, S., B. Fadlalla, N. M. Awad, and S. Abdel Wahab. 1978. Ecosystems of the Vegetation of Dinder National Park WRC. (Unpubl. Report) . 22p.

41. Hakim, S. A. 1979. Impact of fire on the Natural system in Dinder National Park. WRC. (Unpubl paper). 6p.

42. Hakim, S. A. 1982. Drying of Mayas as related to aging. WRC. (Unpubl paper). 7p.

43. Hakim, S. A. and N. M. Awad. 1978. Census and migration pattern of Taing in Dinder National Park. WRC. (Unpubl paper). 6p.

44. Hakim S. A. 1978. Fire as an environmental factor WRC, (Unpubl paper). 7p.

45. Hakim, S. A. and M. B. Nimir, 1978. Comprehensive land use plan on Wildlife conservation of the Dinder Region WRC. (Unpubl paper). 10p

46. Hakim, S. A., Abdel Gader. L., and Awad. N. M. 1978. Behaviour of shore line vegetation in response to drying and filling up of Lake Ras Amir. WRC. (Unpubl paper). 5p.

47. Hakim, S. 1981. Description of Wildlife in Dinder National Park as dectated by Habitat structure. WRC. (Unpubl paper).5p.

48. Hakim, S.A. 1979. Law Enforcement and conservation of Dinder. N. P.WRC. (Unpubl paper, in arabic). 7p.

49. Hakim, S. A. 1977. Illegal activities of pasturalists on Dinder N. Park. (Unpubl paper, in arabic).6p.

50. Hakim S. A. 1979. An appraised of a proposal about wildlife and fisheries utilization in D. N.P.WRC. (Unpubl paper, in arabic).7p.

51. Hakim, S.A. 1979. Observation on the animal population at Abdel Ghani Maya. WRC (Unpubl paper) 8p.

52. Hamd, D.M. 1995. Bird Fauna in Dinder National Park. (Report).Uni. Khart.

53. Happold , D. C. D. 1999. The Future of Wildlife in the Sudan. Oryx. 8: 369-373.

54. Harrison, G.L. 1953. Dinder N. Park 1905. Sudan Wildl and Sports . LTd. 3(2):5-26.

55. Harrison, M. N. and J. K. Jackson. 1958. Ecological Classification of the vegetation of the Sudan. Agric. Pub 1. Comm. Minist. Of Agric. Forest Dept. Forest Bu 11. No. 2. Khartoum, Sudan, pp.46.

56. Hashim I. M. 1987. Relationship between biomass of forage used and masses of faecal pallets of wild animals, in meadows of Dinder National Park Afri, J, Ecol, vol. (25): 277-223.

57. Hashim, I. M. and J. E. Oreyma 1996. The possible impact of Rahad link Canal on Dinder National Park. Nature and Wildlife J. Vol. 12 :14-24.

58. Hashim I. M. and Nimir M. B. 1975. Population trend counts of tiang (*Damaliscus korrigram* tiang Heaglin), water buck (*kobus defassa* harnier nurie) and roan antelope (*Hippotragus equinus* Henghim) in Dinder National Park. WRC. (Unpubl paper) 6p.

59. Hashim I. M. 1975. Effect of rapid population decline on Tiang (*Damaliscus korrigram* tiang Heuglin) herd structure. WRC (Unpubl paper) 7p.

60. Hashim, I. M. and Nimir, M. B. 1978. A new policy for protected wildlife areas in Northern Sudan. (In Arabic) . The First Game Officers Conference. Wildlife Administration, Khartoum , Sudan. 13p.

61. HCENR- WRC. 2001. Ecological Base-line Survey in Dinder National Park. Part I. Report 2001 / Dinder Project.

62. HCENR- WRC. 2002. Ecological Base-line Survey in Dinder National Park. Part II. Report 2001 / Dinder Project

63. HCENR. 2001. Socio-economic Base-line Survey in Dinder National Park. Dinder Project. 26p.

64. HCENR. 2001. Hydrological survey in Dinder National Park. Dinder Project. 20p.

65. Holsworth, N. W. 1968. Dinder N. Park. Report to the government of the Sudan. FAO. Rome No TA 2457. 26p.

66. Kodi, A. T. 1998. Biosphere Reserves in the Sudan (In Arabic). Workshop for Management of Biosphere Reserves in Arab region. UNESCO. July , 1998.Syria.

67. Mason, M. H. 1924. Desert idle. Hodder and Stoughtom Ltd, Lond. 211p.

68. Minga, H. C. 1971. Census of the large mammals population within Dinder National Park. Democratic Republic of the Sudan. 12p.

69. Ministry of Interior. 1990. Report of the committee to study the impact of Rahad villages on the Dinder N. Park.

70. Mohammed, A. S. 1980. An out break of Rinder Pest in Dinder National Park. WRC. (unpubl paper) 5p.

71. Mohammed, A. S. 1978. Myiasis in Reedbuck Dinder National Park. WRC. (unpubl paper) 6p.

72. Mohammed, A. S. and F. T. Abu-Shama. 1984. A preliminary report about mortality of reedbuck Dinder National Park, WRC. (Unpubl paper) 5p.

73. Mahmoud , Z. M. 1984. Ichthyofauna of the Dinder National Park, Sudan. Afr. J. Ecol., 14: 27-29 .

74. Moore, G. 1974 : Wildlife and National Parks Legislation. Report to the Government of the Sudan . FAO., Rome, No. TA 3300. 96p.

75. Musko, M. B. 1982. Problems of Dinder National Park: an additional thought. Institute of Environmental Studies. Univ. Khart.
Sudan Environment 20: 7-9.

76. Nimir, M. B. 1979. Mechanized agriculture and other factors threatening the Dinder National Park. WRC.(Unpubl paper) 10pp.

77. Nimir, M. B. 1994. Management plans for National Parks.(in Arabic). Workshop for the preparation of management plan for the Dinder National Park. SECS/ UNESCO. 7p.

78. Nimir, M. B. 1984. Land use conflict in the Dinder Region Presented at the seminar on Environmental Change and Desertification in Sudan. (unpubl. paper) 10p.

79. Nimir, M. B.and I.M. Hashim. 1965. The Conflicts in Landuse Practices in the Dinder Region. The First Agricultural Conference . Ministry of Agriculture , Khartoum. (unpubl. Paper, in Arabic). 24p.

80. Nimir, M. B. 1995. Protected areas in Sudan. A National rept. Sub-Regional Workshop for Management of Protected areas. UNESCO.Khartoum. May 1995. (unpubl. Paper, in Arabic). 15p.

81. Nimir, M. B.and I.M. Hashim. 1975. Landuse Conflicts : Proposal for Re-consideration of Dinder National Park' Boundaries. The First Agricultural Conference. 25 p. (unpubl. Paper, in Arabic)

82. Osman, M. E. H. 1980.Touism in the Dinder National Park. (In Arabic). The Sudanese Tourism Corporation. (Unpubl. memo.,in Arabic).

83. Sahni, K.C. 1968. Important trees of The Northern Sudan, Khartoum University Press. Khartoum, Sudan.

84. Sandon, H., 1950. An illustated guide to the freshwater fishes of the Sudan, Sudan Notes and Records. Special Publication (London: McCorquodale), 66 p.

85. Smith, J. 1949. Distribution of tree species in the Sudan in relation to rainfall and soil texture. Agr. PubL. Comm., Khartoum, Sudan. 68 p.

M.Sc. and Ph.D. Thesis:

1. Abdel Hameed, S. M.1983.Vegetation of Mayas in Dinder National Park, Sudan. M. Sc. Thesis, Colorado State Univ. USA . 93p
2. Abdelhameed, S, M. 1985. Dietary overlap of Tiang, Buffalo Reedbuck, Waterbuck and sheep in Dinder National Park, Sudan. Ph. D. Thesis CSU, USA, 124 p.
3. Abdel Fadele, E. 1982. Ecological Studies of *Acacia seyal* and *Balanities aegyptiaca* in Dinder National Park. MSc. Thesis. Institute of Environmental Studies U.K.
4. Abdel Salam, Y. M. 1985. A population Study of the larger mammalian species in Dinder National Park MSc. Thesis. Institute of Environmental Studies. Univ. of Khartoum
5. Abdu, A. B. 1987. The utilization of national park educational sites in the Sudan: The case of Khartoum sunt forest, Um Barona and Dinder National Park. MSc. Thesis. Institute of Environmental Studies..Univ. of Khartoum.
6. Adam. A. H 1997. Live stock trespassing and its effect on some herbivors in Dinder National Park. M.Sc. Thesis. Institute of Environmental Studies. Univ. of Khartoum
7. Awad, N. M. 1982. Keys to identification of plant fragments from Dinder National Park Sudan. M. Sc. Thesis. CSU, USA. 99p.
8. Ali, S.A. 1986. Vegetation Dynamic of the mayas of Dinder N. P. MSc. Thesis. Univ. of Khartoum.
9. Awad, N. M. 1982, Food habits of Giraffe, roan antelope, Buffalo and Camel in Dinder National Park Ph. D. Thesis CSU, USA. 112p.
10. Dongola G. M. 1985. An ecological Study of the Dinder National Park with special reference to regeneration potential of *A. Seyal* and *Balanities aegyptiaca.* M.Sc.Thesis.Univ. of Khartoum, Sudan.
11. Elgoni, O. 1985. Effect of Burning on soil vegetation in Dinder National Park. MSc. Institute of environmental Studies. U.K.
12. Hage El Toum, A. K. 1982. Some aspects of the ecology of some mayas of Dinder National Park. MSc. Thesis. Institute of Environmental Studies.Univ. of Khartoum
13. Hashim, I. M. 1984. Meadow use by wild ungulates in Dinder National Park, Sudan. Ph. D. Thesis, NMSU, USA.
14. Ismail, E. H. 1982. Base line information of some mayas of the Dinder National Park: some aspect hydrological and siltation aspects. MSc. Thesis. Institute of Environmental Studies.Univ. of Khartoum.

15. Kteib. R.H. 2001. Towards a Management Plan for the Dinder N. Park. M.Sc. Thesis. Institute for Disaster Management. Africa Inter. Univ. Sudan. (in Arabic).
16. Mohammed, A. S. 1994. Ecological studies and the productivity of Guinea fowls in Dinder National Park, Ph. D. Thesis. Uni. Of El Gezira, Sudan.
17. Mohamed, H. A. 1999. A change in the relationship between man and the environment in Southern Blue Nile Area: Acase study of the Dinder Province. M. A. Thesis. Univ. of Khart.
18. Moilinga, P. T. D. 1996 . Base-line Ecology and Management of Olive Baboon (*Papio anubis*) in Dinder National Park. MSc. Thesis. Institute of Environmental Studies.Univ. of Khartoum
19. Nimir, M. B. 1983. Wildlife Values and management in Northern Sudan. Ph. D. Thesis CSU, USA. 180p.
20. Salih, M. 1982. Soil analyses results of Dinder area. Ph. D. Thesis USA.
21. Suliman, S. S. 1986. The effect of competition between wildlife and domestic livestock in natural rangeland of the Dinder N. Park. M.Sc. Thesis, I.E.S. Univ. of Khartoum.

Students' Dissertations

1. Abakar, A. A. Effect of Overgrazing of Domestic Livestock on Dinder National Park in the Period Between 1998 – 2001. BSc. (Honour) Dissertation Univ. of Juba.
2. Abdel Alatif, A. 1996. A study on some aspects of feeding ecology of olive Baboon (Papio anubis) in Dinder National Park BSc. (Honour) Dissertation Univ. of Juba.
3. Aborma, J. 1993. Impact of the proposed Rahad Canal on Dinder National Park.) . BSc. (Honour) Dissertation Univ. of Juba.
4. Abdu AlGauran, W. M. . Mayas of Dinder National Park. BSc. (Honour) Dissertation Univ. of Juba.
5. Adam, H. 2001. Effect of Overgrazing of Umbroro Cattle on Dinder National Park. BSc. Dissertation Univ. of Juba.
6. Adam, M. 2001. Buffalo in Dinder Natioal Park.(in arabic) BSc. Dissertation Univ. of Sennar.
7. Al Degeir, M. T. 2000. Impacts of Human Settelement on Dinder National Park. (in arabic). BSc. Dissertation Univ. of Sennar.
8. Alaa, A. A. 1994. Management Recomnendation for Dinder National Park. BSc. (Honour) Dissertation Univ. Of Juba.
9. Ayull Chan , A.E. 2000. Wildlife Based Tourism in the Sudan; A Case Study ; Dinder National Park. BSc. Dissertation Univ. of Juba 36 p.
10. Awad AlKarim, F. 2001.Trees and Shrubs Components in Wild Animal's Diets in Dinder National Park. BSc. Dissertation Univ. of Juba.
11. Dirdiri, S. Daily Activity of Water buck in Dinder National Park. BSc. (Honour). Dissertation Univ. of Juba.
12. Eliaba, J. A. 2000. Road Counts in Dinder National Park. BSc. Dissertation Univ. of Juba . 37p.
13. Fadul Elmula, D. A. 1994. Management Recommendation for Dinder National Park. BSc. Dissertation Univ. of Juba. 41p.
14. Gaffar, A.O.2001. Ecological Study of Termites (White ant) in Dinder National Park.(in arabic). BSc. Dissertation Univ. of Sennar.

15. George, J. I. 1993. Evaluation of the Development Aspects of Dinder National Park. BSc. Dissertation Univ. of Juba .34p.
16. Haroun, T. 2000. Overpopulation and it's Effect on Dinder National Park. (in arabic). BSc. Dissertation Univ. of Sennar.
17. Hamed, A. A. 2000. Influence of Fire and Tree-cutting on non-breeding bird communities in Dinder National Park. BSc. Dissertation Univ. of Juba . 29p.
18. Hamuda, A. Problems that threaten Dinder National Park.(in arabic) BSc. Dissertation Univ. of Sennar
19. Hassan, A. D.2001 .Tree Cover of Woodland (Dahara) of Dinder National Park. BSc. Dissertation Univ. of Juba.
20. Ibrahim ,T.2001. Kinds of Direct Resources Offered to the People around the Dinder National Park. (in arabic). BSc. Dissertation Univ. of Sennar.
21. Ikang, J. 1994. Evalution of development aspects of Dinder National Park. BSc. (Honour) Dissertation Univ. of Juba.
22. Jumma, A.G. 2001. The Use of Camel for Patrolling in Dinder National Park. (in arabic) BSc. Dissertation Univ. of Sennar.
23. Kara, E. 2001. International Conventions and their Effect on Wildlife Legislations. (in arabic) BSc. Dissertation Univ. of Sennar.
24. Kenneth, J. S. 1993. The Effects of Mechanized Farming and Livestok Grazing in Dinder National Park. BSc. (Honour) Dissertation Un. of Juba.48p.
25. Kimly, M. 2000 Behaviour, Density and Distribution of Baboon (*Papio anubis*) in Dinder National Park. BSc. Dissertation Univ. of Juba
26. Kpoor, N. A. 1996. The Dominant Tree Species of Riverine Forests of Dinder National Park and their inter-relationship with some wildlife species. BSc. (Honour) . Dissertation Univ. of Juba. 20p.
27. Koul, D. M. 1994 Road Counts in Dinder National Park. BSc. (Honour). Dissertation Univ. of Juba. . 50 p
28. Langa, E. J. 1993. Road and Pool counts at Galegu Area and management Recommendations for Dinder National Park. BSc. (Honour). Dissertation Univ. of Juba.
29. Mahjoub, M. 2001. Personnel in Dinder National Park. (in arabic) BSc. (Honour). Dissertation Univ. of Sennar.
30. Manni, M. M. 2000. Acute Toxicity of the Venoms of *Echis carinatus, Pyramidum and Naja nigricollis pallida* Against the Albino Rat (*Rattus norvegicus*) and the and the Common African Toad (*Bufo rigularis*). BSc. (Honour) . Dissertation Univ. of Juba. 37 p.
31. Mardish, B. D. 2001. Law Violations in Dinder Nationak Park. (in arabic) BSc. Dissertation Univ. of Sennar.
32. Mohamed, N. S. 2001. Population Estimate and Age Structure of Warthog in Dinder National Park. BSc. (Honour) Dissertation Univ. of Juba. 25 p.
33. Musa, S. A. 2000. Evaluation of Pellet-group Surveys for Estimating Population Trend in Dinder National Park. BSc. (Honour) Dissertation Univ. of Juba. 29 p.
34. Omer, E. E. 1990. Road and Pool Counts of Galego Area and Management Recommendation for Dinder National Park. BSc. (Honour) . Dissertation Univ. of Juba. 92 p.
35. Omer, F.A. Sustainable Development in Dinder National Park.(in arabic) BSc. Dissertation Univ. of Sennar

36. Osman, N. M. 2001. Dome Trees in Dinder National Park.(in arabic) BSc. Dissertation Univ. of Sennar
37. Osman, E. A. 2000. Comparative Study of Overstory Attributes at Three Mayas ; AbdelGani, Ras Amir and Grerrisa in Dinder National Park. . BSc. (Honour) Dissertation Univ. of Juba. 59 p.
38. Otwel, B. P. 1996. Distribution of *Struthio camelus* in Dinder National Park. BSc. (Honour) Dissertation Univ. of Juba.
39. Rahamtalla, T.2000. Daily Activity of Marabou Stork in Dinder National Park.(in arabic) BSc. Dissertation Univ. of Sennar
40. Students of Forestry Department, University of Khartoum. 1984. Dinder National Park ; Problems, Present and Future. 9 p.
41. Suleiman, K. 1994. Feasibility study of development of Tourism in Dinder National Park 1994. BSc. (Honour) Dissertation Univ. of Juba.
42. Yassin, A. S. 2001. Status of the Reed buck (*Redunca redunca*) in Dinder National Park between 1971- 1998.(in arabic) BSc. Dissertation Univ. of Sennar.
43. Yousef, M.2001. Tourism in Dinder National Park, and It's Role in Socio-economic Development. (in arabic) BSc. Dissertation Univ. of Sennar

Appendix 1: List of Common Plant species in Dinder National Park

(Source: Wildlife Research Center, Abdel Hameed, S. M. and N. M. Awad, 1981 and 1983 collection, HCENR. 2001 and 2002 Ecological Surveys)

A: Grasses and Herbaceous species

Scientific name	Local name
Abutilon sp.	Hambouk
Achyranthus aspera	Khashm Elnaseiba
Achyranthes sp.	
Alternathera sp.	
Amaranthus spinosus	
Amaranthus sp.	
Andropogon gayanus	Abu Rakhies
Astercanthe longifolia	
Aristida funiculata	Ghabash
Aristida mutablis	Gaw
Asparagus africana	Umm Mushbut
Barleria sp.	
Beckeropsis sp.	
Beckeropsis uniseta	Umm furaw
Blepharis lenariifolia	Moreib
Borreria verticillata	Bighail
Brachiaria deflexa	Simsim Elgidad
Brachiaria obtusiflora	Umchir
Brachiaria ramosa	Um chir
Burgia spp.	
Cassia tora	Kawal
Celosia argentea	Danab Elkadis
Chloris gayana	Afan Elkhadim
Chorchorus olitorious	Mulikiyia
Chrozophora Spp.	Argasi
Commelina imberbis	Beid
Crotalaria senegalensis	Safari
Cymbopogon nervatus	Nal
Cymbopogon proximus	Mahareib
Cynodon dactylon	Nagila
Cyperus gigantia	Seida
Cyperus inclinatus	
Dactyloctenium aegyptium	Abu assabi
Denebra retroflexa	Mamleiha
Desmodium dichotomum	Abu Areida
Echinochloa colonum	Difera
Echinochloa stagnina	Birdi
Eragrostis spp.	Banu
Fimbristylis sp.	
Foenicuium vulgare	
Heliotropium sp.	
Heliotropium sudanicum	Danab Elagrab

Scientific name	Local name
Heliotropium supinum	
Hibiscus spp.	Durraba
Hybanthus enneaspermus	
Hygrophylla spinosa	Um shoka
Hyparrhenia pseudocambaria	Anzora
Hyparrhenia rufa	Um surma
Hyparrthenia variables	
Ipomoea aquatic	Arkala
Ipomoea cardiosepala	
Ipomoea cardofana	
Ischaemum brachyatherum	Bous
Juncus sp.	
Kamahia sp.	
Kyllinga sp.	
Leptadenia heterophyla	Shaalob
Leptadinia sp.	
Leucas urticifolia	
Leucus africana	Asal Eltair
Monechma spp.	
Ocimum americanum	Reihan
Oldenlandia senegalensis	Garajoub
Pennisetum pedicellatum	Um Dofofo
Pennisetum ramosum	Danab Elbaashoum
Pidens pilosa	Black jack
Rhyncosia memnonia	Adan Elfar
Rottboellia exaltata	Abu Balila
Saccharum Spontaneoum	Umm ferido
Schoenefeldia gracilis	
Scripusin clintus	
Sesabania sesban	Soreib
Setaria incrassata	Um Hadeida
Setaria pallida fusca	Danab Elfalu
Setaria verticellata	Um Abaka
Solanum dobium	Gubein
Solanum incanum	Gubein
Sorghum purpureo sericum	Aneis
Sorghum sudanensis	Adar
Sporobolus humifusus	Aish elfar
Tribulus terrestris	Derreisa
Vahlia digyana	
Vossia cuspidata	Heliu
Xanthium brasilicum	Ramtouk

B. Trees and Shrubs

Scientific name	Local name
Acacia mellifera	Kitir
Acacia nilotica	Sunt
Acacia nubica	Laot
Acacia polycantha	Kakamout
Acacia schimperi	
Acacia seiberana	Kuk
Acacia senegal	Hashab
Acacia seyal var. fistula	Sofar abiad
Acacia seyal var. seyal	Talh
Adansonia digitata	Tabaldi
Albizia aylmeri	Sireira
Anogeissus leiocarpus	Al Sahab
Balanites aegyptiaca	Higleig
Boscia senegalensis	Mukheit
Boswellia papyrifera	Tarag Tarag, Gafal
Cadaba farinosa	
Calatropis progera	Oshar
Capparis decidua	Tundub
Combretum aculeatum	Shuheit
Combretum glutinosum	Habil
Combretum hartmmanianum	Habil
Commiphora africana	Gafal
Cordia Africana	
Crateva adansonii	Dabkar
Crateva adansonii	Dabkar
Dalbergia melanoxylon	Abanous
Dichrostachys cinerea	Kadad
Diospyros mespiliformis	Gughan
Entada africana	Sesaban
Faidherbia albida	Haraz
Ficus sycomorus	Gumeiz
Gardenia lutea	Abu Gawi
Grewia flavensis	Gregdan
Grewia mollis	Basham
Grewia tenax	Gudeim
Hyphaene thebaica	Dom
Lannea fruticosa	Layoun
Lonchocarpus laxiflora	Khashash Abiad
Maytenus senegalensis	Youi
Mimosa pigra	Shgarat alfass
Oxytenanthera abyssinca	Gana
Piliostigma reticulatum	Abu Khameira
Piliostigma thonningii	Abu Khameira
Pseudocedrela kotschyi	Druba
Pterocarpus lucens	Taraya
Salix safsaf	Safsaf

Sterculia setigera	Tar Tar
Stereospermum kunthianum	Khash Khash
Tamarindus indica	Aradeib
Tamarix aphylla	Tarfa
Terminalia brownii	Subagh
Terminalia laxiflora	Subagh
Xeromphis nilotic	Um mideko
Ziziphus abyssinica	Nabag El Feel
Ziziphus spina-christi	Sidir

List of endangered species in the park:

Acacia nilotica subsp. tomentosa	Sunat
Adansonia digitata	Tabaldi
Albizia aylmeri	Sereira
Dalbergia melanoxylon	Abanous
Diospyros mespiliformis	Gughan
Oxytenanthera abyssinica	Gana
Pseudocedrela kotschyi	Druba
Pterocarpus lucens	Taraia

Appendix 2: Common mammals of Dinder National Park

Scientific name	Local name
Caracal caracal	Caracal
Chlorocebus aethiopicus	Vervet monkey
Civetticus civetta	Civet cat
Crocuta crocuta	Spotted hyaena
Damaliscus korrigum	Tiang
Erythrocebus patac	Patas Monkey
Gazella runfifrons	Red-fronted Gazelle
Hippotragus equinus	Roan antelope
Hyaena hyaena	Striped hyaena
Hystrix cristata	Porcupine
Kobus defassa	Waterbuck
Leptailurus serval	Serval cat
Loxodonta africana	Elephant
Lycaon pictus	Wild dog
Mellivora capensis	Ratel (honey badger)
Orycteropus afer	Aardvark
Ourebia ourebia	Oribi
Panthera leo	Lion
Panthera pardus	Leopard
Papio anubis	Baboon
Phacochoerus aethiopicus	Warthog
Redunca redunca	Reedbuck
Syncerus caffer caffer	Buffalo
Tragelaphus imberbis	Greater Kudu
Tragelaphus imberbis	Lesser Kudu
Tragelaphus scriptus	Bushbuck

Appendix 3. List of common bird species in Dinder National Park

Struthioniformes:	
Struthionidae: **(Ostriches)**	
Struthio camelus	Ostrich
Pelecaniformes:	
Pelecanidae: **(Pelicans)**	
Pelecanuse rufescens	Pink-backed Pelican
Ciconiiformes:	
Ardeidae: **(Herons, Bitterns and Egrets)**	
Ardea cinerea	Grey Heron
Aredea melanocephala	Black-headed Heron
Ardeola ralloides	Squacco Heron
Bubulcus ibis	Cattle Egret
Egretta garzetta	Little Egret
Ardea purpurea	Purple Heron
Egretta intermedia	Yellow-billed Egret
Scopidae: **(Storks)**	
Anastomus lamelligerus	Open-billed Stork
Ciconia abdimii	Abdim's Stork
Ciconia episcopus	Wooly-necked Stork
Ephippiorhynchus senegalensis	Saddle-billed Stork
Leptoptilos crumeniferus	Marabou
Mycteria ibis	Yellow-billed stork
Threskiornithidae: **(Ibises and Spoonbills)**	
Botrychia hagedash	Hadida
Plegadis falcin ellus	Glossy Ibis
Threskiornis aethiopicus	Sacred Ibis
Platalea alba	African Spoonbill
Anseriformes:	
Anatidae: (**Ducks, Geese and Swans)**	
Dendrocygna bicolor	Fulvous Whistling Duck
Dendrocygna viduata	White-faced whistling Duck
Alopchen aegyptiacus	Egyption Goose
Anas platyhynchos	Mallard
Anas querquedula	Garganey
Plectropterus gambensis	Spur-winged Goose
Sarkidorins melanotos	Knob-billed Duck
Falconiormes:	
Accipitridate: **(Birds of Prey)**	
Gyps rueppellii	Ruppell's Vulture
Neophron monachus	Hooded Vulture
Neophron percnopterus	Egyption Vulture
Circus macrourus	Pallid Harrier
Accipiter minulhus	Little Sparrowhawk
Polyboroides radiatus	Harrier Hawk
Accipiter badias	

Labhactus occipitalis	Long-crested Eagle
Melierax gabar	Gabar Goshawk
Melierax metabates	Dark-chanting Goshawk
Haliaeetus vocifer	Fish Eagle
Milvus nigrans	Black kite
Chelictinia riocourii	Swallow-tailed kite
Falconidae: **(Falcons)**	
Falco biarnicus	Lanner Falcon
E. tinnunculus	Kestrel
Galliformes:	
Phasianidae: **(Qualis, Francolins)**	
Francolinus clappertoni	Clapperton's Francolin
Numididae: **(Guinea fowls)**	
Numida meleagris	Helmeted Guinea fowl
Gruiformes:	
Otididae: **(Bustards)**	
Otis arabs	Arabian Bustard
Tharadrii formes:	
Jacanidae: **(Jacanas)**	
Actophilornis africanus	Jacana
Chavadriidae: **(Plovers)**	
Charadrius	Ringed Plover
Vanellus Spinosus	Spur-winged Plover
Scolopacidae: **(Sand pipers and Snipes)**	
Actis hy poleucos	Common Sandpiper
Tringu goaveola	Wood Sandpiper
Tringa nebularia	Greenshank
Tringa stagnatilis	Marsh sandpiper
Tringa tetanus	Redshank
Calidris ferruginea	Curlew Sandpiper
Recurvirostridae: **(Stilts and Avocets)**	
Himantopus himantopus	Black-winged Stilt
Burhinidae: **(Thicknees)**	
Burhinus oedicemus	Stone Curlew
Difoemes:	
Columbidae: **(Pigeons and Doves)**	
Oena capensis	Namaqua Dove
Streptopelia dicipiens	Mourning Dove
Streptopelia senegalensis	Laughing Dove
Streptopelia vinacea	Vinaceous Dove
Turtur abyssinicus	Black-billed Wood Dove

Diformes:	
Cuculidae: **(Cuckoos and Coucals*)*	
Clamator glandarius	Great-spotted Cuckoo
Centropus senegalensis	Senegal Coucal
Strigiformes:	
Strigidae: **(Owls)**	
Bubo africanns	Spotted Eagle Owl
Apodiformes:	
Apodidae: **(Swifts)**	
Cypsiurus parvus	Palm Swift
Coliiformes:	
***Coliidae*: (Mousebirds)**	
Urocolius macrourus	Blue-naped Mousebird
Coraciiformes:	
Alcedinidae: **(Kingfishers)**	
Ceryle rudis	Pied king fisher
Alcedo cristata	Malachite king fisher
Halcyon leucocephala	Grey-headed king Fisher
Meropidae: (Bee-eaters)	
Merops abicollis	White-throat bee-eater
Merops bulocki	Red-throated Bee-eater
Merops nubicus	Carmine Bee-eater
Merops pusillus	Little Bee-eatere
Coraciidae: **(Rollers)**	
Cpracoas abussomocis	Abyssinian Roller
Phoeniculidae: **(Wood-hoopoe)**	
Phoeniculus purpur	Green Wood Hoopoe
Bucerotidae:	
Tochus erthrorhynehus	Red-billed Hornbill
Tochus nasutus	Grey Hornbill
Piciformes:	
Capitonidae: **(Barbets and *Tinkerbirds)***	
Pogoniulus chrysoconus	Yellow-fronted Tinker bird
Indicatoridae: **(Honey guides)**	
Indicator indicator	Black-throated Honey guide
Picidae: **(Wood peckers and Wrynecks)**	
Campethera nubica	Nubian Wood pecker
Mesopicos goertae	Grey Wood pecker
Passeriformes:	
Hirundinidae: **(Martins and Rough Wings)**	

Riparia poludicola	African Sand Martin
Dicruridae: **(Drongos)**	
Dicrurus adsimilis	Drongo
Corvidae: **(Crows)**	
Corvus albus	Pied Crow
Paridae: **(Tits)**	
Parus leucomelas	Black Tit
Timaliidae**: (Babblers)**	
Turdoides leucocephalus	White-headed Babbler
Pyenonotidae: **(Bulbuls)**	
Pycnonotus barbatus	White-vented Bulbul
Turdidae: (Thrushes and Robins)	
Oenanthe oenanthe	Northern Wheatear
Muscicapidae: **(Flycatchers)**	
Batis minor	Black-headed Batis
Terpsiphone viridis	Paradise Flycatcher
Motacillidae: **(Wagtails, Pipits and Long claws)**	
Motacilla alba	White Wagtail
Motacilla Flava	Yellow Wagtail
Laniidae: **(Shrikes)**	
Lanius collurio	Red-backed Shrike
Lanius nubicus	Nubian (masked) Shrike
Lanius sebator	Woodchat Shrike
Sturnidae: **(Starlings and Oxpeckers)**	
Creatophora cinerea	Wattled Starling
Lamprotornis chalybaeus	Blue-eared Glossy
Lamprotornis purpuropterus	Ruppell's long-tailed Glossy Starling
Buphagus aficanus	Yellow-billed Oxpecker
Nectariniidae: **(Sunbirds)**	
Nectarinia pulchella	Beautiful Sunbirds
Ploceidae: **(Weavers)**	
Ploceus badius	Cinnamon Weaver
Ploceus velatus	Vitelline Masked Weaver
Quelea quelea	Red-billed Quelea
Passer domesticus	House Sparrow
Passer griseus	Grey-headed Sparrow
Vidua macroura	Pin-tailed whydah
Estrildidae: **(Waxbills)**	
Estrilda astrild	Waxbill
Lagonosticta senegala	Red-billed Fire finch
Urageginthus bengalus	Red-cheeked Corodon-bleu

Amadina fasciata	Cut-throat
Lonchura malabarica	Silver-bill

Fringillidae: **(Buntings, Canaries and Seed-Eaters)**

Serinus mozambicus	Yellow-fronted Canary

Appendix 4: Game count results.

TRANSECT	Reedbuck				Oribi				Tiang					Waterbuck				
	1972	1989	1994	2001	1972	1989	1994	2001	1972	1985#	1989	1994	2001	1972	1985#	1989	1994	2001
Galegu-Farsh El Naam		75		17		29		1							64/28	15		
Galegu- Ras Air	116		6	13	13		3	6	22	21/30				6			7	
Galegu-Ein Es Shamis			9	20			7	3										
Galegu-Mayat Musa		61	64	5		47	17	2								24	3	2
Galegu-Moh Dafalla				35				2										
Galegu-Gerirrisa	238	227	53	65	76	20	12	11	10	10	19			35	13			6
Gerirrisa-Dabkara				14				3							13/16			
Gerirrisa-Samaaya	156	59	112	13	10	24	25	1			17			3				
Al Abyad-Al Tabya			12	10			20	20										
Galegu-Sambroug			88	71			20	9							26		23	5
Total	510	422	344	263	99	120	99	58	32	21/40	36			44	90/77	39	33	13
Estimated population	118677	94528	34400	33401	23037	26880	9900	7366			9248			10239		8736	3300	1524
Galegu-Farsh El Naam																		10
Galegu- Ras Air																	12	
Galegu-Ein Es Shamis				1														
Galegu-Mayat Musa		4	2	2		300								4				10
Galegu-Moh Dafalla				4														
Galegu-Gerirrisa	1			1													19	5
Gerirrisa-Dabkara				6														
Gerirrisa-Samaaya			9	6													4	
Al Abyad-Al Tabya			14	4							5	12				5		
Galegu-Sambroug																		

TRANSECT	Bushbuck				Buffalo				Greater Kudu				Red-fronted Gazelle				Warthog			
	1972	1989	1994	2001	1972	1989	1994	2001	1972	1989	1994	2001	1972	1989	1994	2001	1972	1989	1994	2001
Galegu-Farsh El Naam																		10		7
Galegu- Ras Air																	12			
Galegu-Ein Es Shamis				1																5
Galegu-Mayat Musa		4	2	2		300								4				10		
Galegu-Moh Dafalla				4																3
Galegu-Gerirrisa	1			1													19	5		10
Gerirrisa-Dabkara				6																3
Gerirrisa-Samaaya			9	6													4			6
Al Abyad-Al Tabya			14	4							5	12				5				18
Galegu-Sambroug																				50

El Salam (1984/85), Kuol (1989/94), Kano (2001)

Appendix 5: Game census figures
(B): Pool Counts

Species: Reedbuck
Date :19th June,2002

SL No.	Pool/Maya Name	Species Number
1	Ras Amir	9
2	Ein Es Shamis	12
3	Mayat Musa	3
4	Dabkara	83
5	Beit el Wahash	154
6	Samaaya	2
7	Heneifa	7
8	Al Abyad	-
9	Gererrisa	26
Total		**296**

(C): Pool Counts
Species: Oribi

SL No.	Pool/Maya Name	Species Number
1	Ein Es Shamis	9
2	Beit el Wahash	14
3	Simaaya	1
4	Heneifa	3
5	Gererrisa	5
Total		**32**

(D): Pool Counts
Species: Warthog
Date :10th June,2002

SL No.	Pool/Maya Name	Species Number
1	Ras Air	9
2	Ein Es Shamis	3
3	Dabkara	29
4	Beit el Wahash	36
5	Simaaya	126
6	Heneifa	2
7	Gererrisa	24
8	Al Abyad	11
Total		**243**

(E) : Pool Counts
Species: Ostrich

SL No.	Pool/Maya Name	Species Number
1	Ras Amir	36
2	Ein Es Shamis	2
3	Mayat Musa	14
4	Heneifa	4
5	Al Abyad	27
Total		**83**

(F): Pool Counts
Species: Waterbuck
Date : 10th June, 2002

SL No.	Pool/Maya Name	Species Number
1.	Ein Es Shamis	18
Total		**18**

(G): Pool Counts
Species: Singa Gazelle(Red fronted)
Date : 10th June, 2002

SL No.	Pool/Maya Name	Species Number
1.	Ein Es Shamis	5
Total		**5**

(H): Pool Counts
Species: Green Monkey
Date : 10th June, 2002

SL No.	Pool/Maya Name	Species Number
1.	Ras Air	1
Total		**1**

(I): Pool Counts
Species: Patas Monkey
Date : 10th June, 2002

SL No.	Pool/Maya Name	Species Number
1	Ein Es Shamis	7
Total		**7**

(J): Pool Counts
Species: Baboon
Date: 9th June,2002

SL. No.	Pool/Maya Name	Species Number
1	Ein Es Shamis	6
Total		**6**

(K): The Strip Transect Counts
Transect : Galegu – Ras Amir
Transect Length : 11 km Date: 9th June,2002

SL. No.	Kind of Animal	Characteristics			Total	Av. Perpendicular Distance (m)
		Male	Females	Young		
1	Reedbuck	21	37	4	62	91
2	Oribi	5	9	0	14	95
3	Warthog	-	-	2	7	142
4	Patas Monkey	-	-	-	19	80
5	Baboon	-	-	5	21	35

(L): The Strip Transect Counts
Transect : Sharia Haran Date: 9th June,2002
Transect Length: 8km

SL. No.	Kind of Animal	Characteristics			Total	Av. Perpendicular Distance (m)
		Male	Females	Young		
1	Reedbuck	8	19	1	28	96
2	Oribi	-	-	-	7	200
3	Waterbuck	-	6	5	11	120
4	Warthog	-	-	12	41	91
5	Baboon	-	-	22	116	50

(M): The Strip Transect Counts
Transect: Galegu Heneifa Date: 9th June,2002
Transect Length 10.3km

SL. No.	Kind of Animal	Characteristics			Total	Av. Perpendicular Distance (m)
		Male	Females	Young		
1	Reedbuck	6	5	0	11	144
2	Oribi	0	6	0	6	30.5
3	Bushbuck	0	2	0	2	35
4	Warthog	0	1	4	9	19
5	Patas Monkey	1	-	-	1	75
6	Baboon	-	-	6	15	10

(N): The Strip Transect Counts
Transect: Gererisa - Dabkara **Date: 9th June,2002**
Transect Length 30.2km

SL. No.	Kind of Animal	Characteristics			Total	Av. Perpendicular Distance (m)
		Male	Females	Young		
1	Reedbuck	26	92	11	176	41
2	Oribi	3	5	1	9	49
3	Warthog	-	-	4	12	25
4		-	-	-	25	150
5	Patas Monkey	1	-	-	1	10
6	Baboon	-	-	-	71	18

(O): The Strip Transect Counts
Transect: Galegu- Farsh el Naam **Date: 9th June,2002**
Transect Length 20.8km

SL. No.	Kind of Animal	Characteristics			Total	Av. Perpendicular Distance (m)
		Male	Females	Young		
1	Reedbuck	17	43	1	61	28
2	Oribi	1	9	-	13	12
3	Singa Gazelle	1	-	-	8	35
4	Warthog	0	3	3	35	22
5	Ostrich	7	3	-	11	67
6	Baboon	-	-	5	70	33
7	Patas Monkey	-	-	-	2	23
8	Green Monkey	1	-	-	1	20

(P): the Strip Transect Counts
Transect: Galegu Heneifa **Date: 10th June,2002**
Transect Length 25.9km

SL. No.	Kind of Animal	Characteristics			Total	Av. Perpendicular Distance (m)
		Male	Females	Young		
1	Reedbuck	19	85	1	159	29
2	Oribi	2	14	0	25	25
3	Singa Gazelle	2	2	0	4	10
4	Bushbuck	2	0	0	2	8
5	Warthog	-	-	-	6	17
6	Monitor Lizard	-	-	-	1	10
7	Patas Monkey	1	-	-	1	-
8	Baboon	-	-	-	1	20

(Q): the Strip Transect Counts
Transect: Ein Es Shamis-El Suneit Date: 10th June,2002
Transect Length 30.2km

SL. No.	Kind of Animal	Characteristics			Total	Av. Perpendicular Distance (m)
		Male	Females	Young		
1	Reedbuck	6	8	0	14	111.6
2	Oribi	5	10	0	17	124
3	Singa Gazelle	2	2	0	4	113
4	Waterbuck	16	33	0	49	130
5	Bushbuck	2	6	0	8	65
6	Warthog	3	3	0	14	208
7	Ostrich	10	7	0	17	417

R: The Strip Transect Counts
Transect: Galegu- Al Abyad Date: 9th June,2002
Transect Length 29.4km

SL. No.	Kind of Animal	Characteristics			Total	Av. Perpendicular Distance (m)
		Male	Females	Young		
1	Reedbuck	3	7	0	10	54
2	Oribi	-	-	-	-	-
3	Waterbuck	-	-	-	-	-
4	Bushbuck	2	8	0	10	67
5	Warthog	14	19	17	50	112
6	Monitor Lizard	0	0	0	2	10
7	Mangoose	0	0	0	1	-

(S): Animal Population Estimates
Period: 9th – 10th June, 2002
Estimated total Number of Animal Population: $\hat{N} = \frac{nA}{2LR}$

SL/No.	Kind of Animal	Number of Observation	"n"		TL.	A	$\hat{N}$
1	Reedbuck	162	512	.117	184.6	738.4	17,812
2	Oribi	49	91	.129	184.6	738.4	2,822
3	Singa Cazelle	8	16	.123	184.6	738.4	520
4	Bushbuck	14	25	.105	184.6	738.4	952
5	Waterbuck	7	60	.249	184.6	738.4	964
6	Warthog	46	210	.168	184.6	738.4	5,002
7	Ostrich	6	28	.483	184.6	738.4	232
8	Roan Antelope	1	25	.3	184.6	738.4	333
9	Monitor Lizard	3	3	.02	184.6	738.4	600
10	Mangoose	1	1	.02	184.6	738.4	200

N = Population Estimates of the species
"n" = Number of animals seen and recorded along length of the transect.
2 AV. PD = Double Average Perpendicular
Distance = R = Effective with of the transect.
TL = Transect Length in kilometers
A = Total Area Censused in Square Kilometers.

APPENDIX 6: WORKING FOR WATER PROJECT

Project Proposal

Restoration of the Dinder National Park through job creation and social initiatives

1 Executive Summary

The overall objective of the proposed project is to use job creation and basic social programmes to integrate local communities into the restoration of the national parks.

The opportunity to earn a wage must be implemented as early as possible during the project, otherwise it will run the risk of losing momentum and also the enthusiasm and participation of the local communities. Preliminary meetings have been held with the communities along the Rahad river and they have expressed their strong desire to participate. It is thus proposed that a **pilot project** is launched to do the following work:

Control and eradication of invasive alien plants [IAP's]
Road opening, and reconstruction
Clearing of litter
Erosion control
Crafts

The success of this approach has been demonstrated in the national parks of South Africa, and the aim is to adapt it to suit the people and the natural environment of Sudan. As local communities are already resident in some of the Sudanese parks, their integration into the future of the parks is probably even more important than elsewhere. As it is important to develop a strategy that will work in Sudan, it is proposed that we commence with the pilot project in the Dinder National Park. Depending on the success achieved here, and the lessons learned, the programme can be expanded to other areas.

Initial efforts should be aimed at relieving the basic needs of the affected people, - **work, food, primary health training and dignity.** Once these have been met, the objective should be to make it sustainable, involving medium- to long-term strategic planning. This planning process should commence in parallel with the initial phase of the project, to facilitate a smooth transition into later phases. It is essential that the commencement of any phase be preceded by an education, training and development [ETD] programme. While only some of the people will actually be working initially, the ETD programme can be designed to include most of the community.

Both the unique natural heritage, and the people of Sudan, have been extensively and detrimentally affected by social upheaval and the civil war for several decades. The future of the natural environment is closely linked to the future of the people, and it is

imperative that any reconstruction programme takes account of this. While the focus is on the reconstruction of the national parks of Sudan, it presents an important opportunity to link the restoration to the upliftment of the poorest citizens of the country. Making the people partners and stakeholders in the process is an essential strategy in ensuring the long-term viability of the national parks. It will not be effective without the participation of communities.

The development of a strong partnership between the community, the government, aid agencies and project management is an essential pre-requisite if success is to be achieved. The partnership must be underpinned by a shared commitment to work together and to complete transparency in all aspects of implementation, and especially in terms of financial management. Both implementation and financial management must be subject to independent audit.

This document represents an initial proposal for consideration and approval in principle of the pilot project including the appointment of project management. If accepted, it must be followed by the development of a more detailed business plan and implementation strategy to be presented to potential funding agencies. It is essential that initial funding is secured for at least three years to avoid disruptions in implementation.

2 Objectives

The overall objective presented in paragraph 1 incorporates the following:

2.1 Facilitate the integration of resident- and peripheral communities into the future management strategy of the national park.

2.2 Commence restoration of the national park, through job creation to meet the basic needs of the community, namely work, food, primary health care and dignity.

2.3 Basic education and training towards the upliftment of the affected communities

2.4 Skills training and development, to empower people for sustainable livelihoods

2.5 Medium- and long term strategic planning for sustainability of the overall programme

3 Implementation of the objectives

Long-term strategic planning is essential here, but the most basic needs of the people and the park must be met as early as possible in the programme. Implementation should thus be phased, with some phases running parallel to each other. A basic management structure needs to be put in place to facilitate planning and implementation.

The management structure would essentially be a partnership between the roleplayers, and we propose would include:

- Sudan Government departments/agencies as appropriate
- Funding agency representatives

- Community representatives, such as the Dinder Project VDCs
- Project Management [as appointed in Sudan]
- UNDP as Implementing Agent

The following phases are proposed.

3.1 Appointment and induction of project management

3.1.1 Appointment of an implementing agent [IA]. With the agreement of the Wildlife Dept., a project manager [PM] will then be appointed.

3.1.2 The IA will facilitate the initial training and induction of the PM at similar projects.

3.1.3 Once an IA has been appointed, the detailed planning and preparation of the business plan can commence

3.1.4 Identify the roleplayers in the local communities in Dinder National Park, and establish a forum with them [this process has already commenced, and has been well received]

3.2 Drafting of the business plan and implementation strategy

3.2.1 Identify potential funding agencies, and determine their requirements for the presentation of proposals.

3.2.2 Draft appropriate business- or implementation plans to meet the requirements of the funders, and to address the specific needs of the project

3.2.3 Communicate with local communities at all stages, and incorporate their needs and proposals in all plans.

3.2.4 Develop the induction programme and commence with development of the ETD programme

3.2.5 Identify and appoint local ETD service providers. These people will also need to be trained in presenting the ETD programme

3.2.6 This phase will be used to plan and develop further phases

3.2.7 Presentation of the plans to funding agencies. **It is imperative that adequate funding be secured before proceeding further with implementation.**

3.2.8 It would be the task of the Dinder Project to source and secure funding. If an NGO is required to assist with this process, a clear and legal mandate would have to be provided to facilitate the process.

3.2.9 **Budget**

This serves as an indication of the level of funding required to launch the program. However, we see this as a process which should be developed in collaboration with the Wildlife Dept., and that approval is granted for various items as we progress.

3.3 Identification and induction of workers

3.3.1 Workers for the pilot project to be identified in close collaboration with the sobas, and local community forums. Criteria can be set, such as one workers per household, etc.

3.3.2 Schedule- and implement the induction programme. This will include the registration of workers, and the issue of protective clothing.

3.3.3 Commence basic skills and safety training

3.4 Commence work

The opportunity to earn a wage must be implemented as early as possible during the project, otherwise it will run the risk of losing momentum and also the enthusiasm and participation of the local communities. Planning for the development of further social- and community programs can then commence as a parallel process.

Tasks

While the program will need to be developed as it progresses, it is proposed that the following tasks can be undertaken initially without major preparatory work being required.

3.5 Control and eradication of invasive alien plants [IAP's]
3.6 Road opening, and reconstruction
3.7 Clearing of litter
3.8 Erosion control
3.9 Crafts

4 Conclusion

This proposal presents the overall framework. However, detailed project document is needed and contacts should be established with potential donors.

Appendix 7.

Socio-economic status of the Dinder area

1. Historical Review

The history of human settlement in the Dinder area dates back to the pre – nineteenth century. Samuel Baker, the British explorer, described the area as fairly heavily populated when he visited it in 1861 (Ali, 1986).

However, the area witnessed massive outward migration to support and defend the Mahdist rule (1885-1898), and also because of the famous famine of 1888. When visiting the area in 1898, Harrison noticed that it was void of population, but remnants and traces of earlier human settlements were evident (Mohamed, 1999). The resettlement of the area was intensified by immigration from the famine- striken areas in western Sudan and west African countries together with the severe drought of the 1980s (Suliman, 1986). West African Muslims used to pass through the area in their pilgrimage journey to and from Mekkah, and many of them decided to settle in the area permanently. A large number of these immigrants have settled along the banks of the Rahad and Dinder rivers. Nomadic pastoralists have also been attracted to the area where they continued to remain during the dry seasons to tap the available water and grazing resources.

The influx of population into the area has been further exacerbated by two additional factors:
(1) The introduction in 1950 and subsequent unplanned and uncontrolled expansion of mechanized rainfed agriculture created a soaring market (demand)for wage labour (Schemes are 1000- 1500 feddans each), and thereby attracting increasing numbers of workers who settle seasonally or permanently in the vicinity of the Park since mechanized schemes are encroaching closer and closer to the Park, reaching a distance of less than 10km while their distance from the Park boundaries was 27- 28 km in 1985 (ElMoghrabi A.I. and Abdu, A.S.1985).
(2) Recognizing that according to the Land Registration Act of 1905 all land, with limited exceptions, is public land, native administrators and tribal leaders distributed traditional agricultural land to migrants and urged them to settle in the area in quest for consolidating their own powers and authority and extending their influence over the area.

As a result of this population influx existing villages continued to grow and new settlements to spring up. With the exception of a few villages, all settlements adjoining the Park were established during the latter half of the twentieth century, i.e. no less than 40 years after the establishment of the Park, and some villages, like Um Sagiet and Um Bagara, were established as late as the 1980s.

When an additional area of 2630 km^2 was annexed to the Park in 1983, many villages became located inside the Park and the others became closer to its new boundaries.

However, most studies and surveys concentrated on the villages situated along the Rahad river; these are ten inside the Park and 38 outside it. Villages inside the Park are Ain El- Gamal, Um kakar, Nour El-Madeina, Hanou El- Shateib, El- Hanou El-Azrag, Um Kura west, El- Gammam west, Hilat Hashim, El- Khairat, and Um salala. Most of the Rahad villages outside the Park are within a distance of less than 12km from the boundaries of the Park.

Adjacent villages in Sennar State have not received adequate attention because they lie at a distance of more than 10 km from Park, but they are receiving considerable number of migrants. Likewise, the adjacent villages of the Blue Nile state are not adequately studied because of security reasons. It is worth noting that most of the Park' these villages will witness a tremendous increase in population and economic activities. Carrying out socio –economic surveys of these villages in both States, especially the Blue Nile, is of paramount importance.

2. Demographics and Households:

Although demographic and household data and information are meagre, old and only partial in geographical coverage, the surveys of the HCENR (2001) and Mohamed (1999) can provide a reasonable data base to build on. However, the coming 2003 population census can be tapped for more recent, detailed and comprehensive socio – economic data at both the village and household levels.

The surveyed Rahad villages vary considerably in population size, from about 6000 persons as in EL Azaza to 300 as in Um Sagiet, and the overall average is 2023 persons per village. Variations in household size are negligible, and the overall average is 6.66 persons per household.

The sex structure of the population is rather skewed, with males constituting 51.6%, giving a sex ratio of 107. An important feature revealed by the survey is the large number of female – headed households who constitute 8.62% of all surveyed households. The socio – Economic Baseline Survey (HCENR, 2001) reveals an unusual marital structure of surveyed women:
13.9% married, 30.6% divorced, 44.4% widows and 8.3% abandoned. This large number of wonen without husbands for one reason or another (86.1%) and their single –parent families should be targeted by a variety of suitable projects.

The population age structure is rather normal with 20.2% of less than six years of age, 39.3% aging between 6 and 17 years and 40.5% in the age group 18 years and over.

The tribal structure shows a multiplicity of tribes and tribal groups. The most dominant groups are the tribes of western Sudan, constituting 43% of the villages population, followed by Arab tribes (20%) west African tribes, accounting for 13%, and Nilotic tribes accounting for about 8% (Mohamed, 1999).

The Masaleet come first among the tribes, making up to 30.5% of the population; then follows the Burgo (17.5%),the Dago (11.9%), Fellata (6.9%), Houssa (5.4%), Salahab (3.8%), Halaween (3.1%), Rezaigat (2.1%), Dugul (2.1%), Dinka (1.3%), Nuba (1.2%), Messairia (102%) and Rashaida (1.2%) (HCENR, 2001).

Tribal cluster is rather limited since only four of the 26 surveyed villages are mono – tribal settlements. On the other extreme are the villages of Um kura and EL Azaza with 19 and 14 tribes, respectively. But despite tribal heterogeneity, village residents have developed a common sense of belongingness and basis of cooperation.

Residents of the various villages have established a variety of institutions some of which are formal while others are traditional, and yet others are community –based. Each village has a local government institution but with almost no facilities, and a traditional leadership which is more influencial. Community – based organizations are less wide- spread. Religious committees, expectedly, are the most wide spread of these institutions, being established in 88% of the surveyed villages. Pupils' parents committees are the second most numerous covering all the villages which have basic schools. Only six villages have charity associations. Health committees are present in four villages and water committees in three.

Houses are simple in structure, and are of locally available and affordable building materials. 76.4% of the households are built of stalks, 3.6% of earth and the rest of a mixture of the two. Sanitation is poor since only 28.7% of the households have latrines. The majority (61%) of households contain kitchen (HCENT,2001). In Magano village the situation is worse as 21% of the surveyed families have only one sleeping hut, 35% have two, and 44% have more than two huts despite the fact that the average size of household is over 6 persons, All the huts are built of a combination of straw and wood used as temporary, dry season dwellings (Sudan Development Association and WRC, 1992).

3. Basic Services:

3.1 Water:

The river is the major source of water for all the villages in its vicinity. Most of them depend on the ' jammam' in the River bed during the dry season. Only few villages have hand pumps as another source. Hand pumps are concentrated in villages far away from the river, e.g. two – thirds of all hand pumps are installed in EL Azaza village. The residents of 42% of the villages perceive their water supply as inadequate, especially during the dry season, Regarding the quality of water, the settlers of only one village (EL Gammam Kandro village) describe their water as 'good', while the water in all other villages is perceived as 'contaminatcd '.

Water has become a commodity sold by venders except for 31% of the surveyed villages which are located on or very close to the river bank, and hence residents fetch water by themselves. The number of water venders in each village depends on its distance from the river and/or its population size. Thus, EL Azaza EL Beida, which lies at a distance of only 0.1km from the river and has a population of only 700 persons, is served by one water vender. On the other hand, Um kura, which is the most heavilly populated villages (6.800 persons), is served by 70 water venders.

3.2 Health:

Health services are grossly poor. The limited health facilities and personnel are remarkedly concentrated in Um kura village which houses the only hospital in the area,the only physician, one (16.7%) of the dispensaries, one (50%) of the medical assistants, five (41.7%) of the nurses, one (16.7%) of the midwives, one (25%) of the health visitors, and 4 (44.4%) of the health workers. The only health centre is located in EL Azaza village, and the only three dressing stations are housed in the villages of Um Bagara, Hilate Hashim and El Gammam kandro. The residents of 16(61.5%) of the villages have to go elsewhere to get any kind of medical attendance.

Table (1): Major Diseases by % of Villages

Disease	First disease	Second disease	Third disease	Fourth disease
Kalazar	42.3	34.6	15.4	3.8
Malaria	57.7	42.3	0	0
Chest Infection	0	19.2	57.7	15.4
Skin diseases	0	0	11.5	46.2
Eye diseases	0	0	3.8	7.7
Bilharzia	0	0	3.8	0
Diarrhoea	0	3.8	7.7	26.9

Source: Compiled from HC ENR, 2001

Table (2): Wild Plants and Animals Used for Medication

Disease	Plant or Animal Used
Malaria	Tamarindus indica and Acacia nilotica
Fever	Acacia nilotica fruits
Diarrhoea	Acacia compylcantha
Rhometic fever	Balanites aegyptiaca and commiphora sp
Stomach pain	Special type of plant root
Asthmatic disease	Hyaena meat
Minor wounds	Nauroea sp.root
Jundice	Leucas sp. and Acacia seyal
Tooth ache	Special type of plant root
Gonorahea	Spcial type of plant root
Fractures	Special type of plant root

Source: Sudan Development Association and WRC, 1992.

Although vaccination has been offered in all villages and the vaccination rate is as high as 70%, yet serious diseases are wide – spread. Table (1) shows that malaria had been reported by all villages as either the first or second most prevalent disease. Kalazar is the second most dominant disease, yet its treatment is almost exclusively confined to the one hospital in the area. When weighted, the total of the four ranks of malaria would be 357.7 points, and that of kalazar would amount to 307.6 points, while the total weight of the least prevalent disease, i .e. bilharzias, is only 7.6 points. Diarrhoea occupies the third place, with a total weighted prevalence of 53.7 points.

The complete absence of any health facility, and the scarcity and/unaffordability of medicines have forced people, as in Magano village, to depend, to a very large extent, on traditional medicine by resorting to medicinal herbs, plants and fauna extract for medication of common diseases (Table2). Most of these are obtained from the Park.

3.3 Education:

The traditional, religious form of education predominates over the formal form. Khalawi (plural of khalwa, i.e qoranic school) are operating in all surveyed Rahad villages except for Um Sagiet. Most villages (61.5%) have one or two each of the 77 khalawi while the village of EL Dalieb Mugadi (with a population of 3.300 persons) has an exceptionally high maximum number of 16.

Formal education is limited to the basic education level only. Because of the limited number of school – aged boys and girls, co-education is dominant. Mixed schools total 14 while there are only two female schools (in EL Azaza and EL Dalieb Mugadi) and only one male school in EL Azaza. While EL Azaze, the best educationally served village, has 3 schools, 13 (50%) of the surveyed villages have no schools at all.

Expectedly, the illiteracy rate is high, accounting for 86.6% among males and for 97% among females. Male illiteracy rate ranges between a minimum of 45% in EL Azaza village and a maximum of 95% in a number of villages. For females the minimum illiteracy rate is 85% in EL Fazra village and the maximum is 99% in a number of villages. The gender gap is generally high. The generally high rate of illiteracy despite the wide – spread of the khalawi may suggest that these khalawi are of the type which focuses on the memorization of the qoran verses and not so much on reading and writing abilities.

The situation in Magano village is not better than in the Rahad villages. There are no education facilities, and the overall illiteracy rate is 90%, and the remaining 10% of the surveyed residents have only a primary level of education.

4. Occupations:

4.1 Gender Division of Labour:

Rainfed traditional cultivation and animal raising constitute the dominant occupations, mostly combined by the same household. Table (3) shows the major primary and secondary occupations in the Rahad villages. The high percentage of females designated as having no occupation is misleading. It only indicates that very few of them have access to economic resources. They all perform domestic tasks. Furthermore, the survey conducted in Magano village, which is not very different from the Rahad villages in the gender division of labour, identified the following tasks performed by Females (Sudan Development Association,1992):

Table (3): Primary and Secondary occupations (%):

Primary occupation	Male	Female	Sec. Occup. Both sexes
Farmer	88.0	30.5	8.8
Merchant	3.8	11.1	21.6
Artisan	2.5	13.9	9.3
Worker	2.5	5.6	14.9
Officer	1.3	0	2.1
None	1.9	38.9	40.7

Source: Computed from HCENR.2001.

(One) Water fetching; women and girls fetch water 1-2 times per day, carrying it for a distance of 4 km sometimes.

(Two) Firewood collection; distance covered to collect firewood is increasing because the surrounding land is cleared for traditional rainfed cultivation. Collection takes place every other day.

(Three) Chapaleih collection and preparation; this is rather a characteristic of some villages only, e.g Magano. Chapaleih is a wild plant root which is used as a supplementary diet during periods following the grain harvest, and as a stable food during periods of acute grain shortages. Its preparation is a laengthy and lengthy process involving soaking it in water for about a week to remove its toxic contents, slicing, drying, manual grinding and finally cooking. It is collected from distant sites once or twice a week.

(Four) Collection and weaving of Hyphaene thebiaca (dom palm) leaves (saaf); which are used by some tribes to make such items as mats, baskets, honey pots and handicrafts. Some of the manufactrued items are for household use and others are for sale. Saaf has also social functions and is of symbolic significance being weaved and tied around the hand and leg. It is perceived as a protection for spouses and circumcized girls against evil eyes. It is also used to protect the corpse from rottening until it is buried.

(Five) Agriculture; although it is regarded as essentially a males occupation, female heads of households do practice traditional cultivation as their primary occupation (table 3). Other females contribute in many agricultural processes like land preparation, seeding, weeding and harvesting. Furthermore, females prepare food and take it to males working in the fields once or twice a day. Thus females shoulder heavy responsibilities and tasks, but are very marginalized in decision – making processes, and their participation in public affairs is minimal.

4.2. Agriculture:

This main economic activity is of two types: traditional rainfed and gerif cultivation.

4.2.1. Traditional Cultivation:

Table (4): Household owners of Agric. Land and rate of cultivation 2001:

Area (Feddan)	Owners %	Who cultivated in 2000%
Zero	23.7	14.4
1-15	42.3	58.8
16-30	13.9	15.5
31-45	5.7	7.2
46-60	7.7	2.1
61-70	1.0	1.0
71-85	1.0	0.5
> 85	4.6	0.5

Source: HCENR, 2001

Table (5): Crop statistics, 2000 season

Variable	Crops						Total
	Dura	Sesame	Millet	Ground -nuts	Lentil	Cowpeas	
Area cultivated (fed.)	1444.8	1311.9	224.5	72.8	49.0	13.1	3116.1
% of total area cultivated	46.4	42.1	7.2	2.3	1.6	0.4	100
Production (sacks)	1797	1094	219.5	126	78.2	9.3	3324
Productivity (sack/fed.)	1.2	0.8	1.0	1.7	1.8	0.7	-
Consumption (sacks)	911.5	15.5	55.3	21.8	23.7	4.7	1032.5
Sold (sacks)	792	1015.5	138	79.5	50.5	4.7	2080.2
Stored (sacks)	77	15.9	8.7	17.0	2.0	0	120.6
Other uses (sacks)	16.5	47.1	17.5	7.7	2.0	0	89.5
Average price (SD/sack)	3585.7	8274.5	2666.6	2886.6	7820	?	-

Source: HCENR, 2001

Table (4) shows the area of agricultural land owned by households, and those who cultivated during the 2000 season. The average area per household is about 19 feddans, but most households possess less than this average, In Magano village the per household average agricultural area is only 5 feddans. About 24% of the surveyed Rahad households are landless who rent land to cultivate while large agricultural lands are owned by local leaders who assume the responsibility of land distribution. Some agricultural land remains uncultivated either due to low productivity, or depressed market prices or lack of financial support.

Table (5) shows that most of the cultivated area is put under dura as the main stable crop and sesame as the main cash crop, but the productivity of the two crops is quite low. Besides dura, households consume varying proportions of the other crops: 50% of the cowpeas, 27% of the lentils, 26% of the millet which is the second stable crop, and 19% of the ground nuts. The table also shows that various proportions of the produce of the different crops are sold and stored. However, for most of the households the production of the various stable food crops falls short of satisfying their annual food requirements.

The residents of the Rahad villages inside the Park use a little less than 6000 feddans for traditional rainfed cultivation (Table 6). Their agricultural practices, crop mix, productivity and other crop statistics are not different from those shown in Table (5).

4.2.2 Gerif Cultivation:

Gerif land is land which stretches along the river banks and from which river water recedes after flood time. It is thus quite productive since soil fertility is annually renewed by flood water, and has a high rate of water retention. All Rahad villages inside the Park possess gerif land (Table6), with Um Kura West having over 46% of all gerif land while Um Salala has only just over 1%.

Table (6): Agric. Land of Rahad Villages Inside Pak, 1990:

Village	Agricultural land (Feddans)	
	Traditional	Gerif
Ain El Gamal	405	130
Um Kakar	937	250
Nour EL Madeina	240	290
Hanou EL Shateib	862	260
EL Hanou EL Azrag	937	470
Um Kura West	1162	1800
EL Gammam West	330	315
Hilat Hashim	637	260
EL khairat	225	70
Um Salala	127	50
Total	5862	3895

Source: Ministry of Interior, 1990

Table (7): Gerif Land Ownership, 2001

Area (feddans)	Household(%)
Zero	80.4
1- 10	15.0
11- 20	2.0
21 – 30	0.5
31 – 40	2.1

Source: HCENR, 2001

Table (7) shows that only a small group, usually the powerful local leaders and dignitaries, owns gerif land while over 80% of the households have none. Crops produced here are mostly high- value vegetables an fruits (mango, guava and pawpaw) and beans. 71.3% of gerif land owners have their own financial resources while16.4% got finance through the 'shail' system with merchants,7.2% obtained finance from friends and relatives, and 5.1% from banks in the 2001 season. During this season71% of the gerif land was cultivated by its owners, 23.2% left fallaw, 4.8% rented, and 1% cultivated in partnership.

After harvest the gerif land is usually rented for nomads to graze the crop residues. Thus it constitutes an attraction for large animal herds to enter into the Park area.

4.3. Animal Raising:

The sedentary people keep limited numbers of domestic animals (Table8). They concentrate on small animals and poultry because of their easy feeding. Almost 90% of the surveyed settlers have no cattle at all, and only 1% of them possess 15 goats and sheep. The per village number of animals in the surveyed Rahad villages varies between zero and 500 with an average of 107 for cattle, between 10 and 30,000 an average of 1367 for sheep, between 15 and 500 and an average of 221 for goats, between zero and 10 and an average of 2 for camels, and between zero and 500 with an average of 33 for donkeys (HCENR,2001). It is generally the rich households which own cattle.

Table (8): Average Household Animals:

Animal	Number
Cattle	0.7
Goats	1.1
Sheep	1.0
Donkeys	0.5
Poultry	5.9

Source: HCENR, 2001

Settled villagers generally keep their animals in their vicinity. Animals graze first on the natural pasture around the villages, and then they move into the traditional and mechanized rainfed farms to feed on crop residues, and their final destination may be the Park. Residents of villages inside the Park keep their animals within the Park's boundaries most of the time. The poor segment of residents depends entirely on natural grazing and crop residues while the better off residents use supplementary feeding.

The larger number of livestock which roams the Dinder area belongs to the nomads who immigrate during the dry period from the three States within which the Park is located as well as from other areas like the white Nile, the Butana and eastern Sudan. Nomads are strongly attached to their animals which provide a multiplicity of functions for them, e.g. source of food and cash, means of transport, source of raw materials for handicraft, and social status. Thus, they can do everything to feed and water their herds. Special mention is to be made here of the aggressiveness and high violence potential of the Umbararo tribe. They constitute a heavy burden on the limited grazing land including the Park, and sings of over- grazing have been evident in a number of locations.

Transboundary use of range land in Ethiopia has been reported by local people.
There is an urgent need to carry out an animal census, especially during the dry season, and to calculate the carrying capacity of range land in order to avoid over – grazing and the concomitant ecological and socio –economic problems.

5. Other Economic Activites:

Minor economic activities include felling of trees for various purposes. Local residents cut down trees essentially for household use as fuelwood and building material. The greatest ecological impact pertains to the clearance of forests for commercial production of charcoal and fuelwood. This is carried out by powerful merchants from within and outside the Dinder area.

A new and serious threat to the resources of the Park is the role of the military in the commercial production of charcoal and trade in wood.

Other economic engagements include the collection of minor forest products like gum, wild fruits, medicinal herbs and plants, saaf, and honey which involves the setting of fire which may spread beyond the target area.

Fishing is an important occupation along the Dinder river for Um Baggara community of the Dinka tribe who moved into the area during the 1990s. Dried fish is also an important diet item for the villagers and for agricultural labour. Hunting of small wild animals is rather limited while poaching is more common. A recently introduced (in1998) practice is burnt brick –making which consumes a lot of fuel wood.

6. Income and Expenditure:

6.1 Income:

Wage labour constitutes the major source of income for the average household in the Rahad surveyed villages (Table 9). This reflects poor accessibility to productive resources. The major occupations (cultivation and animal raising) provide only one-third of the residents average monthly income.

Female – headed households get an average monthly income 19% less than that of the average male. Cultivation and animal raising provide less than one- quarter of their monthly incomes. This indicates less empowerment and less accessibility to productive resources. This emphasizes the suggestion that female – headed households should be a target for income- generating projects and a focus for more empowerment.

6.2. Expenditure:

Average female – headed household monthly expenditure is about 18% less than that of the average merage male – headed household (Table10). This difference is about the same as the difference between their respective monthly incomes (Table 9). The male – headed household monthly income covers about 90% of its monthly expenditure, while the percentage is about 89% for female – headed average household. The paradox is that the purchase of food items constitutes over two- thirds of the total monthly expenditure for both male- headed and female – headed households who are supposedly food producers themselves.

Table (9): Average Household Monthly Income:

Source	Male-headed H.		Female-headed H.	
	SD	%	SD	%
Crops	3925.0	27.7	2038.0	17.8
Vegetables	454.1	3.2	397.2	3.5
Forest	579.7	4.1	86.2	0.8
Livestock	379.1	2.7	180.6	1.6
Rent	459.9	3.3	51.9	0.5
Work	5858.9	41.4	5134.7	44.8
Salaries	565.2	4.0	500.0	4.4
Transfers	457.9	3.2	422.2	3.7
Others	1468.3	10.4	2658.3	23.1
Total	14148.1		11469.1	

Source: HCENR,2001

Table (10): Average Household Monthly Expenditure:

Item	Male-headed H.		Female-headed H.	
	SD	%	SD	%
Food	10957.4	69.7	8679.2	67.0
Water	539.2	3.4	549.7	4.2
Soap	437.0	2.8	418.1	3.2
Energy	978.7	6.2	1005.6	7.8
Cloth	967.7	6.2	894.6	6.9
Education	440.4	2.8	221.7	1.7
Medicines	667.2	4.2	563.2	4.3
Social	464.1	3.0	197.2	1.5
Land rent	124.1	0.8	276.4	2.1
Others	153.5	1.0	143.1	1.1
Total	15729.3		12948.8	

Socurce: HCENR, 2001

7. Changes and Coping Mechanisms:

7.1 Major changes:

The inception and later expansion of the Park, the introduction and subsequent dramatic extension of mechanized rainfed cultivation, the reoccurrence of drought and decline/fluctuation of rainfall, and the increase in human and animal populations have all given rise to significant ecological and socio- economic changes and impacts. Most important among these changes and impacts are the following:

(One) The land use mosaic in the Dinder Province has changed in favour of types of land use other than traditional rainfed cultivation and animal raising (Table 11).

(Two) The area where the Park is now located used to constitute a source of food (fish and small wild animals) and of fuelwood and building material for local inhabitants. With the inception of the Park they have lost that resource.

(Three) The blocking by the mechanized schemes of the animals

Table (11): Land Use Changes in Dinder Province:

Period	% of Dinder Province area		
	Traditional cultivation and grazing	Mechanized cultivation	DNP
Before 1935	100	0	0
1935-1949	51	0	49
1950-1984	34	17	49
1985-1999	8.5	22	69.5

Source: Mohamed,1999

Table (12): Changes in Animal Mix, Dinder Prov.

No. of animals	No. of Households	
	Before Park	1998
> 3 types	27	0
3 types	55	2
2 types	14	18
1 type	4	80

Source: Mohamed, 1999

customary passages to the river and the shrinkage of grazing land and the deterioration of the pasture quality have forced the residents to reduce the animal mix and to concentrate on small animals (Table12).

(Four) The general ecological deterioration has forced many nomads to settle down. The percentage of nomads in the Dinder Province decreased from 80 in 1950 to 53 in 1983 (Elmoghrabi et. al., 1985), and the nomads of Sinnar State dropped by 69% between 1983 and 1993 (Mohamed, 1999).

(Five) Poverty has become a common phenomenon, averaging over 98% for the surveyed Rahad villages.

(Six) Massive male migration to urban centres, especially after harvest, and a sharp increase in divorce and desertion by husbands have resulted in an increase in the number of female-headed households and of single-parent families and family break –downs.

(Seven) Wage labour is progressively replacing 'nafir' (reciprocal) unpaid work), the moral economy is shrinking, and conflict over resources has taken the place of the former communal use of these resources. The wildlife administration has adopted a policy of employing local people as scouts and labourers, and monthly salaries and wages paid by the WECGA in the Dinder town amount to about SD3 million.

7.2.Coping Mechanisms:

The foregoing changes, the deterioration of the resource base and the depressed economic conditions have to be managed by adopting a mix of coping mechanisms by the people.

Generally, the poor traditional cultivators resort to the diversification of crops in response to rainfall fluctuation and security against possible low market prices for some crops, and also against natural hazards, e.g. pests. A sample survey in the

Dinder Province showed that 49% of the surveyed traditional cultivators grow more than two crops, 32% grow two crops, and only 19% cultivate one crop (Mohamed, 1999). Mention has been made to concentrating on small animals as a response to deteriorating grazing conditions.

Table (13) shows the coping mechanisms adopted by the surveyed households in the Rahad villages. Almost every resident combines a number of these mechanisms. The efficient utilization of food, e.g. by minimizing waste and rationing, is the most dominant mechanism. Despite the social changes mentioned earlier, still a large number of residents resort to each other at times of acute need to get free assistance (moral economy) or to borrow. Expectedly, settlers also resort to the environment (flora and fauna) to rescue them. Observations suggest that settlers engaged in the collection of firewood, charcoal making and hunting of wild animals are more than figures given in the table. The gravity of food shortage is indicated by the high percentage (80%) of residents who use wild food.

Table(13): Coping Mechanisms

Mechanism	**Households(%)**
Consumption smoothing	89.2
Solidarity	85.6
Borrowing	85.1
Use of wild food	79.9
Savings	52.6
Sale of assets	24.7
Wood cutting and selling	24.7
Seasonal migration	20.1
Charcoal production and selling	15.5
Hunting of wild animals	3.6
Other	3.1

Source: HCENR, 2001

8. Main Problems:

Table (14) shows the relative magnitude of the major village problems as perceived by the surveyed residents in the Rahad river area. Conflict with the Park authorities is one of the major problems encountered by essentially villagers living inside the Park and also by others. Problems aggregated in the table as “others” refer to lack of services, namely electricity flour mill, mosque and veterinary services.

Five kinds of village problems are weighted and scored, lack of educational facilities becomes the biggest problem, scoring 75 points, followed by lack of health facilities with 56 points. The least serious problems are lack of electricity and lack of veterinary services, each scoring one point only.

When the problems are analysed at the level of the perception of individual respondents, lock of basic services occupies the first place. Only 8.7% of the respondents reported no basic service problem, while 69% reported a combination of

lack and/or high cost of education and health facilities and services and drinking water. Agricultural problems come second in magnitude ranking, With about 42% complaining from a combination of lack of agricultural machinery, of finance and decreased productivity while 13.4% reported no agricultural problem (HCENR, 2001). The problem of the lack of agricultural machinery is raised by those residents living in side the Park because such use of machinery is prohibited by the Park authority on the land which they are allowed to cultivate inside the Park.

Table (14): Main Problems

Problems	% of villages				
	First problem	**Second problem**	**Third problem**	**Fourth problem**	**Fifth problem**
Conflict with Park authorities	23.1	0	0	0	0
Agricultural machinery	19.2	7.7	7.7	11.5	11.5
Education facilities	19.2	46.2	7.7	0	0
Agricultural land	11.5	0	0	3.8	0
Health facilities	7.7	19.2	46.2	19.2	11.5
High cost of education	7.7	3.8	11.5	3.8	0
Low productivity	3.8	0	3.8	7.7	0
Water and sanitation	3.8	11.5	11.5	26.9	30.8
Floods	3.8	0	0	0	0
Agricultural finance	0	7.7	0	3.8	0
Transport	0	3.8	3.8	3.8	7.7
High cost of health services	0	0	3.8	3.8	0
Environmental problems	0	0	3.8	3.8	0
Others	0	0	0	7.7	11.5
None	0	0	0	3.8	26.9

Source: computed from HCENR, 2001

Table (15): Number of Violations inside the Park by Rahad Villagers

Year	No. of herds/ animals (H/A)	Gum collectors	Poachers	Tress-passing	Saaf and honey collectors	Fishing	Weapons possession
58/59	-	-	15	-	-	-	-
59/60	9 H	59	2	-	-	17	-
60/61	-	144	2	-	6	-	-
62/63	2 H	82	3	-	-	-	-
64/65	-	-	18	-	-	6	-
65/66	-	-	-	-	-	-	-
66/67	-	6	9	30	-	-	-
67/68	9 H	150	-	48	5	-	-
69/70	-	-	5	-	85	-	-
73/74	135 A	11	65	15	4	33	-
76/77	270 A	-	10	8	36	29	-
80/81	422 A	-	55	96	-	27	25
1985	-	?	-	?	?	-	-
1986	4 H	?	27	?	?	9	7
1987	9 H	?	18	?	?	-	4
1988	31 H	?	29	?	?	22	5
1990	50 H	?	5	?	?	2	-

Source: Ministry of Intaerior, 1990
H= Herds
A= Animals
?= Unavailable data

9. Impacts on the Park:

Impacts inflicted on the Park are made by all who intervene in the Park to use its resources. These stakeholders include nomadic pastoralists and settled animal raisers, traditional rainfed and gerif cultivators, mechanized rainfed farmers, charcoal makers, firewood collectors, collectors of other minor forest products, mechanized rainfed farmers, poachers, fishermen, and craftsmen. Although the cultivation of sesame inside the Park is prohibited, yet some residents practice it illegally. Special attention in this respect should be given to those settlers inside and around the Park.

The previous sections of this report point to the various adverse impacts made by these beneficiaries. Table (15) shows the various illegal interventions with the Park's resources. More serious interventions started to occur during the early eighties of last century-including cultivations inside the Park (15 in 1986) and felling of trees to produce charcoal. In 1985 the charcoal kilns reported by the Park authorities numbered 190, and incidents of trees cutting totalled 14 and jumped to 32 in 1988 (Ministry of Interior, 1990). All these reported figures are believed to be much lower than the actual numbers of violations.

These activities, especially grazing, cultivation, trees felling, poaching, and fire setting tend to reduce the nutritional quality of wildlife feed, and to reduce biodiversity, i.e. put in jeopardy the very function of the Park.