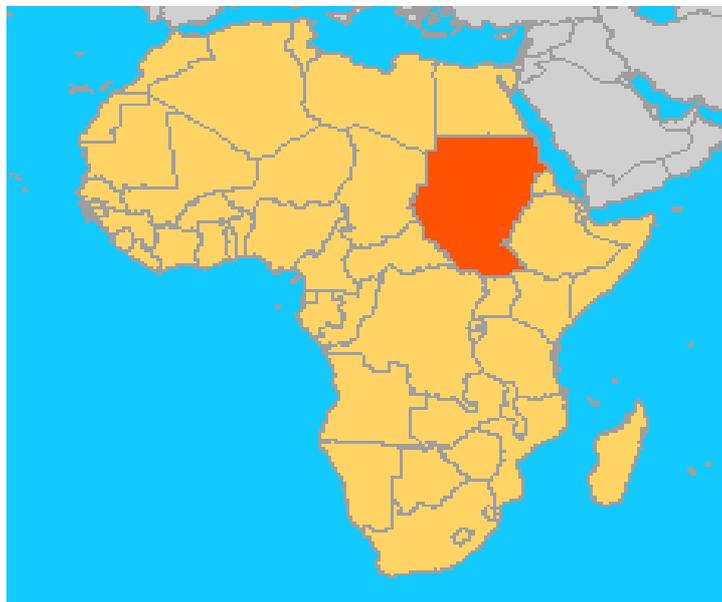


# Forestry Outlook Study for Africa (FOSA)



## Sudan

**Government of Sudan  
Ministry of Agriculture and Forests  
Forests National Corporation**



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*Please note that the views expressed in this paper reflect those of the authors and should not be attributed to any of the institutions.*

*This paper has been minimally edited for clarity and style.*



## Summary

A number of important factors and developments will shape the forest sector in the coming years. In broad terms, forestry like all other sectors responds to macro - level factors.

These factors include: *Population growth* and changes in demographic attributes (rural/urban balance, agricultural dependency, income, changes in aspirations and expectations such as greater interest in environmental issues); *Economic growth* (and related changes in personal wealth, prosperity and consumption patterns); *Land-use change* (particularly deforestation); *Changes in social dimensions* (including changes associated with cultural, ethnic, gender equity issues, changes in socio-political structures, and issues associated with improved education, welfare, and other social services); *Evolution of political orientations* and policies (within and outside the sector); and *Institutional/policy adaptations* (such as economic liberalisation and deregulation, decentralisation, adherence to trading blocks, becoming parties to international agreements and the associated obligations).

Somewhat distinct from these more “human” macro-dimensions are environmental factors. Increasing concerns over pollution from industrial discharges, climate change, soil and water degradation, deforestation and forest degradation, and visual/aesthetic pollution are of marked significance to the forestry sector.

More direct in their influence on forestry are developments in linked sectors. Most important are developments in the agriculture sector, including in population settlement that may be associated with it. Critical to the future of forests is the growth rate of farm productivity.

The energy sector is also closely linked to forestry. Most directly, woodfuel and farm residues are important elements in the national energy budget. The rate at which they are displaced by “modern” conventional fuels or at which they enter the commercial mainstream themselves will affect the forestry sector.

Transport infrastructure, particularly roads, can also have major impacts on forestry. By improving access to forests, roads offer greater ease of settlement, encroachment and deforestation. On the positive side, roads open up opportunities for viable commercialisation of forest resources.

An underlying factor is technological change. Apart from affecting farm productivity, it can directly increase efficiency in forestry and forest industries. Improving conversion factors in sawmills also contributed significantly.

### **The major influential driving forces**

- Population and rural/urban dynamics

Continued population growth, particularly rural populations, which have high dependency on agriculture, are likely to result in continuing conversion of forestland to agricultural and other uses. In turn this will likely lead to a future in which the ability of the forests to provide the expected products and services is reduced. However, trees growing outside the forest have permitted continuing availability of wood, mostly for subsistence needs.

The rural-urban balance is shifting and the absolute number of rural people will fall. UN projections show that the rural population will decrease by 11% between 2000-2020 while the urban population will increase by 110%.

- Economic growth and forestry consumption;

Without sufficient increases in income, large segments of the population will continue to rely on fuelwood and charcoal for energy. Also it is possible to have substantial industry relying on forestry products. The key is that it is possible to plan the use of the resources.

- Policy and institutional changes

The implementation of the federal system of the Government, particularly the devolution of forest management powers to the State governments and the sharing of revenue with them. As past experience shows the shared management of the forests by local and national administrative body's lead to depletion and mismanagement of the forests and the forest area.

## **1. INTRODUCTION**

### **1.1. OBJECTIVES OF THE PAPER**

The Forestry outlook paper for Sudan was carried out as part of a process to prepare the forestry outlook study for Africa towards 2020 (FOSA).

The paper is an in-depth review analysing the status, trends and driving forces shaping Sudan forestry and assessing potential changes in the sector to the year 2020. It examines forestry policies, programmes, and institutional & external influences affecting the sector. It will also take into consideration intersectional linkages. Arriving to present possible guidelines for future developments of the forestry sector through the year 2020.

### **1.2 COUNTRY BACKGROUND**

#### **1.2.1 General outline of Sudan**

Sudan is a vast country with an area of 2.5 million km<sup>2</sup>. It is bounded on the east by the Red Sea and on the other sides by nine African nations. The Nile Valley forms the most salient geographical feature of the country.

Sudan's total population in 1993 was 24.94 million, of which 25.2% was urban. Nearly 8.7% of the total population resided in the three towns making up the capital (Khartoum, Khartoum North and Omdurman). The total population grows at an average of 2.8% per year<sup>1</sup>.

Sudan's economic growth is dominated by agriculture, which accounts for an estimated 49% of GDP, 55% of employment, and 85% of export earnings in 1999. Among the four main sub sectors, the value of forestry product is generally quoted about 3.3%. However, the Forests National Corporations (FNC) estimated that forestry contributes to the GDP by more than 12% (FNC, 1995). Forestry plays an important role in the national economy that is often under estimated in the national accounting. This role is apparent in its contribution to national energy

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<sup>1</sup> National Census 1993, and projections

needs, balance of payments through direct foreign exchange earning, wood supply for construction and employment generation.

### 1.2.2 Forest Policy, Institutional Strengthening and Capacity-building

Since 1989, the FNC has the responsibility for the co-ordination of forestry development in the Sudan. The FNC will continue to play a major role, providing the necessary policy, planning and administrative framework for forest and woodland management. Since its establishment, the FNC has been instrumental in achieving important changes in forestry. The Corporation emphasises the development of a forestry information system and planning database as part of national capacity building for effective planning, policy analysis and programmes implementation. To obtain reliable estimates of consumption of forest products and a reliable estimate of sustainable supply, FNC carried out:

- A Forests Products Consumption Survey (FPCS) in the Sudan (1993-1995); with technical and financial support from FAO/Netherlands Forestry development Project
- A National Forest Resources Inventory (NFRI)

The data from the FPCS and the data derived at the completion of the NFRI worked as a strong database for forestry planning and environmental management. A Comprehensive National Strategy (CNS) for socio-economic development 1992-2002 has been formulated and enacted by the Federal Government. The CNS also stressed the importance of taking the environmental dimension into consideration during the process of planning for sustainable development. The CNS is regarded as the provisional Sudan's National Action Plan for Agenda 21.

### 1.2.3 Current State of Forests

Forests are subdivided according to their origin into two categories:

- Natural forests subset of forests composed of tree species known to be indigenous to the area
- Plantation forests refer to:
  - o Forests established artificially by afforestation on lands, which previously did not carry forest within living memory
  - o Forests established artificially by reforestation on land, which carried forest before and involving the replacement of the indigenous species by a new and essentially different species or genetic variety

Other wooded land includes the following two categories:

- Forest fallow: refers to all woody vegetation deriving from the clearing of natural forest for shifting agriculture.
- Shrubs refer to vegetation types where the dominant woody elements are at maturity under 7.6 m in height

The ecological regions are defined with the help of ecological parameters: climate, physiography, and soils. The climatic parameters include mean annual rainfall, rainfall regime, and length of the dry season, relative humidity and temperature. The vegetation can be divided according to the aforementioned parameters, into seven principal types that in general follow the isohyets and form consecutive series from north to south:

- Desert
- Acacia Desert Scrub
- Acacia Short Grass Scrub

- Acacia Tall Grass Scrub
- Broad-leafed Woodland and Forests
- Forest (Gallery Forest, Bowl or Depression Forest and Cloud Forest)
- Swamps and Grassland

The forest and woodland area in Sudan is currently amounts to 85.90 million ha, which is continuously being encroached upon by agriculture and urbanisation or otherwise degraded by uncontrolled felling. This area represents 34.5% of the total land area of the country. At 1999 the forest reserves area is about 8.86 million ha, that make 3.6% of the total area of the country. Of which about 7,738,000 ha are in the Northern States, which classified as follows:

- Rivirine forests amount to 523,000 ha (under management plan).
- Montane forests amount to 180,000 ha (only at Jebel Marra forest the plantation is under management plan).
- Dahara forests (Rainfed) amount to 7 million ha

Afforestation and reforestation activities are restricted to areas constituted as reserves and subsequently put under management, almost exclusively owned by FNC. The Afforestation inside forest reserves is 240,000 ha by 1999. Institutional forests such as those owned by agricultural schemes and sugar schemes have tree resource plantations. Community woodlots, private woodlots (natural and planted) are approximately 340,000 ha.

Wood products obtained from Sudan forests include fuel wood (firewood and charcoal), building poles and sawn timber in the form of railway sleepers (rail ties), construction and joinery timber.

The most important non-wood forest product (NWFP) in the Sudan is gum Arabic, which is an exudate of *Acacia senegal* known as gum hashab and *A. seyal* known as Gum talh. Gum Arabic is an export commodity and hard currency earner. It plays an important role as a major source of foreign exchange, accounting for about 13.6% of annual export income. In this respect, Sudan commands over 80% of the world's gum Arabic production and trades. Other NWFPs like species yielding edible fruits, which are mostly known only in their specific localities, while a few are known and consumed all over the country through the agency of the trade between State.

For example, the value of exports of NWFPs for the Sudan (mainly gums) has been more than her imports of wood products during last ten years from 1986-1995. This confirms the positive effect of the forest sector on the country's balance of payment. Other benefits are fodder and wildlife utilisation.

The on-going process of environmental degradation is a critical issue that affects the livelihoods of a large sector of the population. Removal of tree cover for crop production, felling trees for fuel wood and building poles in addition to overgrazing are factors that, together with drought conditions, resulted in desertification and consequently, shortage in food crops, and loss of soil fertility. People's awareness about the critical situation and its future consequences and the importance of tree planting and protection is vital for their involvement in the protection and rehabilitation of the environment. It is also proving to be more forceful and apparently sustainable when it is of an income generating nature.

## 2. THE CHANGE DRIVERS

This chapter identifies and discusses the factors that may bring about changes in the forestry sector during the next two decades (until 2020).

### 2.1 SOCIO-ECONOMIC CHANGES

The population density in Sudan is 12 persons /km<sup>2</sup>. This figure gives a false indicator of population distribution when cultivable/ arable land is considered. The population density is as high as 370 persons/km<sup>2</sup> in land presently cultivated along the Nile. Approximately half population is estimated living on just 15% of the land.

Main feature of population is rapid growth rate 2.05% due to high fertility rate that shows declining trends estimated in 1980 by 6.4, reduced to 4.6 in 2000. However, a declining trend of mortality rate influences the population growth rate. The annual rate of growth of the population in urban areas is 5.6–6% versus 2% in rural areas. An important demographic dimension is the impact on the age structure of the population; about 38.9% of the total population is under 15 years of age. This young population structure implies heavy burden on social services, especially on education and health. During the next 20 years these people will likely form an increasingly heavy consumption base for forests products and services. However, at the same time young population structure will promise a big development potential in terms of labour market during the next two decades. The projection of UN reflects that urbanisation will increase by 110%, so expansion of human settlements will be at the expense of tree cover.

Epidemic diseases have serious impact on population increase, mortality and socio-economic features. Most dominant epidemic diseases were malaria, diarrhoea, and dysentery. In recent years malaria has become one of the major causes of death in Sudan. Due to this fact we expect shortage for household and communities with potentially serious implications for production hence it has considerable long-term socio-economic consequences.

Rural-urban migration due to different factors affects demand for natural resources and plays an important role in urban growth. In spite of large flows of rural to urban areas, high fertility rate in rural areas resulted in substantial growth, exerting pressure on forest resources.

Civil war in southern Sudan and natural hazards in western Sudan entail displacement of sizeable population in urban or secured areas; total migrants or displaced persons in Northern secured States constitute about 16% of the total population. Concentration of displaced persons and livestock on surroundings resulted in land degradation, influenced population, distribution, and changed socio-economic features that entails food security problems and exerts pressure on limited social services. Although there is no reliable quantitative information on living conditions in the South, poverty is reported to encompass the entire population in the South, and consequently access to social services is minimal. The bulk of population is dependent on food aid from NGOs, UN agencies and bilateral donors.

On the other hand civil war, and political conflicts in neighbouring countries have created large flows of refugees estimated about one million, residing in Western, Central, Eastern and Southern Sudan. Although their movements have been too small to significantly influence national population growth, but have significant role in environmental degradation.

Estimated per capita income is 269.8 US\$ in 1997 (Central Bureau of Statistics, 1999). Income was unevenly distributed so it is difficult to be used as development indicator, however, it may influence demand for forest products, as income growth change, demand for forest products changed. In urban areas where the per capita income is relatively high, demand for forest products as source of energy decreased due to shift to other sources of energy (butane gas & electricity). On the other hand, due to urbanisation, demand for timber products will increase as standard of living improves. Accordingly in early 1990's about 93% of the rural population and 84% of urban population are poor.

## 2.2 OVERALL ECONOMIC PERFORMANCE

There are broad indications that the Sudan economy improved in the 1990s after years of decline. This is manifested in the following:

- ✓ GDP growth rate averaged 5% during 1992-93 to 1998. This was led mainly by agriculture. Construction activities linked to investment in oil in the last three years contributed to the growth process. The general economic improvement has been helped by the government's containment of fiscal deficits, limits on monetary growth and a reduced rate of inflation.
- ✓ A notable development in agricultural production in the 1990s is the emergence of livestock exports which rose from US\$ 57 million in 1994/ 95 to around US\$ 100 million in 1998. While earnings from cotton fell from US\$ 162.8 million to US\$ 95.6 million during the same period. Export volume grew at around 140% during 1995-98. The recent discovery of petroleum stands to diversify exports further.
- ✓ Inflation was high in the earlier parts of the 1990s, reflecting widened fiscal deficits and domestic credit expansion. Recently, inflation declined from a more than 100% in 1991 to 17% in 1998 as Government adopted tighter policies, especially tight monetary measures.
- ✓ Starting in 1997, a phased introduction of a wide range of trade and other reforms moved the exchange regime towards a unified system. The spreads between official and unofficial exchange rates were gradually reduced. Import and export restrictions, were relaxed except for a few items kept for reasons of religion, national security, public health and domestic food sufficiency. The exchange rate was effectively unified by the end of October 1998.
- ✓ Investment: the Investment promotion Act intends to rationalise the investment sanctioning procedures and stimulate greater private investments and growth. The Act provides guarantees against nationalisation and for transfer of profits. The Act also provided fiscal exemptions for investors, including tax holidays and exemptions on import duties, fees and consumption and production taxes.
- ✓ External Debt: The main challenge to external financial management is a heavy external debt burden, which amounted to some US\$ 22 billion at the end of 1998.

## 2.3 TRADE LIBERALISATION

From 1992 Government of Sudan adopted the Trade Liberalisation policy from the Paraguay Round of the WTO.

Analysis of the wood consumption data under current market prices can be used to estimate the contribution of forestry to the national economic: In 1994 the forestry sector provided 15.77 million m<sup>3</sup> of wood products to the economy. In addition is provided appreciable of non-wood products for local consumption and export. At current market prices (1994) these products are valued at Ls. 219,425 million. This estimate amounts to 12.4% of the GDP at current prices for 1994/95.

## 2.4 POLICY AND INSTITUTIONAL CHANGES

Sudan's development plans and programs have stressed the importance of increased agricultural production, but only some of them tackled adequately the balance between agricultural development & natural resource management. As a result Sudan's natural resources have been neglected & seriously degraded by destructive agricultural activities and tree cutting for charcoal & firewood consumption.

Periodic drought intensified the environmental impact of these land management practices and large areas of Sudan were left useless for agricultural and pastoral production. As a result from this, land degradation became a major concern for the government. However, major problem facing these efforts is the lack of an integrated land use policy.

Recent development policies are calling for rational use of natural resources and environmental protection through range rehabilitation and forestry development. In the 1990's Sudan has undertaken strategies and policies aiming at sustainable development, as it ratified and signed the UN conventions on environment.

A Higher Council for Environment and Natural Resources (HCENR) was established in 1992 with the mandate of co-ordinating activities pertaining to the environment and developing policies and strategies in this regard. The HCENR is implementing three strategic projects: Support for Strategic Planning for Sustainable Environment Development; National Biodiversity Strategy and Action Plan and Climate Change. These strategies together with the National Action Plan for combating desertification and mitigating the effects of drought -under preparation- will be harmonised through a newly Formulated project: Strengthening the Government of Sudan for the Formulation of a National Strategy for Sustainable Development. This action is supported by the promulgation of the Environment Conservation Act 2000, which provides a policy and institutional framework for the conservation of the environment and natural resources.

Preparations are now under way to formulate a 25-years National Strategy (2002 –2027). However, the implementation of the CNS (1992-2002) was far below the expectations and there were inherent contradictions in the components of the strategy.

One of the determining factors in natural resource management in the Sudan is the federal system (26 States) and the decentralisation process, which was started in 1993. This resulted in imbalances in the distribution of natural resources, where some states have abundant resources, others lack them. The States considered forests as a revenue-generating sector. This led to conflict between the FNC as the institution responsible about federal forests and the States. It is expected that more powers will be divulged to the States as regards natural resource

management. Most probably the responsibility of managing these resources will be amalgamated under the State and local governments.

Land tenure system greatly influences the exploitation of natural resources, the 1970 unregistered Land Act of Sudan stated that all unregistered land is state owned, but local people have usufruct rights. Although the customary systems of land tenure define the use of communal lands to some extent, the scarcity of land-based resources and due to some development policies conflicts on land use have occurred. Being the freehand hold owner of land, the Government enjoys *Locus Standi* (right of action) in relation to any dispute over benefits arising out of the same.

Both the Forest Policy 1986 and the Forest National Corporation Act 1989 recognised for the first time the right of private ownership of forests (community, institutions and individuals).

It is expected that future policies will endorse the present trends in the forestry sector of more involvement of local communities in management and benefit sharing in all forests, especially the reserved forests.

## 2.5 AGRICULTURE DEVELOPMENT

Irrigated agriculture covers some 2 million ha, with irrigation water coming mainly from the Nile and its tributaries by way of gravity flow from the dams, pump uplifting from the river or flood irrigation in Gash and Tokar plains (deltas). Small areas are irrigated from under ground water.

Mechanisation is most suitable in the central clay plains due to the heaviness of the clay soil, the extensiveness of the area the scarcity of population and shortage of drinking water, especially during the harvest season. All land in the central clay plains is government owned and is being granted to interested investors on 25-year lease.

The Traditional Rain-fed Agriculture area is estimated at 9 million ha mostly in western and southern Sudan and in certain areas of central Sudan. All the land in the traditional sector is virtually communally owned and is distributed by the local leaders to members of clans and tribes in small plots where hand implements are used.

Agricultural development and investment in Sudan had in the past been sharply skewed towards modern irrigated and rain-fed mechanised sub-sectors. The dominant traditional rain-fed sub-sector has been marginalized. This led to lower growth rates in the economy, magnified regional disparities and created social tensions and civil strifes which further drained the country's scarce, human and material resources needed for development. In addition to political instability, agricultural development and food security in Sudan are impeded by various other challenges and constraints.

The pressures on the forest resources are attributed to three causes:

- The concentration of the human and livestock populations in the most productive and well-developed central parts of the Sudan
- The uneven distribution of the forestry resources and population between the North and the South
- Arboreal biomass constitutes over 75% of the country's energy requirements

Agricultural crop production is practised mainly in the central clay plains where the annual rainfall is about 450 mm, the optimum for grain production. The area was originally forest where the trees were cleared. An area is cultivable for about four to five years after which it is abandoned due to soil depletion and lands exhaustion. Crop production advances opening new of virgin forest area at a rate of about 300,000 ha per year. The needs of the population for food must be satisfied while agriculture is the main producer of export commodities and foreign currency earnings.

Agriculture expansion in the absence of proper land-use and forest management plans will affect negatively forestry development. This calls for an urgent need to plan and rationalise land use in such a way as to fulfil that need of contemporary and future generations in sustainable manners.

## 2.6 INDUSTRIAL DEVELOPMENT

Sudan is characterised by low level of industrialisation therefore most of wood-based products consumed by industrial sector utilised by traditional industry as wood fuel.

The Forest Products Consumption Survey in the Sudan (FNC, 1995) reflects that the industrial sector in 1994 used only 6.8% of the total wood consumption. Its consumption was 1.07 million m<sup>3</sup> round wood. Almost all the quantity (98.5%) was consumed in the form of firewood and the remaining 1.5-% are distributed among all the other uses. Brick kilns were the highest consumers, consuming about 51.5% of the total wood. The furniture industry consumes a small proportion (1.5-%) of the total wood supply equivalent to Household per capita of 0.009m<sup>3</sup>. Saw milling industry consumes not more than 1% of the total wood produced in the country.

There are no other industrial uses of wood not even the simple ones like; the manufacturing of matchsticks, pencils or wood-based boards. There are no chemical industries depending on wood or NWFPs. Most of the sawn softwood and all wood-based panels currently consumed in the Sudan are being imported. Local and global changes are expected during the next two decades to influence the future of forestry development, forest utilisation and the type of forest products. This will be generating the establishment of forest-based industry and will give an opportunity to engage local labour in the growing and delivering of raw material. Hence development of sound forest industries in response to the expected increasing demand can be an engine for further economic growth in the country.

## 2.7 DEVELOPMENT IN THE SERVICE SECTORS AND THEIR POTENTIAL IMPACTS

For centuries forests have supplied a multitude of food, fibre, medicines, fodder, fuel, construction materials and environmental services all over the Sudan, to the indigenous people and more recently to migrants from other African countries.

The broadened perspectives on forest roles are reflected in the international initiatives designed to enhance both the management of forest and the benefits derived from them. The development in forest services is greatly linked with affects and has effects on other sectors. The pressure on forest can be considered much higher than their natural regeneration capacity.

The Sudan government gives high priority to land protection by trees and forests. Some of the developmental projects aim to stabilise sand dunes and produce seedlings for shelterbelts and soil stabilisation around wells. Most of these projects include training of local communities to achieve sustained, environmentally sound rural community developments.

#### 2.7.1 Socio-cultural roles and nature-based Eco-tourism

The Socio-cultural functions of forests are a major factor favouring conservation of certain trees in some regions of the Sudan. Sheikhs in rural areas as part of the community legislation prevent people from cutting trees and punish those who commit such illegal tree felling. There are certain cultural and religious beliefs and myths attached to trees, strengthening the importance of the forest for the local people. Non-timber forest products are very important for traditional medicine in most parts of the Sudan. An array of mammals, birds and reptiles are used for healing and prevention.

Eco-tourism provides an economic incentive to protect natural resources. It also offers jobs and the potential for economic advancement to residents of rural communities. Eco-tourism in forest is still a relatively small component of the world's huge travel and tourism industry, but locally Eco-tourism in forest and parks is generating significant interest recently. All protected game and forested areas have high potential to serve in ecotourism. But there is a lack of necessary infrastructure for development of wildlife and forestry related tourism. The large tourist companies in Sudan are concerned only with the wealthy first class tourists who mostly come from Arab Countries to practice sport hunting. Eco-tourism (not all of which is forest-based) had a turn over of about 22.3 millions US\$ in 1999.

#### 2.7.2 Agricultural Services of Forest and Trees

Forests provide a restorative service to agriculture most clearly evident in shifting cultivation in replenishing degraded land, recycling nutrients, maintaining and rehabilitating soil structure contributing to the water cycle and regulation of water protecting watershed, providing shade and shelter. Windbreaks are another important service in specific situation (DANIDA 1989).

One of the most prominent agriculture related forest service is grazing and browsing. UNSO (1991) stated that in many developing Sudano-Sahelian countries 30 to 40% of domestic animals rely on forest for some or all of their grazing and fodder. Forest grazing is generally carried out under traditional accesses; right and fees are rarely levied. Consequently overgrazing is common, particularly around water sources and wet season grazing areas. The extension of farmland mostly in traditional rain-fed sector is execrably reduces the space available for traditional pastoral farming.

#### 2.7.3 Conservation of Wildlife and Biological Diversity value

Wild animals exert significant influence on food production systems and ecological systems. They also provide other services such as pollination. The loss of biological diversity is being experienced at an alarming rate. The main cause is being human intervention, especially deforestation, overgrazing and overall ecosystem fragmentation.

The conservation strategy adopted in all Africa is the system of establishing national parks and game reserves. This is due to ever increasing conflicts, between human interest and those of wildlife resources. Now, 8 national parks exist with a total of 8,499,790 ha representing 3.2%

of the area of the country. Two national parks are declared as “ biosphere reserves “ and the national parks also include a marine park in the Red Sea Coast. There are also 14 game reserves with a total of 318,000 ha constituting 1.3% of the area of Sudan and 3 game sanctuaries with a total area of 95,500 ha. The total area of protected areas is 11,775,240 ha or 5.04% of the total area of the country.

#### 2.7.4 Service of Mangrove ecosystems

Mangrove forests extend over about 42 km<sup>2</sup> in the Sudanese Red Sea coast. Mangrove forests are located along the Red Sea coast from Ageig up to Halaeb. There are about 19 forests. Extensive stands of mangrove-tree species are the most common halophytic fodder species in the Red Sea region of Sudan.

Mangroves provide a wide range of services and functions:

- Production functions ranging from fuel wood and charcoal, medicinal and chemical products, wildlife and fishery products to the local communities near by
- Habituated Functions: mangroves are important for many resident & migratory bird populations
- Important sink functions holding excess nutrients and pollutants that could otherwise be discharged directly into coastal lagoons, coral reefs and other near-shore areas
- Physical coastal protection or storm protection functions for shorelines

The subsequent sharp rise in human population and their activities in the Red Sea Coastal regions posed considerable damage on such ecosystems. Mohamed (1999) mentioned that salt marsh vegetation at marsa Atta, being described by Kassas (1957), which comprised six recognisable zones, presently is reduced to a poor diffuse trizonal assemblage of halophytes.

#### 2.7.5 Carbon sequestration

Geriegikh community based rangeland rehabilitation project under GEF programme, which is situated in arid zone, it covers an area of 23,477 ha. Total carbon retained by biomass in open and grazing allotments and those quantified of carbon added due to the activities in form of reduced demand displacement and change in house construction were summated a total of 43,311.83 tons equivalent to 2.4T/ha.

#### 2.7.6 Watershed Services of Forests

Forests contribute to watershed quality by stabilising off-site soil, reducing off side sedimentation, reducing flood peaks on streams in small watersheds and replenishing ground water and watercourses. These ecological stabilisation functions of forests also contribute to orderly management of hydro-power and irrigation schemes.

Many important watershed areas at the Eastern mountains, Rashad Area in South Western Sudan, Nuba Mountains, Jebel El Dair, where Bamboo forests contribute to watershed services. Radom National Park supports a high diversity of fauna and floral structure characteristics of the high rainfall woodland Savannah. It is an important watershed area holding the main contributors to the water regime of Bahr el Ghazal, which contribute effectively to the White Nile water regime.

## 2.8 CHANGE IN ENERGY USE AND THEIR IMPLICATION ON FORESTRY

Sudan depends mainly on forestry sector as energy source; it contributes a total of 4.11 million T.O.E representing 70.8% of energy supplies in the country (FNC, 1995).

Demand for wood fuel increased in last years due to rapid population growth, urbanisation and shortage of modern energy, however, wood fuel consumption in Sudan is expected to decrease from current consumption as a result of investments and refining of petroleum by 2001 especially in household and traditional industries sectors. Fire wood consumption decreased by urbanisation, while firewood still dominates in rural areas.

Household per capita commercial energy consumption was very low, due to population growth, urbanisation and limited supply, hence more pressure on forests resource, especially in subsistence sector where pattern of supply took place in form of collection (free as public good), by family members from near by forests. The ratio of purchased versus collected firewood is strongly associated with urbanisation: The percentage of firewood collected is 14.6% for urban households, and 82.2% in rural areas. Collected wood is generally less damaging to natural resources and environment, since the material is confined to collected branches, twigs etc.

Purchased wood represents only about 28% of wood supply pattern (took place in market economy). It was more destructive, because it is harvested from natural forest areas cleared for agricultural production or for purpose of wood fuel production i.e. whole plant. Fire wood purchase and/or collection is associated with income level in both rural and urban areas, collection tends to decrease as income rises. Agricultural residues and biogas for use as fuel were only at its pilot stages; most of production is consumed in small scale.

For traditional industries, including brick making, bakeries, oil mill etc. is found that wood fuel provides about 69.3% of their total consumption. Type of wood consumed is mainly firewood (stem), which had significant impact on forest resources.

In commercial and services sector: include institutions such as schools, hospitals, restaurants, commercial establishments and informal activities (tea, kisra ,etc), wood fuel consumption accounts 67% of the total energy used. It is concentrated in urban areas and their development depends on urbanisation rate. Quranic schools: depend totally on wood fuel especially in lighting.

Investments in petroleum resource have impact in supply and consumption of biomass energy especially on household and industrial sectors. Total LPG supply was 200 ton/day while actual consumption about 100 ton/day in all sectors equivalent to 15 % of total country consumption (Ministry of Energy and Mining 2000). This investment resulted in reduction and drop of petroleum product prices e.g. kilo of butane gas dropped by 50%, this will provide opportunities for substitution of biomass energy in household and traditional industrial sectors in urban and rural centres, however, rural energy demand is expected to continue its dependence on wood fuel unless supported by a strategic plan for energy change, this includes:

- Encouraging gas cylinder and butane gas cookers industry
- Providing loans and credits for gas equipment purchase for low-income groups.
- Taking out taxes and other expenditures put on the imported butane gas equipment.

- Establishing new butane gas service centres in rural areas. All these will change degree of dependence on biomass energy especially in semi arid zones where firewood-collecting areas are becoming very remote

Charcoal high price compared to butane gas price will make its marketing no longer continue due to shifting to butane gas consumption in household sector. With respect to traditional industries fuel wood will be substituted by furnace.

## 2.9 INFRASTRUCTURE AND COMMUNICATION

The development of the infrastructure is highly important for the Sudan with its extensive area, diverse environment and agricultural systems. The railway lines draw their importance as lifelines connecting south, west and north Sudan to the main port on the Red Sea Coast. The railway in Sudan is the oldest on the continent and the longest, extending for 4570 km and together with the branch lines constitute some 5500 km.

Sudan's road infrastructure is inadequate. In 1999 there were an estimated 3160 km of main roads and 739 km of secondary roads. Most roads are unpaved. The road carries 40% of the country's petroleum products. New roads are under way in a number of infra-state highways.

River navigation is an important mean of transport to link North and south. After the peaceful settlement of conflicts, this means of transport is important for forest Development in the south.

Port Sudan is the country's major commercial Port, other ports, are being rehabilitated and developed such as Suakin, Ausif and Bashair from which petroleum products are exported. Sudan Sea Line, which is government owned, has a number of vessels for the transport of commodities and passengers around the world.

Air services in Sudan are limited. The country has 19 airfields, of which Khartoum, Port Sudan, El Obeid, El Fasher and Nyala have right facilities. The sector has developed significantly.

Sudan has only 411,000 terrestrial telephone lines in 1999, of which 70% are in the Khartoum area. Daewoo of South Korea is carrying out the development of the mobile telephone network in the central region of the country in a joint venture with Sudatel, the national Telecom Company. The project began in early 1996 and covers Khartoum, Omdurman and wad Medani. There is an Internet service company.

## 2.10 FOREST POLICY CHANGES

In 1986, the 1932 Forest policy was amended in response to the socio-economic and political developments in the country. The Forest Policy 1986, is characterised by the following:

- Maintenance of the major objective of the Forest Department
- Stressing the role of forests in environmental protection.
- Recognising and encouraging the establishment of community, private and institutional forests within the agricultural sugar schemes.

- Subjecting tree cutting outside forest reserves to the discretion of the General Manager, of the FNC, provided that these areas are reserved immediately following their utilisation for the purpose of their protection and regeneration.
- Making obligatory the utilisation of tree stocks on lands allocated for agricultural investment (not to be burnt into ashes) and to leave specific percentage of tree cover inside and around agricultural schemes in the form of shelterbelts and windbreaks).
- Stressing the polarisation of popular and international efforts for participation in afforestation, tree planting and forest protection.
- Raising the national goal of reserves from 15 to 20% of the total area of the country for environmental protection and meeting the population's needs for forest products.
- Emphasis on forest extension and awareness
- Conceptualising the multiple use of forests.
- Division of authority between the centre and the regions as regards forest management.

The FNC General Manager is appointed *ex officio advisor* for the regional authorities and the institutions in all matters pertaining to the forests.

Among the major provisions of the Forest Act 1989 is the requirement for farmers obtaining lease from Government or Parastatal schemes to have shelterbelts of forest cover of 10% of rain-fed lands and 5% of irrigated lands. Individuals, communities or institutions planting trees on their own or leased lands will have the freedom to utilise the cut trees, as they deem fit.

Significant changes have taken place in the Sudan and in the world since the present policy was adopted in 1986. The 1997 Draft Policy emphasised the privileges and rights of the local people in obtaining their needs from the reserved forests according to agreements between them and the Government. The draft policy also encouraged the establishment of private and community forests. Protection of trees outside the reserved forests was emphasised to maintain biodiversity. The role of forests in environmental protection was also elaborated. Also it is partially based on the Comprehensive National Strategy (1992 - 2002) which contained a chapter on environment and which allocated 25% of the total area of Sudan for natural resources (forests, range and wildlife), and considering the following:

- The general aim of forest policy is to provide guidelines to leaders, administrators and decision makers and to those people whose livelihood depends on the forests as how the forest resources should be managed to give sustained yields.
- The threat faced by the natural forests and the need to give them better protection to conserve their biodiversity and make available their sustained indirect benefits.
- The concept of multi-purpose management as a general principle especially in indigenous forests, woods lands or bush lands that are not strictly protected as national reserves.
- The enhancement of social forestry and farm forestry, including diversification farming systems by various types of tree planting to ensure improved management of water catchment areas, higher land productivity, increased agricultural products, increased rural incomes and alleviation of poverty.
- The role of woody vegetation in supporting development in arid and semi-arid lands.
- The need for forest protection especially against pests, diseases and fires.
- The rationalisation of forest industry to maximise its contribution to the national economy.

- Fulfilment of the agreed national obligations under international environmental and other forest-related conventions and principles.

## 2.11 TECHNOLOGICAL CHANGES IN THE FORESTRY AND ALLIED SECTORS

### 2.11.1 Forestry

Farm machinery has partially replaced simple manual works such as planting, silvicultural operations and harvesting.

In the field of surveying there is a shift to application of Remote Sensing (RS) and Geographical Information system (GIS) techniques especially in large area surveys carried out by some field projects.

There are different varieties of renewable energy technologies that can replace wood fuel especially in H, H and industrial sectors, these includes briquetting, charcoal from crop residues, improved stoves, biogas and solar energy. Wind energy was long used in Sudan. About 250 windmills were imported in 1950 to solve the drinking water problem in Tokar (Eastern Sudan). Because diesel engines are cheaper and can easily be repaired, all those windmills are new out of operation.

To have a successful future for this technology in Sudan, the first step must be the establishment of a model station to encourage the investment in this technology; some means of offering loans and credits must be included in the State policy. Benefit must be made from the experience of other countries in this field.

### 2.11.2 Range (Pastoral sector)

Main technological change in the pastoral sector is the shift from traditional livestock production system to other modernised systems that depend mainly or partially on feeds other than natural vegetation that reduces pressure on range. In ranching systems animals depend on range-irrigated fodder and concentrates. In feed lots animals are mainly raised under range, then driven to urban centres for fattening based on concentrates and additives. In dairy farms, animals are raised around urban centres. They depend completely on irrigated fodder crops and concentrates.

Use of mechanisation (tractor+disc harrows) in range rehabilitation operations. A further technology applied in the pastoral sector is the harvesting and bailing of natural forage from water deficiency areas.

### 2.11.3 Agriculture

The technologies in agriculture include:

- Increased use of farm machinery over years especially in irrigated & mechanised rain-fed agricultural system
- Water harvesting and use of treated wastewater for efficient water management
- Biotechnology: Includes shift from chemical fertilisers to bio-organic farming systems, such as green manuring, use of leguminous species (inter cropping) for Nitrogen fixation and nodulation. To increase crop productivity, stability and sustainability of

production there is shift from low genetic characteristics germplasm to others such as high yielding and drought tolerance varieties either by breeding or introduction.

- Post-harvest technology: Adoption of post-harvest technology to avoid post harvest losses,

Other utilisation technology is treatment of agricultural residues and agricultural industry by-products as renewable resources to be used as food, feed, fertiliser and fuel.

#### 2.11.4 Wildlife

Traditional inventory assessment, being used in Sudan for long time, is often impractical in vast areas due to manpower and funding limitations. Remote sensing techniques are suitable for habitat inventory monitoring and assessment. These have been used in Sudan for the first time in 1994 for reconnaissance mapping of Dinder National Park and Radom National Park. Also GPS system started to be used since 1997 for monitoring and assessment of wildlife resources in different States.

In Sudan, most of wild animals are captured, to implement various management purposes or for research studies, using traditional methods by chasing and capturing animals by hand using ropes, especially for capturing big game animals. Generally successful capturing programmes result from the efforts of experienced rural people depending upon their indigenous knowledge. Some local fermented drinks (Marisa) are the most attractant bait for capturing Baboon and monkeys. The collection of biological specimens used as techniques for the preservation of biological materials for both animals and plants (herbarium specimens) being practised for long time in Sudan.

The anti poaching units working under the supervision of Wildlife Administration are carrying out their responsibilities of law enforcement under limited conditions of equipment. Vehicles for patrolling purposes in National Parks replaced camels being used previously in the 1970's and early 1980s. Cars could only cover limited areas in the rainy seasons compared to camels which cruise the inaccessible dense forested areas following poachers, armed with modern automatic weapons (G.M.3, automatic rifles) while game scouts armed with mark 4 rifles.

There are many techniques being used world wide either to maintain the quality of the habitat as it exists in natural ecosystems or to provide quality habitat. It is notable that water pumps were used during harsh dry seasons, to provide water in marches (mayat) in Dinder National Park as a water development method.

New techniques of Ultrasound investigation techniques are being used to study production capabilities for Dorcas gazelles, in captivity, during 1999.

## 2.12 TRENDS IN INVESTMENT IN THE FORESTRY SECTOR

### 2.12.1 Trends and sources of funding

- o *Annual expenses and investment in the forestry sector:*

Accordingly, the FNC retains all the revenue it generates to meet recurring expenses, namely wages and salaries, operation and maintenance. Simultaneously, the FNC annually receives grants in aid from the Federal Government in the form of local counterpart funds for donor-

assisted forestry projects and in the form of direct funding for forestry development projects particularly environmental rehabilitation and desertification control activities, which had diminished from 1996.

Experience during the previous ten years since the commencement by FNC of its functions as a corporate body (as of 1 February 1990), indicates that these arrangements are feasible and conducive to growth. During this period the FNC has escalated its forest reservation, tripled its annual afforestation and increased its technical staff list by 25%.

o Private Investors:

In tree planting and forest management, the expected return on capital invested is the critical factor. Except for fast-growing plantations, profitability is generally inadequate to mobilise private sector. The traditional involvement of small holders of gum orchards, some large-scale holders, the recent involvement of Gedaref State mechanised scheme owners in the tree belts and the involvement of Gandil private company and small holders of Eucalyptus wood lots around Khartoum.

Forest products: It covers the investment in charcoal making, private sawmills, furniture industry, gum Arabic trade and internal trade of other NWFPs.

o The Agricultural Schemes and Sugar Companies:

They have investment in the tree planting and final products, (annex 1.12), but data about the volume of investment is not available.

o NGOs:

They work in the area of capacity building, empowerment and awareness raising for environmental conservation and planting trees out side forests. The main areas that have received the major funding are:

- Establishment and support to the FNC
- Support to forestry education and research
- The establishment of forestry extension.
- The conduction of socio-economic studies for some natural forests
- The conduction of demand survey (1994) and the national forest inventory (1995)
- Rehabilitation and desertification control activities

### 2.12.2 Investment (in wildlife)

CITES enhanced wildlife breeding farms & ranches, as sort of conservation measure, in order to elevate the pressure exerted on the wild resources. The government of Sudan, likewise, encouraged the private sector to invest in the area of wildlife as stated in the National Comprehensive Sudan Strategy (1992-2002). Accordingly, about 40 licenses being issued for the establishment of game farms.

Types of wild animals being reared in such farms are gazelles (*Dorcuas gazelles* and red-fronted *gazelles*), *Ostrich*, Reptiles and *Guenia fowl*. The intention is to provide optimum condition for the propagation of these species, to protect them from instruction and to fetch a good economic reward to the investors. The current situation showed that most of them are unsuccessful due to lack of scientific supervision and extension support. Mean while an

experimental research station is being established to furnish investors with the technical back up and the technological packages needed to help in breeding and rearing

Other field of investment is Eco-tourism. Eco-tourism potentials are great in Sudan, however, it is still very limited due to lack of infrastructure development and the war in the south where most of the rich wildlife areas exist.

## 2.13 OTHER FACTORS HAVE IMPLICATION ON FORESTRY SECTOR

### 2.13.1 Non-Wood Forest Products

A wide range of Non-wood forest products (NWFPs) is provided in Sudan. NWFPs are products of almost 76 indigenous tree species including gums, bamboo, fruits, nuts, fibres, fodder, honey, flowers, medicinal herbs, silk, animal skin, ivory and others (Ibrahim, 1999). Despite the great variety in the NWFPs, only a few are considered of commercial value. The most important NWFPs is gum Arabic. Mainly produced from *Acacia senegal* (hashab) but also from *Acacia seyal* (talh) trees. At present, almost all non-wood products are used in the raw (unprocessed) form.

Currently gum Arabic is used in food and pharmaceutical industries. Historically gum was exported in its raw manually cleaned and graded form. Recently, however, Sudan has introduced mechanised cleaning and production of kibbled gum Arabic (small granules of uniform size) was introduced to gain added value (Coppen 1995 p. 21).

A few other NWFPs are currently subject to varying degrees of processing. For example, gunlaize (fruit of *Adansonia digitata*) is sold in the form of powder, doum in the form of cake...etc. New lines of use for NWFPs have recently been invented. One of these is the use of gum Arabic in curing kidney failure. Also the production of oil, cake and molasses from fruits of *Banalities egyptiaca* is under trial. The products are to be distilled to produce medical alcohol (Ibrahim 1999).

The most important role of NWFPs is its provision of self-reliance, employment and food security to local economy. Many communities in the Sudan receive income from collection, processing and marketing of these products. Gum Arabic in particular is an important off-farm activity for the inhabitants of the Gum Arabic Belt (GAB).

Regarding the other NWFPs they provide the main employment and income sources for the elderly, women and children. As such they play a decisive role in rural areas where resources are meagre and the weaker categories in the community cannot migrate to seek employment elsewhere or cannot engage in the more labour demanding activities.

At the national level, NWFPs contribute to income through export earnings. On average, gum export earnings amount to about 17% of total Sudanese exports thus considered one of top important exports. The rest of the NWFPs contributed to less than 2% of the total export earnings<sup>2</sup>.

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<sup>2</sup> Excluding oil exports.

### 2.13.2 Water Resource

The country's share of Nile water is dictated by the 1959 Nile Water Agreement as 18.5 billion m<sup>3</sup>. Streams, which are not part of the Nile basin or do not flow to the Nile, mostly flow in the savannah region, flowing for few days or hours during July, August and September.

Ground water is potentially available in about 50% of the surface area of the country. The estimated probable strategic potential of ground water aquifers is amounting to some hundred milliards m<sup>3</sup> (Iskander 1998).

The water resources and irrigation strategy is directed towards expansion of irrigated agriculture. Forest belts in irrigated and rain-fed agricultural schemes are part of governmental adopted policies. Limited availability of funds to increase irrigation storage or to develop ground water sources is limiting development of agriculture. Water is realised as the constraint for irrigation development. The strategy in water policy caters for combating desertification and drought and flood mitigation and calls for watershed management and environment analysis and management (Sudan National Water policy, 1999).

The importance of forests for watershed management is recognised. However, decline of areas covered by riverine forests is documented. Loss of tree cover in watershed areas is reflected on increased sedimentation and loss of storage in irrigation dams. The Sudan water policy 1999 addresses care for catchment areas. Introduction of vegetation cover and control of deforestation of catchment areas and overgrazing are included in measures to improve water yield and quality. Watershed management in neighbouring countries is also a prerequisite for efficient water use.

The role of forest in watershed management is recognised in relation to water quality by stabilising on-site soil, reducing off-site sedimentation, reducing flood peaks and replenishing ground water and watercourses. These ecological stabilisation functions of forests also contribute to orderly management of hydropower and irrigation schemes including delaying silting up of dams and loss of storage capacity. Regional co-operation is needed in watershed management.

### 2.13.3 Impact of petroleum industry on forestry

Large concessions are allocated for petroleum prospecting in different parts of the country. Such areas are subjected to deforestation and soil and air pollution. The problem of disposal of the water produced from oil operation is presented as one of the environmental problems linked to petroleum industry in Sudan. Disposing of large volume of sodic water, contaminated with hydrocarbons and treatment chemicals is being considered now. The level of contamination by oil and grease (hydrocarbons) in the produced water in one of the oil prospecting areas of the Sudan could be reduced from 230 000 mg/l to less than 10 mg/l through use of evaporation ponds. The water after reduction of grease and hydrocarbons through evaporation is considered suitable for irrigation and because of residual hydrocarbons and treatment chemicals the water cannot be used for crops intended for consumption by humans and/or animals. The only suitable crops are forest crops.

The above findings are based on preliminary surveys and are subjected to further studies. Large areas of land could be needed for afforestation activities to dispose of large quantities of water produced in petroleum operations.

## 2.14 SUMMARY OF KEY DRIVING FORCES

### **Selected major driving forces influencing the future**

- o Population and rural/urban dynamics:

Continued population growth, particularly rural populations which has high dependency on agriculture, is likely to result in continuing conversion of forest land to agricultural and other uses. In turn this will likely lead to a future in which the ability of the forests to produce the products and services expected them to be reduced. However, growing trees outside the forest has permitted continuing availability of wood, mostly for subsistence needs.

- o Economic growth and forestry consumption:

Without sufficient increases in income, large segments of the population will continue to rely on fuel wood and charcoal for energy. Also it is possible to have a substantial industry relying on forestry products. The key is to plan the use of the resources.

- o Policy and institutional changes:

The implementation of the federal system of the Government, particularly the devolution of forest management powers to the State governments and the sharing of revenue with them. Past experience reflects that sharing management of the forests between local and the national administrative bodies lead to depletion and mismanagement of the forests and the forest area.

## **3. FORESTRY SECTOR IN 2020**

This chapter provides an outlook for forest resources in Sudan, and for their production potential through the year 2020. It also projects likely demands that will be placed on forests. Finally, it attempts to show the most likely situation for institutional framework for forestry.

There is always some uncertainty associated with key factors that will affect demand and supply of forest products. It is, however, possible to prepare an outlook for forest sector in which scenarios are used to organise and display possible future developments and the magnitude of uncertainty surrounding these projections.

### 3.1 SCENARIO I: THE DREAM

In this scenario, the civil strife in Southern Sudan is amicably resolved. The countries sharing the Nile Basins too have resolved their internal problems and all of them have come together to cope the environmental degradation problems.

Fulfilment of Sudan to its commitment to the International Conventions and effective implementation and development of several Strategic National Action Plans succeeds.

#### 3.1.1 Assumptions

- o Development of economic status:

- ✓ Improvement and accessibility to forest resources in Southern Sudan
- ✓ Integrated resource management
- ✓ Model agriculture projects that take the tree into consideration will be formulated
- ✓ Process land use planning, reservation, registration, afforestation, reforestation, range rehabilitation and management is started and continued
- ✓ An integrated forest management project is formulated, financed and implemented
  - Development in forest industries:
  - ✓ Environmental rehabilitation policies
  - ✓ Environmental management integrated in all sectoral areas of policy and action. I.e. multi sectoral approaches are vital (co-operation among governments, non-governmental organisations, private sector and local communities)
  - Petroleum production:
  - ✓ Utilisation of Sudan of its oil resources
  - ✓ Positive economic impact (GDP)
  - ✓ It will bring in hard currency (Improved infrastructure and the construction of model villages that require building poles and timber will be a reality)
  - ✓ Provision of alternatives to fuel wood

## 3.2 SCENARIO 2: ACCOMMODATING THE PREDICTABLE

The predictable engines of drive that have negative impact on forestry continue. The scenario is restricted to the Northern States (the area between latitude 10°-22° N). The area below 10° N that constitutes the Southern States is inaccessible at the outlook period, because of the insecurity situation created by the civil war.

### 3.2.1 Assumptions

- Agricultural expansion:

Since the 1980s the government adopted a horizontal expansion policy (area increase) in the agricultural sector to meet the successive increase in the population needs and to insure food security. This trend is also adopted in the Government projections towards the year 2015. This will definitely require the conversion of more forests and rangelands to meet this expansion.

The ever increasing national life stock and its dependence on forest and woodland for forage will have negative impact on tree/shrub regeneration and vigor.

- Petroleum production:

Utilisation of Sudan to its oil resources has positive economic impact. There is provision of alternatives to fuel wood in the way of kerosene and Liquid Petroleum Gas (LPG). Investments in petroleum resource have impact in supply and demand of biomass energy especially on household and industrial sectors.

- Population dynamics:

Expansions of human settlement at the expense of tree cover, leading to the increase in the use of bricks in building and the consequent increase of firewood for brick production.

### 3.3 OUTLOOK FOR STATE OF FORESTS AND PLANTATIONS

#### 3.3.1 Outlook for Area under forests, forest cover, and growing stock:

According to FAO the forest area have decreased from 34% in 1958 to 17.5% in 1998 of the total country area. The forest and woodland area in Sudan is currently amounts to 85.90 million ha. This area represents 34.5% of the total land area of the country. 8.86 million ha constituted as forest reserves and under reservation, which make 3.6% of the total area of the country (FNC 2000).

#### 3.3.2 Forest Resources

A growing stock inventory at low intensity to provide ground truth was carried out in selected areas including the Blue Nile, White Nile and Kassala States in 1982. The result of these activities indicates an increase in total growing stock to 1.994 million m<sup>3</sup>. However, analysis of the ground truth data reveals severe reduction in growing stock volumes, particularly in the once heavily forested areas of the Blue Nile, where the growing stock is estimated to be only one-third of previous estimate, i.e. less than 9 m<sup>3</sup> per hectare. Preliminary data from these surveys indicate a total annual allowable cut of 15.1 m<sup>3</sup> million of wood for the Northern Sudan and 20.3 m<sup>3</sup> million for the Southerner's. As results of the uncertainty no reliable database exists for forestry planning purpose, against this background the National Forest Inventory (FNC) has been carried out in 1995. The NFI covered an area of 62 million ha, which is 24.9% of the total area of Sudan. The findings reflect total volume of all woods vegetation and annual allowable cut, see Table 1.

Table 1: Total volume of all woods vegetation and annual allowable cut in the inventoried area

Sector	Total volume of all woody vegetation m <sup>3</sup>	Annual allowable cut (increment m <sup>3</sup> )
River Nile	672,000	47,040
Eastern	3,234,000	226,380
Central *	29,531,000	2,067,170
Kordufan	44,218,800	3,095,316
Darfur	89,096,800	6,236,776
<b>Total</b>	<b>166,752,600</b>	<b>11,672,682</b>

Sources: Sudan National Forest Inventory (1998).

\*Khartoum, Gezira, Sennar, Blue Nile and White Nile States.

#### 3.3.3 Outlook for state of natural forests

The area of natural forest is approximately 85.90 million ha in 1999 (according to NFI for Northern States and projection for Southern States). The natural forests under reservation and proposed for reservation are approximately 8 million ha.

Unfortunately, the area of reserved natural forests under Sustainable Forest Management (SFM) amounts to 80,000 ha. The rest of the natural forest resource is managed, in best case,

with only one element of SFM, which is forest guarding. Although, more than 80% of national consumption of fuel wood in Sudan is produced from the natural forests.

According to *scenario 1*:

- Natural forests are expected to rehabilitate and restore
- Additional areas of natural forests are likely to be reserved for Eco-tourism and biodiversity conservation, as utilisation is permitted through effective management plans

Applying *scenario 2*:

- Would lead to decline in natural forest area to million ha in 2020. As in the past, some of this will be due to conversion to plantation or other land uses.

### 3.3.4 Outlook for state of plantation forestry

Plantations in Sudan can be classified as reserved forests established by reforestation. They are mainly stocked by indigenous species as *Acacia senegal*, *Acacia nilotica* and *Khaya senegalensis* together with exotic species as *Eucalyptus* and *Tectona grandis*. The plantation within forest reserves is about 453,000 ha. They have the following main objectives:

- Sustained supply of general utility timber
- house construction and rough furniture for rural areas
- High-grade timber for quality furniture, urban houses
- Development of foreign exchange-earners e.g. gum Arabic gardens
- Creation of shelter belts as a measure of augmenting agricultural yield or for protection purposes such as sand dune fixation and creation of aesthetic plantain around habitations

Estimates of current plantation in the agricultural schemes and sugar companies are approximately 1 million ha. 42,000 ha are plantation owned by local communities.

Criteria and indicators of SFM which include; implementation of all silvicultural and tending operations are not effective in most forests. Experience from the field showed that there is a considerable amount of divergence from the proper work plan.

According to *scenario 1*:

- As there is a development in economic status this will grantee that all forest lands would be reforested by fast growing tree species to provide industrial wood. And as we expected integrated resource management, the outlook towards 2020 will be planting of thousands hectors in irrigated agricultural schemes, which represent the reaming area of the 5%.

Applying *scenario 2*:

- The estimates of current plantation establishment were obtained from FNC afforestation programmes, which is affected by the investment capability available annually so there is no definite establishment rate to calculate the proposed accumulative area at 2020. For the agricultural schemes and sugar companies an area should be afforested. Mobilising local communities will ensure their involvement in tree planting it reflects sufficient economic returns.

### 3.3.5 Outlook for state of trees outside forests

Trees outside forest-area are trees growing in public utilities (e.g. schools, public yards, institutions), houses and highways. This type of trees exhibit the typical tree shape referred to as wolf trees. The contribution of such trees in wood products is very little because they are essentially planted for shade, amenity, decoration and protection purposes. The existence of trees outside forest area is not intensive, and there is no calculated data reflecting the number of trees or the area.

### 3.3.6 Outlook for status of non-wood forest products

It is not possible to develop a quantitative outlook to NWFPs except for gum Arabic. Data of production, supply and marketing is not available to enable adequate modelling. Nevertheless, there is considerable evidence that NWFPs are both socially and commercially important particularly for poor rural people living close to forests. At the same time collection, processing and distribution NWFPs in organised markets provides employment for large numbers of people. Building the outlook model for NWFPs entails descriptive projections that differ in some of the assumed forces of change.

#### *Scenario 1:*

Regarding macro-level policy reforms, the main change will be related to the government commitment to the World Trade Organisation (WTO), which requires privatisation and liberalisation of the economic activities. The other policy change assumed is to abide by the international environmental conventions. In addition it is expected that forest policy will be integrated in land use policy and planning. Within the forestry sector, the main changes are related to the increasing rate of reservation and addressing socio-economic aspects, including benefits to local population and participatory management.

The main influence of the supply of NWFPs is the area under forest cover. The integration of forestry into land use policy and planning will ensure that other activities will not grow at the expense of forestry. Investments will be directed to activities that provide best real value. This requires the application of evaluation methods that integrates economic, social and environmental effects in the estimation exercise.

The realisation of the targeted area of forest cover and forest reserves (even if not fully realised) will contribute to increasing areas under forest. This will positively influence the total supply of NWFPs.

On the demand side, secured supply of gum will surely but slowly lead to the regaining of the country's position in the gum Arabic world market. Studies, inventories and research work will be carried out to assess the NWFPs for maximum utilisation.

#### *Scenario 2:*

In this scenario the present situation is assumed to persist. That is, present forces that affect demand and supply will not change.

Regarding gum Arabic, if the present situation continues, supply will continue its declining trend by an average rate of (-0.02) metric tons per year. By the year 2020 supply will reach 9000 metric tons. On the other hand, the average rate of growth of demand is (-0.04) metric tons per year. This means that quantities demanded will reach as low as 5000 metric tons in the year 2020.

As was learnt from experience, declining supply encourages users to shift away from natural gums to substitutes. Returns to producers will considerably be affected since decreasing supply is also accompanied by a decline in demand. This will eventually lead to complete abandonment of the gum business. Signs of this have already been witnessed.

Regarding other NWFPs a major factor to be considered is how growing prosperity may affect the numbers and habits of forest-dependent people. Although within the 2020 horizon of this outlook study the absolute numbers of forest dependent people may not decline, their needs and demands could change significantly as alternative livelihood opportunities open up to them.

### 3.3.7 Outlook for conservation of biodiversity & protective functions of forests

Sudan's government gives an increased attention to forest conservation & protection of biodiversity exemplified in the comprehensive strategic plan. That means protected area and game reserve should cover about 56 million ha to constitute 25% of the Sudan area. Including different categories, aiming for protection of wildlife in mountain, desert and wetlands.

Some forest formations are unique in the Sudan e.g. relics of Rain forest (Bowl forests) in Equatoria. These areas are suggested to be reserved both for their flora and fauna resources.

#### *Scenario 1:*

Adoption of unified environment law and the enforcement of existing land legislation & customary rights concerning land ownership, management forest resources will be satisfied to conserve diversity of species and will be in harmony of Sudan national biodiversity strategy and action plan. Efforts will take place to reserve the targeted areas.

#### *Scenario 2:*

There are the complex relationship and contradictions between land legislation and customary rights, in particular concerning land ownership. So future opportunities for protection by establishing the same system of game reserves or at least forest reserves managed in the same way are decreasing with the increase of population densities. Inadequately regulated harvesting for fuel wood production, increased demand for commercially popular species, traditional use of forests by rural population and others.

The key challenges are to achieve balances among the multiple roles of forest to provide the greatest overall benefits & to adopt measures that keep the sector responsible to changing needs without compromising the sustainability of forest resources as well as management of forests for non-marketed services.

New protected areas may need to be in more closely defined conservation categories.

The system of biosphere reserves as a new concept involving further and more sustainable local and indigenous communities would demand sacrifices for conservation of biodiversity to be more acceptable locally.

### 3.3.8 Outlook for state of park management and Eco-tourism

While all protected areas control human occupancy or use of resources to some extent, there is a wide variation in the degree of such control. If we evaluate the state of Park Management with regard to the effective management policy measures as:

- Planning problems that lead to extensive mechanised agriculture
- Enforcement of law
- Improvement or rehabilitation of habitats (by different techniques)
- Promotion of corrective actions such as afforestation and reforestation
- Control of deforestation

It is clear that they lack all these measures, even there is no effective presence of authorities in any area designated as protected area. Management status can be rated as unsatisfactory. The protected area especially National Parks faced by land-use, the deterioration of natural rangelands, deforestation and settlement of displaced populations.

*Scenario 1:*

Rehabilitation of protected areas (Northern & Southern Sudan) through a planned mix of National Parks and other categories of protected areas, a mix of production forests, agriculture, and grazing conservation can serve human community and safeguard the well-being of future generations of people living in balance with their local ecosystems. Some Natural forests are reserved and withdrawn from wood production and developed for recreation and Eco-tourism. Proposed protected areas may be established.

*Scenario 2:*

The current status of park management (National parks and forests) is expected to continue, threatening the biodiversity; this will affect the Eco-tourism.

### 3.4 OUTLOOK FOR THE DEMANDS PLACED ON FORESTS

#### 3.4.1 Outlook for forests industries

According to the information that has been mentioned in chapter 2, about the low level of forest industry in the Sudan, two scenarios have prepared forest industry outlook towards 2020.

*Scenario 1:*

- Large areas of natural forests characterised with high production quality saw logs.
- Great amounts of woody material are available from savannah woodland as result of a decreased consumption of fuel wood
- Large areas of plantations forest with high production of wood from fast growing species
- Large quantities of agricultural residues
- Policies in favour of investment
- Adequate infrastructure for the development of the wood-based industry
- Many local and foreign investors interested in forest-based industries
- High demand for forest products. The production of round wood is 15.77 million m<sup>3</sup>; there is no doubt that this demand will increase throughout the foreseeable future.
- The key determinant factors of the demand placed on forest industry products include economic performance, population growth, trend toward urbanisation, technological advancement, price competitiveness and consumer preferences for forest products compared to non-forest products.

The per capita consumption of local fuel is expected to decline as a result of local production of gas and other oil-products. However, total consumption may not decrease in absolute terms

a result of increasing population especially in the rural areas unless this is accompanied by some measures that encourage the shift to oil products. Energy is expected to remain the main wood consumer over this period.

Any measures taken to promote the replacement of gas for fuel wood will probably have clear effects in the urban and Peri-urban areas. This will lead to reduction in the consumption of charcoal, which will result in releasing the pressure on vast areas of the savannahs, forest. Consequently, considerable amount of wood material can be saved or used to supply other wood industries.

The production of wood-based panels is predicted to increase significantly, using some of the wood previously supplying the charcoal industry and plantations wood products, and supplemented by the saw milling and myriad agricultural residues.

The species occurring in the semi-desert and dry savannah of the central and northern Sudan are not suitable as raw material for the production of plywood, or veneer on account of their technological properties, their stem form, and their total yield. This species will be good reserve for pulp and paper industry and some wood-based panels. Pulp and paper industry may be established using raw material mentioned before.

Saw milling and furniture industry, which consumes 2.5% of the total round wood consumption, is expected to increase. Main supply of wood for saw milling, furniture, plywood and veneer industries will be from the natural and plantation forests in southern Sudan.

Price of all forest products will probably decline due to the competition, although demand will continue to be strong in the region. Products and technological substitution could cause prices to decline.

Sawn wood import to the country will remain the same, but plywood and other wood-based panels import may decline.

#### *Scenario 2:*

- An increased demand associated with a decreased supply of forest products.
- Increased use of agricultural residues for energy, fodder and other uses.
- Forest-based industries are not attractive to the local or foreign investors.

Charcoal industry is predicted to increase due to the increase of population and emigration toward urban areas. Agricultural residues will have a considerable share in household energy consumption.

A decline in supply of saw logs is expected during the next two decades. Wood-based industries have little chance if any, to flourish. Import of softwood-sawn wood and wood-based panels will increase.

### 3.4.2 Outlook for roundwood and other products demand–supply situation

#### o *Supply of forest wood products:*

To determine the contribution of forest product supplies, three sources can be distinguished: production from natural forest, plantation, agricultural schemes and village woodlots.

The sustainable annual increment is of the order of<sup>3</sup>

- Natural rainfed forest with MAI (Mean Annual Increment) of 1.0-1.6 m<sup>3</sup> RWE o.b. (Standing) per ha.
- Irrigated Plantations of Eucalyptus micro theca: MAI of 12 m<sup>3</sup> RWE o.b. (Standing) per ha.
- Village wood lots: the production cannot be estimated at present.

The supply of wood is based on the formulation of equation for supply that content the stock, the area and the allowable stock which give the annual allowable cut. At the States level: it indicates that the Northern, Central and Eastern States have less growth rate represents only 0.01, 0.5, and 0.26 respectively that means the need for more forests policies in the future to alleviate the severe degradation and to control the degradation that affects the areas. Western Sudan has a good stock, which means that the growth rate of forests is higher than that in the previous States.

o The Demand:

It is important for the forestry sector to develop the use of wood as a raw material for the production of high value products e.g. paper, pulp and furniture; wood for construction is expected to continue assuming an important role in the country in both rural and urban areas.

When we assess the demand for wood products, using the 1994 survey. The calculation is based on the consumption of the different sectors, see Table 2.

Table 2: Wood Demand projection towards 2020

Types	1993	2000	2005	2010	1020
Fuelwood	11,998,131	13,253,748	13,759,271	14,728,291	15,461,804
Wood Construction	1,257,774	1,167,216	1,033,225	1,365,780	1,471,711
Wood furniture	241,022	268,566	285,584	304,733	327,726
<b>Total</b>	<b>13,494,934</b>	<b>14,687,530</b>	<b>15,076,075</b>	<b>16,396,794</b>	<b>17,259,221</b>

**Outlook for wood fuel and other biomass based energy supply**

Wood fuel is an important energy source in national energy budget, driving forces affecting future utilisation are:

- Investment and refining of petroleum: utilisation especially in household and traditional industries sectors, (supply)
- Policy to words petroleum products prices e.g. reduction of LPG price (dropped by 50%) by year 2000
- Population dynamics: baseline projections of population dynamics suggest that by 2020 Sudan will have increase in urban pop. by 110%(10.8 mill. to 22.7 mill.), while rural population increased by 11% (19.05 mill to 21.1 mill.) this due to fact that urban-rural migration coupled with population growth. Annual pop. Growth rate wills has annual rate of change estimated at 2.76% during 1995-2000) suggested to declined to 1.1% during 2015-2020

<sup>3</sup> Fenton, 1999, forest resources and planning, North Sudan. GCP/SUD/933

- Availability of other renewable energy technology
- Major constraints for LPG utilisation household sector.
- Social: low socio-economic status of majority of wood fuel users hence they cannot access to gas equipment
- Economic: financial feasibility of large scale, wood fuel supplies where majority of poor collect their fuel wood as public good, therefore income effect is negligible
- Lack of infra structure such as absence of LPG centres in remote rural areas

*Scenario 1:*

Household sector

It is assumed that fire wood and charcoal per capita consumption in urban areas declined at annual rate of 2.5% (50% by 2020) on account shift towards non-biomass energy. In rural areas the annual rate will decline by 0.5% during 2000-2005, and by the same rate as in urban areas during 2006-2020

*Scenario 2:*

Household sector

Wood fuel use in rural and urban areas is assumed to decline at annual rate of 5.5% due to shift in non-biomass energy sources (10% by 2020).

Service sector

According to assumed growth (5.43%) rate of services in Sudan, rate of increase of wood fuel consumption assumed to be constant during 1994-2000 increases. Then declined by 0.45% during 2001-2010 declined by 0.48% during 2010-2020.

Industrial sector

According to assumed growth rates of industry in Sudan, rate of increase of wood fuel consumption assumed as 0.09%, which is constant during 1994-2000, then declined by 0.11% during 2001-2010 and by 0.14% during 2010-200.

Table 3: Summary of wood fuel consumption scenarios in 2020 (per 000 m<sup>3</sup>)

SECTOR	SCENARIO	FW	CHAR.	TOTAL
HOUSEHOLD	*	8,219.201	6,196.655	14,415.856
	S1	96,796.93315	272,273.6129	36,9070.5461
	S2	180,055.2989	218,135.4654	398,190.7643
INDUSTRIAL	*	1,050.174	11.673	1,061.847
	S1	0	0	0
	S2	27,191.85639	302.9144661	27,494.77085
SERVICES	*	240.68	283.899	524.579
	S1	0	0	0
	S2	6,175.668401	497,204.2198	810,758.3632
<b>TOTAL</b>	*	<b>9,510.055</b>	<b>6,492.227</b>	<b>16,002.282</b>
	<b>S1</b>	<b>96,796.93315</b>	<b>272,273.6129</b>	<b>369,070.5461</b>
	<b>S2</b>	<b>6,175.668401</b>	<b>7,283.210325</b>	<b>1,236,443.898</b>

\*BASE YEAR (1994)

S1 SCENARIO 1 (THE DREAM)

S2 SCENARIO 2 (ACCOMMODATE THE PREDICTABLE)

### 3.4.3 Outlook for social and economic implications

- o Employment:

Forestry activities provide significant opportunities for employment and income generation in almost all-rural areas of Northern Sudan. The opportunities will increase with adoption of forest industry.

o *The income of other stakeholders:*

Income from forest products seldom accounts for a large share of a household's total income, but is often important in filling seasonal or other cash-flow gaps. The importance of forests incomes usually lies more in its timing.

The share of individuals in agricultural land in Sudan is declining. Official figures indicate that the per capita agricultural land has declined from 0.67 ha in 1980 to 0.61 ha in 1997 and is expected to drop to 0.49 ha by the year 2025 (Danielson and Hammerskjold, 2000). Forest products increasingly provide one of the main sources of non-farm income to rural households (Arnold, 1997). Extra non-farm income generation from forestry in Sudan is dwindling for two reasons. First, the per capita forest area is declining e.g. where it was 2.56 ha in 1980, 1.56 ha in 1995, and is expected to drop to 0.70 ha in 2025. Second, the relationship between population concentration and forest resource abundance is inverse. Well-stocked forests are found in areas where populations are originally sparse and are reduced further by the displacement caused by civil unrest or depopulation for economic reasons. However, the potential of these forests to provide non-farm income is diverse.

o *Forest foods and food security:*

Sudan forests extend across several agro-ecological zones, which imply the existence of a variety of fauna and flora species. Traditionally, forests of Sudan have been managed by forest-based communities to satisfy their needs for forest products. An accumulated indigenous knowledge with respect to the local use of trees and forests to provide food and other non-wood materials has been recognised. Badi (1993) prepared, from available literature only, an exhaustive list of forest species bearing non-wood forest products. The list includes above 150 tree species. Forest fauna is also contributing to food security through the provision of different kinds of bushmeat. Permitted hunting in hunting blocks is targeted against some wildlife species that are known for its quality meat. While the later is connected with tourism, local communities share the former. During the periods of drought that hit the Sahel, the fruits of *Cordia africana* and the fruits of *Boscia senegalensis* were used extensively by local people as famine foods. Forestry was making the difference between being and not being for rural communities at these critical moments.

#### 3.4.4 Outlook for forest services

It is not possible at present to develop a quantitative outlook for services of forests. Data is too scarce to enable formal modelling. The importance of forest services is largely described in chapter 2. The outlook forest-provided services will range between two extremes.

*Applying scenario I:*

It would be marked with intensive efforts to control deforestation and forest degradation. The value of NWFPs should be acknowledged. That will be done by Sudan government commitment to the global International Conventions and effective implementation and development of the several strategic National Action Regional and inter-regional collaboration and co-operation would promote sharing responsibility to the Nile Basin and its watersheds. Therefore forest

policies would be integrated into land use policies & development of broad partnership forestry programs.

Energy change patterns to substitutes (LPG & kerosene) might elevate the pressure exerted on forests, But that will lead to reduced financial return to forestry sector and related fields, from such investment. Hence achieving sustainable financing to manage natural forests for non-marketed services is the major challenge facing the sector.

Strategies and mechanisms for better mobilisation of both national & external financial resources for securing sustainable management of forest resources should be developed. FNC would conserve trees of less valuable timber for the production of non-wood products and services. Many forest formations, especially those proposed for reservation (e.g. Mangrove and bowel forests) would be stated reserved. Rates of Reservation as stated in the constitutional decree to 25% of Sudan total area, would be activated with more plantation, woodlots and shelterbelts. The efforts have to be pursued and intensified in the next biennium.

Parks will succeed in realising their conservation objectives only to the extent that the areas themselves are effectively managed and to the extent that the management of the land surrounding them is compatible with the objectives of the protected areas.

#### *Scenario 2:*

Continuing disregard the values of forest services in institutional policies (At the National or the sectoral level) as coupled with poor and ineffective implementation of the National Action Plans for development of Natural Resources, would result in substantial devastating effect in forest status and functions. It would be reflected on widespread deforestation, increased felling of trees due to more agriculture expansion. (As stated in Agriculture strategic plan of Action 2000). Subsequently agricultural productivity will fall. Hence, the appearance of rapid shrinking of forest formation, if this continued, would mark more degraded landscape leading to more devastating conditions. The huge migration of rural people surrounding protected areas would continue, leading to biodiversity loss and environmental hazards. Deforestation will affect watershed quality and quantity due to the increased rate of erosion.

Only limited additional areas of natural forest and wildlife areas are likely to be reserved for Eco-tourism and biodiversity conservation. Unless buffer zone development and other utilisation patterns are permitted through effective management plans otherwise strict protection of parks will be come increasingly difficult.

### 3.5 OUTLOOK FOR INSTITUTIONAL FRAMEWORK FOR FORESTRY

#### 3.5.1 The structure and functions of forest and wildlife administrations

The creation of FNC fits in with the rethinking of the role of Government in the guidance, stimulation and control of the national economy, as laid down in a publication about the National Economic Salvation Programme of June 1990. FNC as stated before (chapter one) is affiliated to Ministry of Agriculture when commenced in 1989. In 1995 it had joint the newly established Ministry of Environment & Tourism, and since 1997 it again joined Ministry of Agriculture and Forestry. Difficulties encountered by forestry services may be summarised as follows:

- Lack of integration with other public bodies in the rural environment, inadequate contact with NGOs and private enterprise
- Excessive administrative and technical decentralisation, and insufficient delegation of responsibilities
- Lack of funds (working credits), equipment and suitably trained personnel at all levels, especially in out posted services: the modest resources allocated, in comparison with the enormous amount of work to be done, lead to discouragement

Since 1995, the Wildlife Administration joined the new established Ministry of Environment and Tourism. The Wildlife Administration offices in southern Sudan were separated in 1972 following the establishment of the Regional government of southern Sudan.

*Scenario 1:*

Enhanced awareness of the benefits & values of forest services and wildlife would gain a more positive future. Co-operation will be an important part of future decision processes. Co-operation is needed in areas such as watershed management, capacity building, technological development etc.

It is clear that commitment to research and development will be essential, if the sector is faced to meet the emerging challenges and opportunities.

*Scenario 2:*

The Government is not able to provide all necessary funds for development and actual expenditures were far less than original plans. The FNC, pasture & range and the Wildlife Administration lack funds to conduct its role in a satisfactory way or even for practising any conservation measures. The forestry and Wildlife Units in the States lack facilities such as transportation and equipment for expecting any management and law enforcement programs. Affiliations to different Ministries would continue conflicts of interests and non-integrated Natural Resource Polices.

### 3.5.2 New roles for private sector & local communities in forest management

The Forests Act of 1989 is a benchmark in the development of forest resources in the Sudan. For the first time, the Act recognised the right of ownership of forests by the private sector and local communities. Since the Act came into force, the roles of the private sector and local communities in forest management have increased.

The involvement of local communities in natural resource management has been traditionally practised in the Sudan. The FNC has recognised the importance of involving local people in forestry activities and in a number of reserved forests management plans are designed with the active participation of local people. It is expected that this trend will gradually be a common practice in most of the reserved forests.

The Sudanese Constitution (1998) states that the conservation and protection of environment is both a right and responsibility of the people. This is particularly relevant to the prevailing political scene in the country as regards the redistribution of powers and revenues being affected under the newly established federal system. Management of natural resources, especially forest, is expected to be the responsibility of local governments at state level and thus local communities will have a greater role in planting, protecting and managing their own forests.

Using *scenario 1*:

It is envisaged that the current trends in Sudan economy, elucidated in chapter 2 of this outlook paper, and the given anticipated shift from reliance on biomass for energy to LPG, that the private sector will be more involved in forest management for other purposes

As regards *scenario 2*:

The civil war will countries to bleed the economy leading to cleaning investment opportunities. The determining involvement of local people and the civil socially at large is the extent of democracy, freedom of association and delegation of powers to local governments.

### 3.5.3 New arrangements in forestry education and research

For education and training although faculties and specialised schools now train growing numbers of university-level managers, the number of intermediate-level staff (technicians) and field staff (skilled workers) is far from meeting the needs. As it is, there are not enough to ensure traditional forestry tasks and this problem increases as new tasks are entrusted to these workers and increased and improved contacts with local populations prove necessary for forest development Lastly. In order to implement fieldwork, growing numbers of skilled labourers are required so as to increase site effectiveness and productivity.

Applied research projects should be conducted to resolve problems of forest formation shrinkage, soil stabilisation ad water shed management. To save guard the endangered plant, tree and animal species, gene banks & seed banks should be developed. Thus research projects would focus on genetics, breeding, tissue culture...etc. The development in wood industry, necessities the research in certain wood varieties. Areas of Research to be considered: -

- Statistic of NWFPs (mechanical, aromatic, ...)
- Inventory & monitoring guidelines
- Indicators and measures of productive functions of forests
- Energy alternative sources
- Socio-economic impacts or forest products utilisation
- Petroleum Industry and its effect on fire wood consumption
- Potentialities of Eco-tourism and recreations in forest parks

## 4. THE CHANGE FACILITATION

### 4.1 FACTORS THAT ARE CRITICAL FOR IMPROVEMENT OF THE SITUATION

Population increases in Sudan far exceed development rates, and there is erosion of the environmental capital (the natural resource base), which is subjected to malpractice and misuse.

The Civil war in Southern Sudan is the main obstacle, which is hindering development efforts. The war is draining all the country resources and is having serious impact on the country's economy. Also the war is stopping any development of the forests of southern Sudan-which are the major forest resources of the country-and intensifying utilisation in the already depleted forest resources of northern Sudan. Although there is strong will and drive within the country for peace.

Resources availed for the forest developments are very limited. Also there are serious administrative problems emerging from the establishment of Federal system of government and establishment of 26 States. Division of responsibilities and benefits regarding forest resources is a source of disputes and the issue is not resolved.

The problem of investment in forestry sector:

- Forestry is seldom presented as an option which is equally or more attractive than competing claims for funds. The exclusion of many non marketed and non timber forest benefits in presenting forestry is considered a problem in selling the sector worth
- In general, forestry is not “marketed” adequately or presented convincingly enough to politicians or to wider constituencies in ways, which meet their concerns and priorities so as to gain their support
- Limited efforts to attract investment by all interest groups, especially the commercial private sector
- Inadequate national political will and commitment to forestry
- Low budget ceilings for forestry, often worsened under rigidly enforced structural adjustment programmes that lead to across-the-board cut backs of government budgets

#### 4.2 CHANGES REQUIRED WITHIN AND OUTSIDE THE FORESTRY SECTOR

**A.** The Sudan is embarked into several positive conservation actions a few are listed as follows:

- The National Comprehensive Strategy 1992-2002
- The establishment of the Higher Council for Environment and Natural Resources and the Ministry of Environment and Tourism in 1992 and 1994 respectively
- The Development of directives for Sudan action plan to combat desertification 1999
- The development of Sudan Country Report and Strategy to conserve biodiversity 2000
- The development of Sudan Water principles
- The passage of the environmental laws 2000
- The development of Sudan directives for climate change
- The development of a document on Sudan Agricultural Strategy
- The development of a document on Sudan environment action plan 1998

The above efforts are considered positive environmental achievements. However they could be criticised as being fragmented based on sectoral basis and lack the comprehensive integrated approach.

**B.** The Sudan is embarked now in effort towards the second national comprehensive strategy 2002-2027. Such efforts should include popular participation and should be based on good data and solid information and database. A national landuse map should be developed to guide development efforts in the country.

**C.** Cross-boundary issues in forest development and management should be addressed. Upper Atbara River is a priority to be considered in collaboration with Ethiopia. Another priority to be considered is Gash, and Barrka and Toker where intensive water shed rehabilitation programmes should be established.

**D.** There is a need for strategy planning to guide land use, natural resources management with emphasis on afforestation efforts. There is sharp decline of forest in the country and a growing

gap between supply and demand. The policies should address the need to develop a multiple use integrated action plan for natural resources. The private sector and all stockholders should be invited to participate.

**E.** Large-scale and sustainable forestry action cannot be formulated without adequate institutional support. The institutions and the mechanisms they use to organise and guide forestry activities are an essential prerequisite to success for any forest action programme.

Forest policy depends on a country's general policy, its economic policy in particular. Policy development and decision-making are subject to two important factors.

- The coexistence of two economies. One based on markets and commercial trade, the other a subsistence economy based on gathering and household consumption, found especially in wooded areas. It is extremely difficult to reconcile both with a view to rational management of forest resources
- The artificially low (or non-existent) prices for natural resources such as water, soil, energy from wood fuels, means that these resources are considered free and thus abused
- The forest policy has to be determined with a trend of gathering the economic and political requests of various interest groups, including representatives of rural populations

A national plan for the forestry sector should be prepared using the best data that are available. As more information is collected, and as the reliability of existing figures is improved, so the plan can be improved.

State level forestry development plans should be prepared in view of the introduction of the federal system and of the need to devolve responsibility to staff based in the States.

All forest should be placed under management plans as soon as possible. It is recognised that data may be lacking and that because of the need to give priority to the reservation programme it may not be possible to collect all of the information required on which to base detailed prescriptions. Nevertheless short-term plans should be prepared, the essential features of, which should be integration of all land users and the function of the records associated with plan to be repository for information and experience.

**F.** Four main areas related to people/forest relationships warrant special attention. The first is to assist local forest-dwelling communities to increase the range of livelihood-supporting options. The second related to mainstreaming collaborative forest management between governments and local communities living near forests. The third is to make tree planting on farmlands more financially attractive. Agroforestry and tree planting have too often been subsistence focused. The final is to promote production forestry for low-income urban centres or to make existing forestry activities more responsive to needs of urban areas with many poor people. The main issues relate to ensuring high productivity to compensate for high land costs near cities and identifying and strengthening institutions responsible for urban forestry.

**G.** The factors that are critical for industrial wood products include:

- The current demand for industrial wood in the Sudan, combined with demands for fuel wood, NWFPs and forest services are placing severe pressures on the country's forests. This demand will increase throughout the foreseeable future.
- The key determinants of the demand placed on forest industry products include economic performance, population growth, and trend toward urbanisation and

technological advancement. This list will not be complete without adding the price competitiveness of goods and consumer preferences for forest products compared to non-forest products.

- Any measures taken to promote the replacement of LPG for fuel wood will probably have clear effects in the urban and semi-urban areas. This will lead to reduction in the consumption of charcoal that will result in releasing the pressure on vast areas of the savannah forests. Consequently, considerable amounts of wood material can be saved or used to supply other wood industries.
- The species occurring in the semi-desert and the dry savannah of the central and northern Sudan are not suitable as raw material for the production of plywood, or veneer on account of their technological properties, their stem form and their total yield.
- The scarcities of large-diameter logs suitable for cost-competitive sawing will encourage a shift toward reconstituted wood panels and other engineered products. A limited supply of large peeler logs (for veneer production) may reduce the chances of establishing a successful plywood industry.

**H.** The biggest challenge related to the provision of services of forests will be to achieve public awareness and acceptance that services are as important as timber benefits and that they can be economically realised. This may require convincing the middle class that ignoring ecological services of forests will cause enormous downstream costs that will directly affect them in negative ways. And to create self-sustaining “markets” for services or ways for beneficiaries to costs of sustaining forests for non-commercial services functions.

Accordingly, an influential factor will be developing further valuation methods for pricing externalities and for identifying beneficiaries. If policy-makers can be influenced by such methods, it will be possible to secure more support for maintaining and investing in the diversity of services of forests.

**I.** The main policy challenge for wood energy development in Sudan is to promote technically viable, economically efficient and environmentally sustainable wood fuel use and to cater for the substitutes. The broad policy areas that need to be addressed include improving information related to wood energy, improving the functioning of markets, development wood-energy strategies, and strengthening wood-energy planning capabilities. Related to the main policy areas, the major challenges to wood energy development are:

- Social: the challenge is primarily due to the low socio-economic status of the majority of traditional fuel users. Low socio-economic status means they and their problems are easily marginalized.
- Economic: the main challenge is to ensure the financial feasibility of large-scale dedicated wood-energy supplies, particularly on public lands (forest and community lands) where a majority of the poor collect their wood fuel.
- Technological: this challenge is primarily associated with the costs of technological adoption. Technology transfer is expensive.
- Institutional: government policies for bio-energy development and the role of the private sector are not clear.
- Legislative: existing policies and legislation in the forestry, agriculture and energy sectors are not geared to promote wood-energy development and may often not be conducive to its planned development. For example, issues related to land ownership and tree tenure are especially important in wood-energy development.

**J.** The main challenges that are likely to face NWFPs development (excluding gum Arabic as it has sufficient attention) in the future include the following as key elements:

- Policy and institutional issues
- Absence of investment in research and development: efforts are also handicapped by lack of focused agenda; there are too many NWFPs for all to be supported
- Resource issues
- Deficient management practices: due to the small-scale of operations, management systems and practices have not been adequately developed for many products
- Technical and management issues
- Absence of inventory information: without such information, sound management decisions are difficult to make

**K.** Reservation of Unique Forests and Habitats:

The vegetation of Sudan Forest is not adequately explored adequately documented. Some of the species have a wide range of distribution and there is a great need for collaborative efforts at National, Regional and International levels for exploration, herbaria and establishment of arboreta at National and State levels.

Some Forest Formations are unique in the Sudan e.g. relics of Rain Forests termed “Bowl Forests” in Equatoria. Also the Mangrove Forests along the Red Sea Coast and other unique Forests on Mountains and Hills. These areas are suggested to be reserved.

Realising the Potential of Forests:

Collaborative efforts are needed for multi-purpose utilisation of Forests and methods for management of these resources natural or man-made need to be evolved.

Protection of Forest Reserves and Habitats:

Protection from fires and diseases, illicit cutting and dereservation need to be intensified. Also protection of villages, installations and water sources need to be intensified specially through popular participation.

#### 4.3 ROLES AND RESPONSIBILITIES OF VARIOUS AGENCIES (GOVERNMENTS, PRIVATE SECTOR, NGOs, CIVIL SOCIETY, DONOR AGENCIES, ETC.)

The newly adopted federal system has created 26 States in the Sudan. The issues of decentralisation and equitable division of power and resources are the emerging issues in the context of governance. The role of the central government is seen as one of strategic planning, policy directives and creation of an enabling environment for the state and local governments to manage natural resources at the local level. Other role of the central government is to strengthen synergies between the (Rio) conventions as regards the development of the forestry sector.

The civil society at large and particularly the NGOs have a key role in information and awareness raising, lobbying and advocacy and empowerment of local communities through training and capacity building of the CBOs. This could be achieved through help from donor agencies and the involvement of the relevant governmental institutions. The NGOs have played an important role in protecting the forestry sector from transgressions at various levels of governance (central, state and local).

International Assistance and co-operation required:

The forestry Programmes in the past few decades in response to environmental deterioration and droughts were geared towards the rehabilitation of degraded farmland, desertification control in agricultural production areas and restocking of productive forest estates. Greater emphasis was laid on the role of rural communities in reforestation, conservation and management. The international assistance and co-operation was of great help in the achievement of most of the envisaged targets with most remarkable results.

The forestry and environmental rehabilitation programmes would continue in the same patterns with the prime objective of reducing the forest cover depletion trends towards positive increase in forested areas through wider involvement of the rural communities in integrated rural development programmes.

International assistance and co-operation would continue to be needed specially so in the following areas:

A. Capacity Building:

- Enhancement of the institutional capabilities in monitoring and evaluation of the dynamics of environmental changes in status of the resource with inputs in the form of hardware and software with the necessary training and expertise
- Technical and financial support for the intervention activities in conservation, management and rehabilitation of degraded and fragile ecosystems
- Exchange of information, materials and expertise between the countries in the sub region including exchange of visits between the rural beneficiaries.

B/ Participation of the Rural Communities:

- Pilot projects for intervention by the rural communities to alleviate pressures on the forest resources for the satisfaction of energy requirements and housing development.
- Promotion of the rural communities abilities in forest resource management and biodiversity conservation through the development of rural and cottage industries and handicraft dependant on wood and non-wood forest products.