

## *Annexes*

### *Readiness Preparation Proposal (R-PP)*

*for Country: SUDAN*

*Date of submission or revision: 9 June 2014*

Version 6 Working Draft April 20, 2012



Forest Carbon Partnership Facility (FCPF)

## The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD)

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- 1) FCPF REDD-plus Country Participants submitting revised or new R-PPs to the FCPF FMT for PC 12 meeting in Colombia, June 27 – 29, 2012 or afterwards.
- 2) UN-REDD countries submitting National Programmes, as agreed.

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### Annex 1a.1. Sudan's Involvement in the Post-Rio Arrangements

Sudan signed, ratified, parted and entered into almost all contemporary international conventions & agreements (ICA) concerned with forestry and the environment at large together with their instruments and initiatives emanating from them. The most salient of such ICA include: The Convention on Biological Diversity (CBD), The United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol (KP), Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), The Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar), World Heritage Convention and The Nile Basin Initiative (NBI).

#### *UNFCCC*

Global interest in climate change led to the establishment of the UNFCCC at the 1992 UN Conference on Environment & Development in Rio de Janeiro. It is now widely recognized that Climate Change (CC) is one of the major global problems posing challenges to sustainable livelihoods and economic development, particularly for Least Developed Countries (LDCs). The adverse impacts of CC on economic activities, environment, food security, human health, human settlements, natural resources and physical infrastructure are already noticeable in many countries.

#### *Emissions from Forests & Woodlands in UNFCCC:*

The UNFCCC is not specifically concerned with forests as such, but is more concerned with natural ecosystems. It acknowledges the role and importance of terrestrial ecosystems as sources and sinks as well as the reservoirs of greenhouse gases (GHG). A forest ecosystem is perceived as an immense carbon sink (CS). Thus, the close relationship between climate and forests is recognized. It also acknowledges that human activities have been substantially increasing the atmospheric concentrations of GHG. The ultimate objective is to achieve stabilization of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human) interference with the climate system. This objective is to be achieved within a time frame that allows ecosystems to adapt naturally to CC, ensures that food production is not threatened, and enables economic development to proceed in a sustainable manner. Under the UNFCCC, forests are addressed both as emission sources and as CSs.

The Convention's **Article 3** states that policies and measures to CC should "be comprehensive, cover all relevant sources, sinks and reservoirs of GHG ... and comprise all economic sectors." **Article 4.1** calls on all parties to develop and update inventories of GHG emissions and removals; formulate programmes and make efforts to address emissions by sources and removals by sinks; promote technologies that lead to lower GHG emissions in forestry; promote the sustainable management of sinks and reservoirs; and prepare to adapt to the impacts of CC and develop appropriate plans for areas that might be affected by flooding, drought or desertification. Under the UNFCCC, all countries are expected to include their emissions and removals from land use change and forestry in national inventories.

#### *Adaptation and Mitigation:*

There are a number of global and national efforts to address the problem of CC through adaptation and mitigation activities. Forests can and do play an important role in CC mitigation.

So far, international debate has focused particularly on reducing emissions from deforestation and forest degradation in tropical developing countries but, in the presence of sustainable forest management (SFM), all forests can help mitigate CC through measures such as reducing deforestation and forest degradation, forest conservation, forest restoration, afforestation, wood-based bio-energy production, and the use of sustainably produced wood products as substitutes for emissions intensive materials.

Adaptive capacity is the ability of a system to adjust to CC, to moderate potential damage, to take advantage of opportunities, or to cope with the consequences. Under some CC scenarios, current levels of adaptive capacity will be insufficient to prevent significant negative impacts on biodiversity and the many goods and services that forests provide.

In many circumstances, adaptation and mitigation objectives are interlinked and compatible, and policy approaches to address them can be mutually supportive.

The cost of adaptation and the magnitude of its benefits are increasingly relevant issues, from both a national perspective and in a global context. It will be important to distinguish between mainstreaming adaptation into forest management (i.e. helping forest ecosystems adjust to the direct impacts of CC) and mainstreaming forests into adaptation planning (i.e. to ensure that the role of forests in buffering the impacts of CC on other sectors such as agriculture, energy, etc, are appreciated and accounted for).

#### *Adaptation as a development issue:*

Many forest-dependent communities are highly vulnerable to the effects of CC and will require financial and technical assistance in order to adapt. Adaptation should be treated as part of national development, even if it is sometimes seen as an additional cost and even if it adds complexity to the delivery of other development goals. In many cases, adaptation will have the same target outcomes as development—such as sustaining or improving social, health, security, and economic wellbeing. Basic development is critical for building adaptive capacity, but CC will make it more costly and difficult to deliver and to sustain the Millennium Development Goals (MDGs) beyond 2015.

SFM provides a suitable framework for the development of the forest sector's capacity for CC adaptation. SFM also serves as a vehicle for sustainable development by promoting the maintenance and improvement of environmental quality, social justice, and economic wellbeing.

To ensure that SFM responds to the changing environment, processes are needed for the continuous collection and analysis of information and to enable adaptive management, including the effective participation of stakeholders. Forest policymakers, administrators, managers, dwellers and neighbours need to be well informed about changes to the forest environment.

#### *Adaptation of forest ecosystems:*

Implicit in SFM is an adaptive approach, which will help ensure that forest management changes in the light of changing conditions. Various measures aimed at assisting forests to adapt to CC, especially in the tropics, have been proposed. They include facilitating the

adaptive capacity of tree species, mainly by maximizing genetic variation; silvicultural and management approaches such as minimizing slash, reduced impact logging and widening buffer strips and firebreaks; and institutional and policy measures such as increasing awareness, improving fire management, seed exchange and participatory genetic improvement programmes

for smallholders, mainstreaming adaptation into national development plans, and establishing financial mechanisms to help implement adaptation measures. Such measures should constitute an integral part of forest-sector strategies to adapt to CC in both natural and planted forests.

*Local community measures that include traditional knowledge and practices:*

A number of studies have shown that communities, particularly at the local level, have historically developed coping strategies to adverse climatic conditions and are currently making efforts to adjust to observed environmental changes. Trees and forest products have always been part of their coping strategies e.g. in agroforestry systems and use of various Non-wood Forest Products (NWFPs), particularly during drought. However, and despite the intimate understanding of the forests by these local communities, the unprecedented rates of CC are expected to jeopardize their ability to adapt to present and future changed conditions.

**Planned adaptation is the result of a deliberate policy decision**, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain or achieve a desired state. Planning adaptation is essential in order to realize the full potential of forests and trees in sustainable development, both to meet the immediate and future needs of increasing populations and to provide the continuity of the natural resource base. Achievement of this goal requires a comprehensive approach in which a wide range of contributions of forest resources to society is fully appreciated and supported. Planned adaptation measures in forestry, more than any other sector, ought to be considered holistically and in coordination with other sectors. It is equally important to create synergies with interventions aiming at controlling desertification, land degradation and conserving biodiversity, among others. The synergy between adaptation to CC and biodiversity conservation requires a unifying strategy in order to enhance the sustainability of the forest resource pools on which poor communities directly depend for their livelihoods. Therefore, ecosystem-based adaptation, which integrates biodiversity and provision of ecosystem services into an overall CC adaptation strategy, can be cost-effective, generate social, economic and cultural co-benefits, and can help maintain resilient ecosystems.

Use of indigenous knowledge and local coping strategies should be promoted as a starting point for planning adaptation. Some of the barriers for dealing with forest adaptation include limited economic resources and infrastructure, low levels of technology, poor access to information and knowledge, inefficient institutions, and limited empowerment and access to resources. The range of measures that can be used to adapt to CC is diverse and includes changes in behaviour, structural changes, policy based responses, technological responses or managerial responses.

*Other essential functions and benefits of forests:*

Implementing measures for CC mitigation and adaptation are expected to not only to reduce harmful GHG emissions and enhance forest resilience but also to provide a range of other benefits—sometimes called co-benefits. These include biodiversity conservation, benefits for the hydrological cycle, soil stabilization, the maintenance of a wide range of livelihood options, and meeting recreational and spiritual needs. Optimizing such benefits requires strong engagement between the conservation and development communities, CC policymakers, governments, forest-dependent people, and other stakeholders.

Maintaining the adaptive capacity of forest ecosystems to environmental change is essential for maintaining their biological diversity and other ecosystem services and might require basic changes in forest management.

Equally important is the adaptation —or reinventing—of forest institutions to enable them to respond effectively to the new challenges and emerging issues and in that way to better serve the needs of society.

Options for improving essential forest co-benefits include influencing the international policy framework regarding the valuation of non-carbon benefits, and the provision of supplementary funds to implement REDD measures in areas of high conservation priority.

While it is important not to raise unrealistic expectations, CC mitigation offers an historic opportunity to reduce deforestation and at the same time maintain the other interdependent economic, environmental and social values of forests. Mitigation and adaptation are equally important, especially given the potential for CC to reduce the mitigation ability of forests, and should proceed simultaneously. Mitigation will succeed only if appropriate adaptation measures are in place.

Even the most aggressive climate stabilization targets under discussion imply an inevitable global average temperature rise of 1–3°C. This will lead both to more frequent and severe climate-related disturbances such as droughts, floods and storms and to longer-term stresses such as changed rainfall patterns, ecosystem degradation, reduced biodiversity, and higher sea levels. These changes will affect poorer countries disproportionately: not only are such countries typically more reliant on climate-sensitive industries such as agriculture and forestry, but poverty, poor health and limited capacity and resources also increasing their vulnerability. Policy approaches to adaptation should therefore particularly address the needs of vulnerable people.

#### *The National Adaptation Plans of Action (NAPAs):*

NAPAs are provided for through Article 4 of the UNFCCC which requires Non-Annex 1 Parties to formulate national and regional programmes to facilitate measures for adequate adaptation to CC. In many countries, adaptation strategies were developed either from the NAPAs or were related to other individual government efforts in undertaking activities to cope with the effects of CC.

#### *Adaptation Measures and Policies:*

Contemporary forest management and forest policies often serve multiple purposes and can incorporate measures to adapt to CC, even if they are not primarily designed to do so. In many situations measures to tackle habitat destruction, forest fragmentation and forest degradation are compatible with efforts to adapt to CC and to mitigate GHG emissions in the forest sector.

Local forest knowledge and traditional forest management practices have developed over a long time frame that encompasses considerable climatic variations. This knowledge can therefore have considerable value in contemporary CC adaptation, particularly when applied to forest rehabilitation, restoration and the adaptive management of forests. However, while local and indigenous knowledge has been shown to be dynamic, its capacity to adapt quickly enough to the more dramatic CC impacts cannot be assumed, especially in many parts of the world where it is already withering for a number of reasons. The recognition and preservation of traditional forest-related knowledge and its translation into the language of formal forest science are important steps towards adaptation and application of traditional forest-related knowledge to new or changing environmental, social and economic contexts.

To date, forest-sector responses to CC have mostly been reactive. Forest policy programmes and instruments can support forest owners and forest managers to take the actions necessary to ensure SFM under changed climatic conditions. National Communications (NCs) and NAPAs produced for the UNFCCC provide an overview of existing regulatory, economic and informational policy measures for adaptation. Overall, existing policies reflect the differing environmental and socio-economic priorities and circumstances of countries.

Most forest policies advocate SFM as a mechanism for CC adaptation, and it is commonly promoted through national forest laws. Most NCs and NAPAs, however, rely on a generalized concept of SFM and do not identify the specific changes that need to be incorporated into management strategies and policies. Existing policies also tend to be reactive to observed events rather than proactive.

#### *Management for Adaptation:*

Adaptation measures are needed to ensure that the ecosystem services provided by forests are maintained under future climates.

The choice of adaptation measures will be determined not only by the likely changes occurring in a forest, but also by the management objectives for the forest. The measures chosen for any given forest will depend on the local situation and the expected nature of future CC. A critical aspect of any adaptation framework will be to ensure that local managers have sufficient flexibility to choose the most appropriate suite of management measures for their conditions.

Forest management actions taken to adapt to CC can be consistent with SFM. The latter is a continuously evolving concept designed to ensure that forests continue to provide a range of ecosystem services.

Forests are social-ecological systems that involve both nature and society. SFM, therefore, serves both forest ecosystems and the people and societies that benefit from the provision of forest ecosystem services. The current failure to fully implement SFM is likely to limit the ability of forests to adapt to CC.

#### *Governance and Policies for Adaptation:*

Traditional forms of forest governance that focus on hierarchical, top-down policy formulation and implementation by the nation state and the use of regulatory policy instruments are insufficiently flexible to meet the challenges posed by CC. Moreover, policies in other sectors, especially agriculture, transportation and resource development, will continue to have significant impacts on forests, requiring improved inter-sectoral coordination that is difficult to achieve through top-down policy-making.

The high level of uncertainty associated with the impacts of CC, the complexity of the problem, the need for better inter-sectoral coordination, and the wide range of new actors and interest groups who are expected to become involved in policy-making for CC adaptation all pose challenges for policy design. These challenges can be met by new and hybrid modes of governance that make greater use of policy networks and by adopting a flexible mix of policy instruments.

Network governance embraces the participation of multiple actors in policy formulation and implementation and turns the presence of a diversity of actors from a problem to a solution.



National Forest Programmes (nfp) are the core instruments of new forest governance arrangements at the national level: they can promote the adaptation of forests to CC by reinforcing the use of SFM as a mechanism for reducing deforestation and forest degradation.

The goal of adaptation to CC should be added to the existing economic, ecological and social goals of SFM. In this way, adaptation can be promoted without compromising the overarching commitment to sustainability that drives nfps.

Action at the international level presently consists of a number of programmes directed mainly at reducing deforestation and mitigating CC rather than at addressing the full range of CC adaptation issues and options. Better linkages between SFM and CC adaptation, and positive interactions between the international forest regimes (as represented by the United Nations Forum on Forests (UNFF), the CBD and the UNFCCC) should be facilitated.

Forest policies should not ignore adaptation in the many drivers of forest change that originates in other sectors: development in agriculture, energy conservation and even macroeconomic policies can have dramatic effects on the incentives to destroy or degrade forests. Improving inter-sectoral coordination would be a first step towards an effective, integrated approach to land use and land management.

SFM aims to contribute to sustainable development. The International Panel on Climate Change (IPCC) 4<sup>th</sup> Assessment Report concluded that sustainable development can reduce vulnerability to CC by increasing resilience and enhancing adaptive capacity (Yohe et al. 2007, Adger et al. 2007). SFM can thus play an important role in adaptation to CC, in particular where SFM is embedded in an array of sustainable land uses within a landscape and where it considers the different expectations, vulnerabilities and capacities of the different actors within that landscape.

While the influence of CC on forest ecosystems poses new questions about how SFM can be achieved, the principles and practice of SFM embodies many of the activities that will be required to respond to the effects of CC on forests (Ogden and Innes 2007, Spittlehouse and Stewart 2003). For example, social, environmental and economic objectives are intricately linked and therefore adaptation and SFM decision-making must consider these multiple objectives (Burton et al. 2002, Sayer and Campbell 2004).

If SFM is to play an important role in adaptation to CC, it will be necessary to develop, disseminate and apply a greater variety of management options, adaptable to different site conditions, considering the different thematic elements of SFM and backed-up by sound and coherent natural resource policy frameworks.

In addition, a broader inter-sectoral and participatory multi-stakeholder approach to forests and their management is needed to facilitate adaptation of the forest sector to changing conditions (Sabogal 2008), including those driven by CC. New forms of governance are among the main requirements to improve these enabling conditions for SFM.

### *Sudan & UNFCCC:*

The Republic of Sudan (RoS) was among the first countries to sign UNFCCC in September 1992 and is party to it since 1993. Sudan ratified KP on 16 February 2005. The Higher Council for Environment and Natural Resources (HCENR), the key governmental body responsible for policy making with regard to the provisions of the Convention has been designated as the National Focal Point to the UNFCCC.

To meet the requirements of the Convention, Sudan embarked on the implementation of a project on Capacity Building (CB) for the UNFCCC. The project aims at building Sudan's capacity to prepare its *first* NC Report, strengthen institutional networks, assess GHG in the country, train personnel in planning, evaluation and development of means and ways of CC mitigation measures, establish policy dialogue, assess vulnerable sectors and adaptation systems and evaluate CC mitigation measures, and incorporating the principle of sustainable development in the formulation of developmental plans. The project carried a number of activities: prepared informatics background of a NC and the emissions of GHG, and defined the options for emission reduction net and methods for different sources. The project conducted a national GHG inventory in 1998 and the *second* NC was finalized. It represents the first update to the initial national inventory submitted as part of Sudan's Initial National Communication in 2003. The forestry sector is represented by members from the Forest National Corporation (FNC) and forestry education institutes. In the *first NC* report, Sudan concluded that forest sector contributed by 75 % of the total national CO<sub>2</sub> content in the atmosphere, and in the *second* NC report, Land-use Change & Forest (LUCF) sector is responsible for most of the decrease in GHG emissions since 1995. Emissions have been reduced by almost 50% compared to 1995 levels, or almost 12% per year. This is a result of sharp reductions in forest and grassland conversion, coupled with the expansion in afforested areas and managed forested land. (SNC, 2012, HCENR. FNC members and financial institutions can assist with capacity building, and other natural resource management sectors should also be involved.

Sudan as one of LDC is not committed to a GHG emission reduction target. However, under the general commitments of the UNFCCC based on the principal and common but different responsibilities; together with specific national and regional development priorities, objectives and circumstances, all Non-Annex 1 Parties including the Sudan may provide information on programs containing measures to mitigate CC, and are encouraged to undertake a development path that limits growth of GHG emissions.

Sudan has the potential to participate in addressing the problem of CC through enhancing the role of forests in CC mitigation. The Country has a total of 67 Million hectares (ha) of forest, wood and rangelands out of which 12 million ha are reserved forests. Forests of Sudan are generally under pressure from encroachment, shifting cultivation, annual wild fires, illicit harvesting of wood fuel, poles and timber, and conversion to other competing land uses, such as agriculture, livestock grazing, settlements and industrial development.

Sudan is exerting efforts to address drivers of deforestation and forest degradation through adoption of legal frameworks and implementation of participatory forest management. In Sudan, the main sources of finance for forest management are currently: charges levied on the major forest products and services and state budget allocation to the forests administration, However, limited financial resources are at present compelling the country to identify innovative financing mechanisms to attract new sources of investment in forest management outside these traditional channels. The adoption and implementation of such initiatives as REDD+, therefore, provides an additional opportunity for Sudan to benefit from financial mechanisms that take cognizance of the increasing importance of SFM in reducing emissions and increasing storage of CO<sub>2</sub> to mitigate CC and its impacts.

The mitigation scenarios presented in the *second* NC report are all related to the forest resources. Special consideration is given to forestry because forests exist within a larger landscape and are vitally linked to other sectors and their sustainable development. Forests are also linked to all

components of the natural environment, which have been at a steady decline, and connected to the currently hot environmental issues. Forests provide most of the energy (about 70%) consumed in the country and a myriad of wood and NWFPs, protect natural rangelands and provide fodder & browse material to livestock and wildlife, protect the agricultural environment, human settlements and contribute to increased productivity & food security, and alleviation of poverty. Deforestation and forest degradation remain the major threats to the development of the forests sector in the Sudan and are mainly affected by the expansion of agriculture and increasing demand for wood fuel (firewood & charcoal). The decline of the resource and its consequences will be aggravated by the vagaries of CC and separation of South Sudan. Increasing forest area is in line with sustainable forest stewardship to achieve economic and environmental benefits, including positive impact on CC adaptation and mitigation.

Two mitigation scenarios are selected, namely, afforestation/reforestation & protection (management), afforestation/reforestation consisting of three options: Public and community tree planting (mainly rain-fed), and planting in irrigated agricultural areas (institutional forest estates). Public afforestation/reforestation is executed by the FNC, the official forests institution in the country, inside reserved and unreserved forest land. Afforestation/reforestation carried out by communities, which follow the same approaches of management as FNC (under technical supervision of FNC staff). The third option is in accordance with the Comprehensive National Strategy (CNS), which stipulates that 10% of rain-fed agricultural area and 5% of irrigated agricultural land should be planted by forest trees.

Protection (management) is a scenario based on the protection of a degraded forest reserve. Forest reservation in the Sudan is meant to facilitate forest protection and felling programs through management planning. Hence, harvesting operations are supposed to be restricted to forest reserves, where working plans are constructed and the potential of regeneration and reforestation is relatively higher than elsewhere. However, forest management inside forest reserves has been confined to patrolling and guarding, except for few forest reserves (about 1.0 %) that are put under working plans (Elsiddig *et al.* 2007). Due to this shortage of management planning and sustainable utilization in forest reserves, most of the natural forests are degraded and some of them have been converted to blank areas as they were heavily mined for wood pillage and/or subjected to pressure of rain-fed agricultural encroachment (Elsiddig and Abdelgadir 1998).

The selected scenarios and options were decided in consultation with policy makers and forest planners, and thoroughly discussed with high- and medium-level managers in the concerned institutions.

#### *Sudan NAPA:*

That was completed in a participatory manner in March 2007 to ensure that the perspectives of all stakeholders/actors are incorporated. NAPA was approved and commended by the Federal Council of Ministers with the goal of identifying priority sectors and actions that deliver their urgent and immediate needs in adaptation to CC impacts. The main instrument is the provision of financial means by the Global Environmental Facility (GEF) /United Nations Development Programme (UNDP) for projects proposed by the NAPA. The NAPA documents also present overviews of projected CC and associated adverse effects. The sectors considered include agriculture, water, health, land-use management and forestry.

It developed criteria for evaluation and priorities for implementation of adaptation initiatives and NAPA recommendations for CB, policy reforms and institutional integration.

For NAPAs to become really effective policy instruments and their preparation should be well integrated into the mainstream national development planning and decision-making.

### *REDD+ Initiative*

Forests play an important role in CC mitigation as sinks and sources of carbon dioxide (CO<sub>2</sub>). Forests act as CSs when their area or productivity increases, resulting in an increased uptake of CO<sub>2</sub> from the atmosphere. They absorb CO<sub>2</sub> and release oxygen into the atmosphere through the natural process of photosynthesis in which CO<sub>2</sub> is converted to carbon and stored in the woody tissue of the plant. It is because of this that some forms of forestry activities are used as valid means for atmospheric CO<sub>2</sub> reduction as they contribute significantly to CC mitigation. On the other hand, forest biomass acts as a source of carbon when burnt or when it decays. Also, when the soil is disturbed it releases CO<sub>2</sub> and other GHG into the atmosphere. The IPCC estimates that 18-20% of current global annual carbon emissions are the result of loss of tropical forests.

The importance of forests and woodlands to human life cannot be over-emphasized. They are crucial as a source of livelihoods and provide direct benefits like firewood, charcoal, poles, timber, and a wide array of NWFPs such as fruits, bush meat, bee-honey & wax and traditional/popular medicines together with fodder & browse material for livestock and wildlife. The forests and woodlands also furnish invaluable 'co-benefits' in the form of important and critical ecological values in ameliorating climate, providers of vital services such as conserving soils and water sources, harbouring rich biodiversity and important genetic resources and serving as habitats for wildlife, providing a wide range of cultural, spiritual and recreational benefits.

Although the role of forests in sequestering carbon and helping to mitigate CC was recognized in the KP, only afforestation and reforestation activities were accepted for inclusion in the Protocol's Clean Development Mechanism (CDM). Reducing emissions from deforestation, also known as avoided deforestation, was thus excluded as an emission reduction strategy - until its reintroduction into UNFCCC negotiations at 11<sup>th</sup> Conference of Parties (CoP 11) in Montreal in 2005.

It was at the CoP 13 of the UNFCCC that took place in December 2007 in Bali, that the Coalition of Rainforest Nations formally proposed that **Reducing Emissions from Deforestation & Forests Degradation (REDD)** be included in the official negotiation agenda for a post-2012 regime, whose key elements would be negotiated under the so-called Bali Road Map. The Bali Action Plan (BAP), on which the UNFCCC Parties agreed in December 2007, provides the road map for this new agreement.

At the CoP 15 held in Copenhagen, Denmark, in December 2009, the CoP noted consensus among some of the Parties with the Copenhagen Accord, which agreed "on the need to provide positive incentives to such actions through the immediate establishment of a mechanism, including REDD, to enable the mobilization of financial resources from developed countries" (UNFCCC, 2009a). During COP 16 which was held in Cancun, Mexico, during November 2010, the Cancun Agreement adopted REDD extended activities to include: **Reduction of Emissions from Deforestation; Reduction of Emissions from Forest Degradation; Conservation of forest carbon stocks; Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks (REDD+).**

The international community is already supporting developing country governments to move towards sustainable development. Forests and forest land need to be seen in this context so that they can contribute to national economies.

The specific policies and measures chosen by governments or project implementers to address deforestation and forest degradation will also have significant implications for the poor. Well-conceived, they can help increase local incomes and thereby address poverty. Poorly conceived, they can exacerbate it.

Under current proposals, REDD+ could become an additional basis for funding to help build technical and institutional capacities and to provide incentives to reduce deforestation

*Sudan's involvement in REDD+:*

This is reflected and culminated into Sudan's REDD+ Readiness Preparation Proposal (R-PP).

## Annex 1a.2. Genesis of Sudan REDD+ Programme



Ministry of Environment, Forests & Physical Planning

Forests National Corporation (FNC)

P.O. Box: 658

Khartoum (2), Sudan

## Genesis of Sudan REDD+ Process

2009

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### Abbreviations & Acronyms

CC	Climate Change
DIFD	Department of International Development
DG	Director General
FAO	Food & Agriculture organization of the United Nations
FNC	Forests National Corporation
GHGs	Green House Gases
HCENR	Higher Council for Environment & Natural Resources
REDD+	Reduction of Emissions from Deforestation; Reduction of Emissions from Forest Degradation, Conservation of Forest Carbon stocks; Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks
RoS	Republic of Sudan
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank

### Chapter one

#### REDD+ Initiative in Sudan

#### Concept Paper

From: Abdel Azim Mirghani Ibrahim  
DG Forests National Corporation

To: The Management Board,  
Forests National Corporation.

Date: 15.10.2009

The Republic of Sudan (RoS) was among the first countries to sign The United Nations Framework Convention on Climate Change (UNFCCC) in September 1992 and is party to it since 1993. Sudan ratified Kyoto Protocol on 16 February 2005. The Higher Council for Environment and Natural Resources (HCENR), the key governmental body responsible for policy making with regard to the provisions of the Convention has been designated as the National Focal Point to the UNFCCC.

RoS observed, participated in and closely followed the genesis of the REDD initiative starting with the global dialogue on the role of forests in sequestering carbon and helping to mitigate Climate Change impacts; the recognition by the Kyoto Protocol for such roles and inclusion of afforestation and reforestation activities in the Protocol's Clean Development Mechanism; the proposal by the Coalition of Rainforest Nations that Reducing Emissions from Deforestation & Forests Degradation (REDD) be included in the official negotiation agenda for a post-2012 regime under the Bali Road Map; the noting by CoP 15 for consensus among some of the Parties with the Copenhagen Accord, which agreed "on the need to provide positive incentives to such actions through the immediate establishment of a mechanism, including REDD, to enable the mobilization of financial resources from developed countries and the eventual adoption by the Cancun Agreement of the REDD extended activities to include: Reduction of Emissions from Deforestation; Reduction of Emissions from Forest Degradation, Conservation of Forest Carbon stocks; Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks (REDD+).

The rationale for RoS's intended involvement in REDD+ emanate from the country's particular circumstances and REDD+ potential. RoS, a Least Developed Country with substantial biodiversity & natural resources and not an emitter of significance of Green House Gases, is concerned about continuing deforestation & forest degradation. As such, a National REDD+ Programme, which estimates in-country emission sources and sinks for GHGs and helps to address underlying drivers, assumes significant importance. Likewise, envisaged multiple benefits under REDD+; financial, social & environmental, are of interest to Sudan. RoS had thus deemed REDD+ Initiative to have the potential to immensely benefit the country. The latter can reciprocate by sharing its wealth of accumulated acquired and traditional knowledge in Agro-forestry, Agro-silvo-pasture and mobilization of peoples' efforts in management of natural calamities and coping with events.

**The matter is posed for your kind consideration.**

## Chapter two

### Authorization for Sudan Involvement in REDD+

From: Secretary, Management Board,  
Forests National Corporation.

To: Director General,

Forests National Corporation.

Dated: 26.10.2009

With reference to your concept note of 15.10.2009 on REDD+ Initiative,

This is to inform you that the Council in its meeting on 25.10.2009 accepts the REDD+ Concept and hereby authorizes you to pursue the involvement of Sudan in the Initiative, tapping resources from all relevant regional and/or international organizations & development partners.

In so doing the Council directs that you follow the widest possible consultative and participatory processes.

Signed

Mohamed Babiker Abbato,  
Secretary,  
Management Board  
Forests National Corporation



بسم الله الرحمن الرحيم

الهيئة القومية للغابات

**مجلس إدارة الهيئة**

التاريخ/٢٠١٢/٢/١م

**السيد / مدير عام الهيئة القومية للغابات**

السلام عليكم ورحمة الله وبركاته

**الموضوع: مبادرة تقليل الانبعاث الناتج من تدهور الغابات**

إشارة لورقة المفهوم المقدمة من قبل سيادتكم حول مبادرة تقليل الانبعاث الناتج عن إزالة وتدهور الغابات يوجه مجلس الإدارة إدارة الهيئة القومية للغابات بالماضي قدما في دخول السودان في المبادرة علي أن تتبع الهيئة في ذلك النهج التشاركي والتشاورى الواسع وان تتحصل علي الدعم الفني والمالي من كل الجهات الراعية والداعمة للمبادرة .

وفقنا الله وإياكم



**بروفسير/ حسن عثمان عبد النور**

**بأمر اللجنة المفوضة المساعدة**

**لمجلس إدارة الهيئة القومية للغابات**

## **Chapter three**

### **Sudan National REDD+ Programme**

**1. Implementing Agency:** Forests National Corporation (FNC),

**2. Cooperating Partners:**

Higher Council of Environment and Natural Resources (HCENR);

United Nations Development Program (UNDP);

United Nations Environment Program (UNEP);

Food and Agriculture Organization of the United Nations (FAO),

The World Bank,

Bilateral Development Partners

In Response to Management Boards authorization for him to pursue the involvement of Forest & Range Sector of Sudan in REDD+ Initiative,

And, in accordance with the Management Board's directives,

The Director General of the Forests National Corporation went about to effect the involvement of Sudan Forest & Range Sector in REDD+:

1. Established a National REDD+ Unit.

1.1. The Unit is mandated to develop and process Sudan's Involvement in REDD+ Initiative,

1.2. The Unit is work closely with:

1.2.1. Higher Council of Environment and Natural Resources (HCENR);

1.2.2. United Nations Development Program (UNDP);

1.2.3. United Nations Environment Program (UNEP); and

1.2.4. Food and Agriculture Organization of the United Nations (FAO),

1.2.5. The World Bank,

1.2.6. Bilateral Development Partners.

1.3. The Unit is to adequately involve all resource custodians and stakeholders throughout the process.

## **Annex 1a.3. Composition and Terms of Reference Task Force I**

### **Terms of Reference Sudan REDD+ Task Force**

#### **1. International Consultant Dr. Patrick Van Laake**

##### **1. A. Objectives and responsibilities of International Consultant:**

Under Supervision of UNEP Office-Khartoum, The British Embassy Khartoum (DIFD) and Sudan National Forest Corporation (FNC), the consultant shall:

1. A.1. Provide support and advice to Sudan FNC at both Federal and State levels, on REDD+ readiness and related Forest/Climate Change and Carbon finance matters,

1. A.2. Work in close collaboration with the national team which includes a Senior National Partner (SNP), Officer from UNEP-Khartoum Office and local staff from FNC and Higher Council for Environment & Natural Resources (HCENR),

1. A.3. Support the preparation of the REDD+ readiness process in Sudan, notably in terms of forest status, institutions, policy context, stakeholders, on-going initiatives and issues.

The preparation for REDD+ readiness approach in Sudan would be conducted at two levels:

- A national REDD+ process that addresses the core REDD+ readiness elements;,,
- Degraded forest area, co-benefits and other areas

##### **1. B. The objectives of the consultancy are to:**

1. Prepare a REDD+ Readiness National Strategy plan for the Republic of Sudan, taking into consideration the national and state level, in order to submit to the UN-REDD Policy Board during 2012,

2. Provide capacity-building, technical and advisory support on REDD+ and Carbon finance, Free-Prior-Informed Consent (FPIC), benefit-sharing and safeguards, such as:

2.1. Development of the Forest Reference Level and Forest Emission Reference Level options against which performance can be measured,

2.2. Development of a Monitoring System for National Monitoring, Reporting and Verification (MRV),

2.3. Advice on filling gaps related to the finance for the National Strategic Plan.

##### **1. C. Conditions of the Assignment:**

1. C.1. This assignment is a thirty five days- consultancy. The consultant shall spend 20 days based home and 15 days in the Sudan (including 12 days in Khartoum and 3 days travel to different states),

1. C.2. The consultant will work under UNEP-Sudan Office supervision and facilitation;

1. C.3. The contract will be assigned/contracted by the British Embassy-Khartoum; accordingly the British Embassy will provide the consultant with a lump sum, including air ticket, consultancy rate for 35 days and DSA in Khartoum and other state, and

1. C.4. FNC shall provide full- support to the consultant particularly:

- Issue of an invitation letter to Sudan,
- Travel permit during his work in Sudan, and
- Provide a team of three technical staff (two from the FNC and one from the HCENR) in order to liaise with the consultancy team, through providing information and any supports as required..

#### 1. D. Requirements

The consultant is required to hold a minimum of Masters Degree in Forestry, Agriculture, Natural Sciences, Development-related subject.

He/s is required to experience of:

- At least 10 years of experience in project design and/or implementation,
- At least 5 years relevant experience in Forest REDD+, Carbon-related projects and/or environmental economics initiatives,
- Demonstrated proficiency on the REDD+ mechanism and its readiness components,
- Working experience in developing countries, preferably Sub-Saharan Africa, Horn of Africa and Sudan,
- Has strong track record of working with government, NGOs and local communities,
- Good interpersonal skills, including facilitation of stakeholder engagement,
- Budget composition skills and proposal-writing experience, and
- Fluent in spoken and written English.

#### 1. E. Activities and Time line

Activity	Expected date	No. of days
Drafting outlines and preparation concept paper	20-24 Feb.2012	5
Field work in Sudan: Conducting reviews and consultations and developing an action plan in Khartoum and other state (this to be determined jointly via FNC and Senior National Partner)	25 Feb.-11 Mar. 2012	14
Brain storming and workshops	Between 25 Feb.-11 Mar. 2012	1

Submitting the first draft	20 -23 Mar.	13
Submitting the report and Contingency days	27-28	2
<b>No of working days</b>		<b>35</b>

## **2. Senior National Partner: Prof Hassan Osman AbdelNour:**

### **2. A. Objectives and responsibilities of International Consultant:**

Under Supervision of UNEP Office-Khartoum, The British Embassy Khartoum (DIFD) and FNC, the Senior National Partner shall:

2. A.1. Work in close collaboration with International Consultant, Officer from UNEP-Khartoum Office and national team which includes local staff from FNC and HCENR,

2. A.2. Develop an outline on REDD+ Readiness National Strategy plan for Sudan, taking into consideration the national and state level, in order to assist FNC submit to the UN-REDD Policy Board during 2012;

2. A.3. Review the FNC analysis of the contribution of forestry to Sudan's economy and the economics of alternative energy;

2. A.4. Identify and analyse options for reform within the forestry and alternative energy sector that would enable Sudan to meet its household energy demands and reverse the current rate of deforestation;

2. A.5 Identify the implications of the economic analyses for the development of Sudan's REDD plus programme;

2. A.6. Provide additional advice to FNC with the formulation of REDD plus National Strategy plan for Sudan as required, and

2. A.7. In liaison with lead consultant, complete the consultancy report.

### **1. C. Conditions of the Assignment:**

1. C.1. This assignment is a thirty days- consultancy, including 21 days in Khartoum and 7 days travel to different states,

2. The consultant shall work under supervision of UNEP-Sudan Office, British Embassy Khartoum (for DIFD) and Sudan Forests National Cooperation (FNC),

3. The contract will be assigned by British Embassy Khartoum and accordingly British Embassy Khartoum will pay the consultant a lump sum of £ 11 106.15 including £ 479.00 DSA outside Khartoum.

4. FNC shall provide full- support to the Senior National Partner during his work and assistance to finalize the consultant task.

## 1. D. Requirements

The consultant is required to hold a minimum of Master's Degree in Forestry, Agriculture, Natural Sciences, Development-related subject.

He/She is required to experience of:

- At least 10 years of experience in project design and/or implementation,
- At least 5 years relevant experience in Forest REDD+, Carbon-related projects and/or environmental economics initiatives,
- Working experience in developing countries, preferably Sub-Saharan Africa, Horn of Africa and Sudan,
- Has strong track record of working with International Organizations, Government, NGOs and local communities,
- Good interpersonal skills, including facilitation of stakeholder engagement,
- Budget composition skills and proposal-writing experience, and
- Fluent in spoken and written English.

Project Objectives:

The Project Funded by FIDF (Supporting development of alternative energy in Sudan) will support GoS strategy on REDD+ capacities and plans. In August 2011, The GoS initiated the National framework for REDD+ and a series of activities including the Forestry Resource Assessment and Inventory, definition of potential REDD areas and, assessment of deforestation and degradation rates. This report will contribute to the understanding of the contribution of alternative energy vis-à-vis deforestation and degradation. These inputs will be used to develop REDD PLUS readiness national strategy plan guidelines which will be submitted, for review, to the UN REDD PLUS policy board in 2012.

This project will have benefits at two levels:

- In the immediate short term, the report provides technical information required in the development of the national REDD+ strategy;
- In the medium term, information from the report will inform the implementation of the REDD+ national strategy

### Longer Term Impact

The project is expected to contribute to a sustainable forestry sector. It will support the GOS efforts in accessing the various REDD funding facilities and fostering changes in public support policies that will promote changes in agricultural technologies that contribute to the forest conservation objective and in the harmonisation of forest-related policies that have a (in)direct impact on forest cover. In particular, the long term impacts of the project include:

1. The articulation of the contribution of forestry to Sudan's economy and economics of alternative energy identified ;
2. The articulation of reform options within forestry and alternative energy sector.

Method	Intervals	Carried out by	Beneficiary Involvement
Review of concepts and study plans;	Prior to start of study	UNEP/FNC/HCENR	Represented on team
Review of initial findings	At stakeholder workshop	Various stakeholders	Beneficiary to the organise workshop
Review of first draft	At production of first draft	UNEP/FNC/HCENR	Represented on team
Review of final draft	At production of final draft	UNEP/FNC/HCENR	Represented on team

#### **Annex 1a.4. Composition, Terms of Reference & Work Modalities of Sudan National REDD+ Programme Implementation Body**

##### **A. Sudan REDD National Steering Committee (SRNSC ):**

###### **1. Composition:**

The **SRNSC** is envisaged to be:

1.1. Chaired by Federal Minister in Charge of Forestry,

###### **1.2. Membership:**

1.2 1. Full Membership composed of Ministers in charge of Forests, Range & Wildlife in States, DG-FNC, and representatives of: HCENR, Private Sector entities involved in forest activities, NGOs, CSOs, Farmer Union, Pastoralists Union, Women Groups, GAPAs, Forest Neighbours/Dependent Communities and Forest Dependent Ethnic Groups.

1.2.2. Observers: Representatives of Advisory Group

1.3. Composition of **SNRSC** shall have fair, gender, ethnic, sectoral and geographic representation

###### **2. Terms of Reference:**

2.1. The main role of **SRNSC** is to:

2.1.1. Formulate policies for **REDD** plus Process in Sudan,

2.1.2. Approve Annual budget & Work-plan of **REDD** plus Process in Sudan,

2.1.3. Supervise implementation of planned activities of **REDD** plus in Sudan.

2.2. **SRNSC** is envisaged to meet twice a year to endorse annual budget & work plan,

2.3. **SRNSC** shall abide by National and International Accountability & Transparency Norms in all of its dealing & business as outlined in Box 1a.4.1.,

2.4. Full Members of **SRNSC** sit in it on complete parity: One member one vote.

##### **Box 1a.4.1. Transparency and Anti-corruption in Sudan R-PP Implementation**

Annual auditing at Federal and State level of the FNC budget by the Auditor General Bureau (AGB) is stipulated by national fiscal policy and law,  
Spontaneous auditing of daily expenditure is stipulated by law and is undertaken by internal auditors seconded by the Ministry of Finance & National Economy. An evolving system of document keeping & maintenance is in place. And is accessible to authorized national & other auditors,  
The involvement of, and active participation by local communities, CSOs, CBOs, NGOs and private sector, in forestry business is institutionalized and explicitly expressed in Forest Policy & Legislation.



Some CBOs such as GAPAs have been trained and encouraged to play a crucial role in policy formulation, project formulation & implementation, business administration, organizational management, financial management, M &E, microfinance and portfolio management.

**The gaps:**

1. Risk map development to indicate areas where forestry Governance in Sudan is most at risk from REDD+ related corruption and a monitoring tool which allows civil society to gauge the effectiveness of existing anti-corruption instruments,
2. Establishment of M&E system that allows for all stakeholders engagement and Sudan R-PP implementation manual to:
  - 2.1. Support the implementation of the R-PP activities as prioritized by stakeholders/custodians that address transparency through participatory approaches, strengthening the capacity of public, private and local communities' management, encouraging the right of access to information and ensure institutional coordination,
  - 2.2. Support all stakeholders/custodians in avoiding and fighting corruption and provides policy and institutional advice to support FNC and other public institutions in improving governance & transparency,
  - 2.3. Provides tools and data to help different partners to develop & deploy anticorruption measures,
  - 2.4. Ensure that REDD+ payments meet their set objectives by having forestry and natural resources related government institutions receptive to transparency initiatives, and a consortium of CBO, CSOs and GNOs capable of monitoring integrity in REDD+ mechanisms.,
  - 2.5. Improve transparency and accountability in REDD+ related financing and auditing conducted by private and public organizations

**B. Advisory Group:**

**1. Composition:**

The Advisory Group is envisaged to be composed of representatives of UN-REDD+ organizations on convening role & expertise of which the collaborative initiative was built: FAO, UNDP, UNEP & WB, Representatives of Donors & Development Partners and National & International Consultants on *Adhoc* basis.

**2. Terms of Reference & work modalities:**

**2.1. The main role of The Advisory Group is to:**

2.1.1. Advise SRNSC and Programme Manager on Technical & Financial Issues related to the implementation of Sudan National REDD+ Programme,

2.1.2. Coach, Facilitate REDD+ activities in Sudan and to coordinate cooperation between and solicit financial & technical support from UN and other agencies throughout Sudan's REDD+ Programme implementation.,

2.2. The Advisory Group is envisaged to have four scheduled meetings a year together with any number of *adhoc* meetings

### **C. Programme Manager**

C.1. The Programme Manager is the Chief Executive of the Sudan REDD+ Programme,

C.2. He/She should have the qualifications & expertise specified by the **SRNSC** on advice from the Advisory Group,

C.3. He/She shall be appointed through competitive bidding,

C.4. He/She shall be assisted by Communication & Administrative Officers and Secretary whose credentials are specified by the **SRNSC** .

## 1b. Information Sharing & Early Dialogue

### Annex 1b.1. List & Mandates of Stakeholders, Resource Custodians & Partners in Sudan REDD+

Potential Resource custodians, stakeholders groups & partners for REDD+ R-PP Implementation at three levels of Governance in Sudan

#	Entity & Subsidiaries	Designation/mandate
<b>I. Public Sector</b>		
<b>I. A. Federal Government</b>		
1	<b>Ministry of Agriculture &amp; Irrigation</b> 1.1. Agricultural Research Corporation 1.2. Extension & Technology Transfer  1.3. Plant Protection Authority  1.4. National Agricultural Schemes of Gezira, Rahad, New Halfa & Suki.	<b>Federal Line Ministry</b> 1.1. Federal Research Institution 1.2. Federal dissemination of approved crops/varieties & technologies 1.3. Federal Authority to control national and trans-boundary pests 1.4. Federal agricultural schemes with gross irrigable areas of 2.5 million ha. They are obliged by law to have 5% of the area under forests & tree formations.
2	<b>Ministry of Livestock, Fisheries &amp; Rangelands</b> 2.1. Range & Pasture General Directorate  2.2. Fisheries General Directorate.	<b>Federal Line Ministry</b>  2.1. Management of range & pasture resources  2.2. Management of fisheries resources
3	<b>Ministry of the Cabinet</b> 3.1. National Strategic Planning Council 3.2. Central Bureau of Statistics	<b>Federal Line Ministry</b>
4	<b>Ministry of Culture</b> 4.1. Public Information Media  4.2. Private information media	<b>Federal Line Ministry</b> 4.1. REDD+ Linkages encompass such media as National & State Radio & TV Channels 4.2. REDD+ Linkages encompass such media as private TV channels, Radio & Newspapers
5	<b>Ministry of Environment, Forests &amp; Physical Planning</b> 6.1. Forests National Corporation 6.2. Higher Council for Environment & Natural resources 6.3. National Meteorological Authority	<b>Federal Line Ministry</b>  6.1. Federal Para-statal Institution 6.2. Federal Coordinating Body  6.3. Federal Authority
6	<b>Ministry of Finance &amp; National Economy</b>	<b>Federal Line Ministry</b>

	6.1. International Cooperation, 6.2. Para-statal Corporations, 6.3. Procurement, 6.4. Internal Auditors,	
7	<b>Ministry of Foreign Affairs</b>	<b>Federal Line Ministry</b>
8	<b>Ministry of Haulage &amp; Transport</b>	<b>Federal Line Ministry</b>
9	<b>Ministry of Higher Education</b> 9.1. Universities of Khartoum, Sudan for Science & Technology, Gezira & Kordofan.  9.2. Private Universities: Ahfad University for Women, Future University and University of Science & Technology (Tagana)	<b>Federal Line Ministry</b> Federal Institutes of Higher Education, Research & Training. REDD+ Linkages encompass Faculties/Departments of Forestry, Range & Wildlife and Pharmacy together with specialized institutes such as Institute of Environmental Studies, Development Studies & research Institute and Desertification Studies Centre; all of UoK. 9.2. REDD+ Linkages encompass private universities with subsidiary institutes engaged in developmental & environmental studies such as Rural Development of Ahfad, Cousteau Chair of Future University and faculty of Pharmacy of Tagana
10	<b>Ministry of Human Resources Development &amp; Labour</b> 10.1. Sudanese Agricultural, Medical & Veterinary Councils	<b>Federal Line Ministry</b>  10.1. Federal Public Institutions for Promotion of Professions
11	<b>Ministry of Interior</b> 11.1. Wildlife Corps	<b>Federal Line Ministry</b> 11.1. Federal Authority for management of wildlife resources at large and special areas designated as National Parks, Reserves or Sanctuaries.
12	<b>Ministry of Justice</b>	<b>Federal Line Ministry</b>
13	<b>Ministry of Oil</b>	<b>Federal Line Ministry</b>
14	<b>Ministry of Science &amp; Technology</b> 13.1. National Centre for Research	<b>Federal Line Ministry</b> 13.1. Federal Research Institute. REDD+ linkages engulf such institutes as Medical & Aromatic Plants Research Institute and Bio-technology Research Institute researching & piloting with bio-oils from such plants as <i>Ricinus communis</i> and <i>Jatropha curacs</i> .
15	<b>Ministry of Social Care</b> 15.1. National Population Council	<b>Federal Line Ministry</b> 15.1.

16	<b>Ministry of Tourism, Antiquities &amp; Wildlife</b>	<b>Federal Line Ministry</b>
17	<b>Ministry Water Resources &amp; Electricity</b> 17.1. Electricity Generation. Transmission & Distribution Companies	<b>Federal Line Ministry</b>
18	<b>The National Council (Parliament)</b> 18.1. Auditor General Bureau	<b>Federal Legislature</b>
19	<b>The Presidency</b> 18. Investment Bureau	
<b>I. B. State Government</b>		
20	<b>State Legislatures</b>	
21	<b>State Ministries of Agriculture Animal Resources &amp; Forests</b>  14.1. Federal Forests Administrations  14.2. State Forests Administrations  14.3. Extension Services 14.4. Plant Protection Services  14.5. State Range Administrations	<b>Ministries for natural resources management @ State level in 17 States of the Country</b>  14.1. Federal Authority administratively affiliated to State Ministries, 14.2. State forest authorities technically affiliated to federal authorities. 14.3. State authorities 14.3. State authorities with special linkages to federal authorities 14.5. State authorities with special linkages to federal authorities
22	<b>State Ministries of Finance &amp; Trade</b>  15.1. In-land Revenue Administrations  15.2. Crop Auction Markets	<b>Ministries for Financial, Fiscal &amp; Trade matters @ State level in 17 States of the Country</b> 15.1. State authorities for financial, fiscal & taxation management, 15.2. State authorities for market management of agricultural crops & animal production
<b>I. C. Local Government</b>		
23	<b>Localities (Local governments)</b> 16.1. Local level agriculture, forests, range & extension offices	<b>Local level administrations</b> 16.1. Local or field level offices for day to day management of natural resources
<b>II. Private Sector Companies</b>		
24	<b>Multi-national and national corporate companies involved in agro-based businesses,</b> 17.1. DAL Group 17.2. Kennana Sugar Company 17.3. Public Sugar Companies 17.4. Private Gum processing & export companies 17.5. Telecommunications & Media	Corporate bodies involved in agro-based businesses and processing & export of NWFPs with substantial land holdings, subject to Forest Act provisions and part of their social corporate responsibility to allocate 5% of their land holdings to forests, woodlots & tree formations.  17.5. REDD+ linkages encompasses telecommunication companies, public media such

		as Radio & TV, together with daily newspapers & periodicals.
25	<b>Multi-national and national corporate companies involved in oil &amp; minerals businesses</b> 18.1. Greater Nile Oil Company	Corporate bodies involved in oil and/or minerals exploration/development, with substantial concessions/land holdings, subject to Forest Act provisions and part of their social corporate responsibility to observe outcomes of Environmental Impact Assessment (EIA) and Free Prior Informed Consent (FPIC).
<b>III. NGOs, CSOs</b>		
26	<b>Community Forests</b>	
27	<b>Sudanese Environment Conservation Society</b>	
28	<b>Homeopath-Herbal Medicine Groups</b>	
29	<b>Sudanese Forestry Society</b>	
30	<b>Sudanese Horticultural Society</b>	
31	<b>Sudanese Consumer Association</b>	
32	<b>Sudanese Farmers Union</b>	
33	<b>Sudanese Women Union</b>	
34	<b>Sudanese Gum Arabic Producer Associations</b>	
35	<b>Sudanese Native Administration</b>	
36	<b>Popular Committees for Desertification Control</b>	
37	<b>Sudanese Pastoralists Union</b>	
38	<b>Private forest/tree formation owners</b>	
39	<b>Religious Leaders</b>	
40	<b>Sudanese Social Forestry Society</b>	
41	<b>Women Groups</b>	
<b>IV. UN Organizations &amp; Development Partners</b>		
42	<b>FAO, IFAD, UNDP, UNEP, UNHCR, WB, WFP</b>	International Organizations involved in natural resources management
43	<b>AFD, DIFD, FINNIDA, USAID</b>	Developmental agencies of Bi-lateral Donor countries

## Annex 1b.2. Translation of REDD+ Terminology into Arabic Language

## Translations from English to Arabic

## C. REDD+ Initiative

## مبادرة رد

للغابات دور عظيم في التخفيف من تغيّر المناخ لكونها محابس و مصادر لثاني اوكسيد الكربون. فهي تقوم بدورها في حبس الكربون مع زيادة مساحتها او انتاجيتها مما يساعد في زيادة امتصاص ثاني اوكسيد الكربون من الغلاف الجوى. فهي تمتص ثاني اوكسيد الكربون و تطلق الأوكسجين في الجو في عملية التمثيل الضوئي التي تحوّل ثاني اوكسيد الكربون الى كربون و حبسه في الخشب. من اجل ذلك يستفاد من بعض المناشط الغابية كوسائل فعالة في تخفيض ثاني اوكسيد الكربون في الجو لمساهمتها الفاعلة في تخفيف آثار تغيّر المناخ.

من ناحية اخرى تعتبر الكتلة الحية للغابات مصدراً للكربون حين تحترق او تتحلل. كما ان نبش التربة يطلق ثاني اوكسيد الكربون وغيره من غازات الدفينة في الجو. يقدر المنتدى الدولي لتغيّر المناخ ان 18.2% من الإنبعاثات السنوية للكربون تنجم عن نقصان الغابات المدارية.

لا يمكن التقليل من اهمية الغابات في حياة الناس. فهي مورد هام للمعيشة بما تقدمه من فوائد مباشرة مثل حطب الوقود والأعمدة والأخشاب والعديد من المنتجات غير الخشبية من الثمار ولحوم الصيد والعسل والشمع والأدوية البلدية والعلف للأنعام والحياة البرية.

وللغابات ايضاً فوائد جمة بما تقدمه من خدمات بيئية عظيمة في تلطيف الجو وصيانة التربة والمياه واحتضان التنوع الأحيائي والرصيد الوراثي وموائل للحياة البرية والكثير من الفوائد الحضارية والروحية والترفيهية. وبالرغم من اعتراف بروتوكول كيوتو بدور الغابات في حبس الكربون وتخفيض تأثيرات تغيّر المناخ إلا أن بروتوكول آلية التنمية النظيفة لم يتقبل سوى مناشط التشجير. وبهذا فقد استبعد تخفيض الإنبعاثات الناجمة عن ازالة الغابات كإستراتيجية في تخفيض الإنبعاثات لحين قبله في مباحثات الإتفاقية الدولية لتغيّر المناخ في مؤتمر الأطراف الحادي عشر في مونتريال عام 2005 .

حدث في مؤتمر الأطراف الثامن عشر للإتفاقية الدولية الإطارية لتغيّر المناخ الذي انعقد في بالي في ديسمبر 2007 ان تقدم تحالف الدول التي تنعم بغابات مطيرة بإقتراح يدعو لتضمين تخفيض الإنبعاثات الناجمة عن ازالة وتدهور الغابات في اجندة المباحثات الرسمية لمرحلة ما بعد عام 2012 التي سوف تكون عناصرها الأساسية محور النقاش فيما يسمى خريطة طريق بالي. وقد تضمنت خطة بالي للعمل خريطة الطريق لهذه الإتفاقية التي حظيت بقبول اطراف الإتفاقية الدولية لتغيّر المناخ في ديسمبر 2007 .

في مؤتمر الأطراف الخامس عشر المنعقد في كوبنهاجن في ديسمبر 2009 حدث اجماع بين بعض الأطراف حول اتفاق كوبنهاجن الذي يدعو لتقديم حوافز ايجابية لمثل هذه الأعمال وذلك عن طريق الأتشاء الفوري لآلية بما في ذلك رد لحشد الموارد المالية من الدول المتقدمة. أقرّت اتفاقية كانكون مناشط رد لتشمل تخفيض الإنبعاثات الناجمة عن ازالة وتدهور الغابات وصيانة الغابات والإدارة المستدامة للغابات و زيادة مخزون الكربون في الغابات وذلك ضمن فعاليات مؤتمر

الأطراف السادس عشر المنعقد بكانكون بالمكسيك في نوفمبر 2010. ما فتئ المجتمع الدولي يدعم مسيرة الدول النامية نحو التنمية المستدامة. من هذا المنطلق لا بد من وضع الغابات وارضى الغابات فى الاعتبار لى تساهم نحو الإقتصاد القومى.

إن السياسات والإجراءات التى تتبعها الحكومات او المشاريع الراهنة التى تعالج مشكلة إزالة الغابات او تدهورها سوف تكون ذات اثر فعال على الفقراء. وبهذا ومع حسن التدبير سوف يزداد الدخل المحلى ومعالجة الفقر. اما سوء التدبير فسوف يفاقم المشكلة.

سوف يصبح رداً بمقترحاته الراهنة قاعدة إضافية للتمويل الذى يساعد فى بناء القدرات الفنية والمؤسسية وتوفير الحوافز التى تقلل من إزالة الغابات.

## Sudan National REDD+ Programme

### D. Rationale

#### برنامج السودان لرد+

##### تمهيد

السودان من البلاد الأقل نمواً يحوز على قدر وافى من التنوع الإحيائى والموارد الطبيعية. وقد وقّع واعتمد وشارك فى الإتفاقية الإطارية الدولية لتغير المناخ منذ عام 1993 . وقد شارك منذ ذلك الحين فى العديد من المبادرات المعنية بتخفيف آثار تغير المناخ والتكيف معها كما أعد إحصائيات قومية لغازات الدفيئة. ويبدى السودان اهتماماً بمسألة تواصل إزالة الغابات وتدهورها رغم إنه لا يبعث قدراً من غازات الدفيئة. ولهذا برزت اهمية البرنامج القومى رداً الذى يقوم بحصر المصادر المحلية للإنبعاثات ومحابس الغازات الدفيئة ومعالجة العناصر الفاعلة المسببة لها. ويتطلب ذلك تقديرات يعتمد عليها للتغيرات فى كثافة الكتلة الحية ومخزونات الكربون ومساحات ونوعية الغابات والمراعى المتأثرة بإزالة الغابات وتدهورها. وبالمثل يهتم السودان بفوائد رداً المادية والإجتماعية والبيئية.

عموماً لى يصبح رداً عملياً فمن الضرورى تحفيز استثمارات رداً لتكون ذات فعالية فى الحماية والادارة الرشيدة للغابات. هذا يتطلب التنسيق و الكثير من العلاقات المؤسسية والقطاعية لتحقيق الدعم والإنحياز من الجميع. هذه هى العناصر الأساسية المؤثرة فى تقييم القدرات المتاحة وتفعيل برامج رداً واعداد نظم رداً للإدارة والإستثمار.

## D.2. Sudan's Vested Interest & Advantages in REDD+



### إهتمام السودان برد+ وفوائده

لدى مبادرة رد+ المقدرة على إفادة السودان. يستطيع السودان ان يتشارك ويتبادل بما لديه من خبرات ومعارف موروثة فى الغابات الزراعية والرعية وحشد الطاقات الشعبية فى إدارة الموارد الطبيعية والكوارث والتعامل مع الأحداث.

#### Sudan National REDD+ Programme

##### E. Developmental & Specific Objectives of Sudan National REDD+ Programme

##### برنامج السودان القومى رد+

##### الأهداف المحددة والتنمية لبرنامج السودان القومى رد+

تتلخص الأهداف بعيدة المدى لبرنامج السودان القومى رد+ فى:

" حصر موارد البلاد الطبيعية المتجددة خاصة الغابات والموارد الرعية وموائل الحياة البرية والتعرف على حالتها الراهنة لوضعها لاحقاً تحت الإدارة المستدامة بهدف حمايتها من أجل مضاعفة فوائدها المباشرة وغير المباشرة بإسلوب يتوخى المشاركة والشفافية والعدالة ."

تشمل هذه الأهداف دون أن تكون قاصرة على ما يلى:

1 . حصر كمى وكفى لغابات البلاد والمجموعات الشجرية والأشجار خارج الغابات والموارد الرعية والعلفية وموائل الحياة البرية بما فى ذلك المنزعات القومية والمحميات والحيازات الخاصة.

1.1 . التحقق من شروط الحيازة والتسجيل والنزاعات

1.2 . التقييم الدقيق للحالة الراهنة خاصة فيما يخص الكثافة والتنوع والحالة الصحية والحيوية

1.3 . تقييم الأغراض المحددة بعناية وما تقدمه من خدمات والمنتجات الفعلية والمتوقعة ورفع مستويات المعيشة للجماعات المحلية والبلاد عامة

1.4 . تقييم اساليب إدارتها

2. مراجعة السياسات والنظم المؤسسية والتشريعات ذات العلاقة

2.1 . مراجعة وتعديل ونشر التشريعات ذات العلاقة وإجراء الإصلاحات المؤسسية التى تساعد فى تحقيق الأهداف المرجوة

### Annex 1b.3.1. Meetings, workshops and gatherings on REDD+

#	Title	Venue & Date	Topics	Participants
1	First REDD+ Workshop	FNC HQs August 2010	REDD+ Concept	<u>60 Participants:</u> 15 forest practitioners from various States, 15 representatives of indigenous people & forest dependent communities, 30 from related disciplines.
2	Second REDD+ workshop	FNC HQs March 2011	1.quick Assessment of Forest Resources, 2. Forest classification according to benefits & co-benefits	<u>75 Participants:</u> Forest practitioners & extension officers including 10 foresters from Workshop 1.
3	In-house Consultation	FNC HQs April 2011	Collect data on inventory, rate of degradation/deforestation, indigenous people & forest dependent communities	Groups from five Regions of Sudan: Eastern, Central, Darfur, Kordofan & Northern
4	4 <sup>th</sup> Gathering	FNC HQs September 2011	Fourth Training Workshop	Present & analyse and endorse data collected in previous in-house consultation
<b>Permanent Representation of Field officers in workshops/gatherings:</b> Ms. Hanadi Kamal edDeen (Northern), Mr. Mohamed Osman Abu Bakr (Northern); Ms. Taghreed Ali Siddig (Eastern); Ms. Muna Rakhi (Kordofan); Mr. Mustafa Yousif (Kordofan), Mr. Hassan El Amin (Kordofan); Mr. Fathi Ismail Omer (Central), Mr. Mohamed Abdel Rahim (Central), Mr. Mohamed Ahmed Magdoub (Central), Mr. Gamal Mohamed Ahmed (Central), Mr. Noah Mohemd Abdel Gadir (Central), Mr. Adil Kamal (Central); Mr. Adil Mohamed Ali (Petroleum exploration); Mrs. Somaya Omer Magdoub (Petroleum exploration); Mr. Abu Bakr Yousif (Darfur).				
	Consultation Workshop on Sudan REDD+	FNC, HQs March 7 <sup>th</sup> , 2012	Review of REDD Activities 2010-2011	
	First Workshop on R-PP	FNC, HQs March 19 <sup>th</sup> , 2012	Workshop organized by Sudanese Forestry Society on the Margin of FNC 19 <sup>th</sup> Annual Conference to familiarize Conference	<u>55 Participants:</u> Foresters, economists, environmentalists,

			<p>participants on REDD+ Process of Sudan. FNC</p> <p>1. Presentation by Dr. Sayeda A. Ahmed Khalil</p>	<p>Journalists &amp; Media People particularly reputable Radion broadcasters from Omderman national Radio and FM100.</p>
	<p>Progress Report/ Informal Back to Office Report</p>	<p>FNC, HQs July 7<sup>th</sup>, 2013</p>	<p>1. Presentation by H. O. AbdelNour of Informal Report on Participation of Sudan Delegation in UN-REDD 10<sup>th</sup> Policy Board and FCPF 15<sup>th</sup> Participants Committee, Lombok, Indonesia 26/6-3/7, 2013;</p> <p>2. Presentation by Dr, Nour Abdalla Siddig on progress to date on MRV</p>	<p>70 Participants:</p> <p>Foresters from all over the country attending a gathering on Gum Arabic Marketing together with 10 journalists &amp; media people particularly reputable Radion broadcasters from Omderman national Radio, FM10 and State Radio Broadcasters from such States as Gadaref and White Nile.</p>

### Annex 1b.3.2. Consultations & Meetings in Capital City Khartoum

#	Name	Designation	Venue	Date	Consultation Aspect
1.	Dr. Mey Ahmed (MS)	UNEP, HCENR and FNC Support to Sudan National REDD+ Strategy Formulation Team	Forests National Corporation (FNC)	20/02 /2012	Preparations for Consultancy
2.	Dr. Sayeda Ali A. Khalil (MS)				
3.	Dr. Hana Hamadalla (Mrs)				
4.	Mrs. Samia Bakheit Mando				
	Dr.Mey, Dr.Sayeda, Dr.Hanaa, Ms.Samia and Prof. Hassan AbdelNour	National Consultant meeting with Support team	FNC	23/02 /2012	International consultant meeting with support team .Progress report on preparations for arrival of International Consultant Dr. Patrick Van Laake
5.	Dr. Patrick Van Laake	International Consultant	Khartoum International Airport	24/02 /2012	Arrival Khartoum, meeting by and transfer to Acropole Hotel, Khartoum
	Dr. Mey, Dr.Sayeda, Dr.Hana, Ms.Samia , Hassan AbdelNour and Patrick Van Laake	Support Team, National &International Consultants.	FNC	25/02 /2012	1.Support Team, National &International Consultants linking up, 2.Discussion of itinerary, 3. Briefing International Consultant on Sudanese Forestry and state the art Sudan REDD+ Readiness.
6.	Mr. Salah Yousuf	Sudan, FRA Focal Person	FNC	25/02 /2012	Presentation on Sudan's Capacity on Resource inventory
7.	Mr. El Fateh Farah	Managers, Petroleum Produced Water Utilization Project	FNC		Presentation on genesis and Sudan's experience in utilization of Produced Water in the process of Petroleum oil purification.
8.	Dr. Mohamed Tom Mohamed.....				
9.	Dr. Abdel Azim Mirghani	Director General, FNC	FNC	26/02 /2012	Briefing consultancy team, capacity building (CB) aspects
10.	Dr. Abdalla Gaafar	Chief, Technical Sector, FNC			
11.	Ms Kate English	Second Secretary, Political, Head of Commercial Section British Embassy,	British Embassy, Khartoum.	26/02 /2012	Briefing consultancy team, envisaged itinerary, outputs and future prospects of National

#	Name	Designation	Venue	Date	Consultation Aspect
		Khartoum.			REDD + Strategy
12.	Mr. Baha El Deen Osama	Projects & Prosperity Office, British Embassy, Khartoum.			
13.	Mr. Robin Bovey	Programme Manager, Sudan	UNEP, Khartoum	26/02 /2012	Briefing consultancy team, ambitious TOR, envisaged itinerary, outputs and future prospects of National REDD + Strategy
14.	Fabian Kreuzer	Assistant to Programme Manager, Sudan			
15.	Mr. Earnest Mutanga	Programme Consultant			
16.	Prof. Omer Abdel Rahim	Director Productive Farm (Animal Production & Forestry), Kenana Sugar Company.	Kenana Sugar Company. Head Office, Khartoum.	26/02 /2012	Briefing by Team, overview by Kenana side on company's corporate social responsibility, undertaking of Environmental Impact Assessment (EIA) prior to major activities and adherence to EIP recommendations besides adherence to Forests Legislation stipulating 5% of estate area for forest and tree formations.
17.	Dr. Abdelrahman Eltahir Ahmed	Environment Manager & Planning Unit Manager Kenana Sugar Company.			
18.	Eng. Ms. Sara Salah El Karib	Marketing Research Officer Kenana Sugar Company.			
19.	Ms Ebtihag Abdelrahman Ali	Sales Officer Kenana Sugar Company.			
20.	Dr. Saad el Deen Ibrahim	General Secretary, Higher Council for Environment & Natural Resources (HCENR)	Head Office, Higher Council for Environment & Natural Resources, Khartoum.	27/02 /2012	Briefing by Team. Overview of HCENR roles, as REDD focal point together with other UN initiatives,  Areas for CB for government, NGOs and CSOs.
21.	Mr. Ismail El Gizzouli	Climate Change in HCENR.			
22.	Dr. Mutasim Bashir Nimir	Manager, NAPA Priorities Implementation Project.			
23.	Ms Rehab Ahmed Hassan	HCENR			
24.	Dr. Nadir Mohamed Awad,	Deputy, Chairman, Sudanese Environment Conservation Society (SECS)	Head Office, Sudanese Environment Conservation Society	27/02 /2012	Briefing by Team. Role of NGOs in general and SECS in particular in environmental management, awareness and advocacy.
25.	Dr. Mutasim Bashir Nimir	SECS Board Member			
26.	Dr. Summaya Ahmed Zakieldeen (MS)	SECS Board Member			

#	Name	Designation	Venue	Date	Consultation Aspect
27.	Mr. Awad Alla Suliman	Forestry Unit, Kenana Sugar Company			
28.	Eng. ElKhawad Salim El Sheikh	Acting Director, Investment, Trade & Contracts	Ministry of Electricity & Dams (MED)	05/03 /2012	Briefing by Strategy Team. Highlights of Ministry's immediate and future plans which incorporate broad land use planning and concerns of other land use sectors such as forestry, range, and wildlife and watershed management. Ministry's adherence to prior conduct of EIA
29.	Eng. Mohamed Hamid Salim	Environment File, MED			
30.	Eng. Ahmed Mohamed El Hassan	Acting, Agreements Section MED			
31.	Eng. Mohamed Osman Abbas	Acting Manager, Contracts, MED.			
32.	Eng. Salah Husein Abdel Sadik	MED			
33.	Eng. Yehia Sineen Salih	MED			
34.	Mr. Abbas Sidig El fadil	Extension director	Ministry of Animal Resources, Fisheries & Range (MARFR)	05/03 /2012	Briefing by REDD+ team.  MARFR immediate and future concerns and strategies, the need for coordinated land-use policies, their aspiration to incorporate other sectors and land-user plans in theirs.
35.	Mr. Abdelrahim Suliman Issa	Animal Production Unit			
36.	Dr. El tahir Abdelgadir Ali	Animal production			
37.	Ms. Hoida Dafa Allah	Animal production			
38.	Ms. Raja Hassan Maki	Animal production			
39.	Ms. Elham Elsayed Mirghani	Technical Office			
40.	Mr. Ahmed Mohamed Ali	Director of Animal Resource			
41.	Ms. Intisar Maki Hassa	Animal resource			
42.	Ms. Eshraga Ahmed Ibrahim	Technical office			
43.	Ms. Laila Mohamed Hassan	Range And Pasture			
44.	Ms. Asmahan Elzubair Eltayeb	Range and Pasture			
45.	Mr. MaiMoussa Abari	FAOR-Sudan	FAO Representation in Sudan	05/03 /2012	Briefing by Strategy team.  FAO commitment to REDD, Sudan Country Programming Framework,  The need to tap government resources and bilateral pledges such
46.	Mr. Salah Muddathir	Deputy FAOR			

#	Name	Designation	Venue	Date	Consultation Aspect
					as that of Kuwait and Qatar to eastern Sudan and Darfur respectively
47.	Eng. Hani Hassan	DAL Fenti Golf	DAL Real Estate	05/03/2012	Briefing by REDD Strategy team,  DAL's activities in the context of corporate social & environmental responsibilities:  - Environmental Forum,  - Cultural Forum.  - Willingness to disseminate awareness material with their products to various parts of the country and printing of such slogans or logos on their packaging material.
48.	Dr. Mohamed Hassan Jubara	Undersecretary, Ministry of Agriculture & Irrigation	Federal Ministry of Agriculture & Irrigation	06/03/2012	Briefing by Strategy Team. Highlights of Ministry's immediate and future plans which incorporate broad land use planning and concerns of other land use sectors such as forestry, range, wildlife and watershed management.
49.	Mr. Abdelrahman Hassan Salih	International Cooperation Administration			
50.	Mr. Mohamed Abd Alla Ali	Companies Administration	Ministry of Minerals	06/03/2012	Briefing by Strategy Team.
51.	Ms. Tahra Saad Hamid	Environment Advisor			Review of ministry's activities in mining.  Their adherence to EIA and FPIC

### Annex 1b.3.3: Consultations & Meetings, Persons Met and Aspects Discussed in Four States



Women group irrigated forest White Nile



Camel herd Gadaref

S.N.	Person met	Designation	Venue	Date	Discussed aspects
1.	Ms Eman Mustafa Adawi	Director of Forests, Gezira State	1. Guneid Sugar Company Irrigated	28/02/2012	<b>Excursion &amp; Field Visit:</b>  1. Excursion & Field Visit to four States viz. Gezira, Gadaref, Senmar and White Nile, 2. To touch base with Ministers of Agriculture, Animal Resources & Forests, Senior Ministry Officials, Senior Forests Personnel, their immediate and future plans and policies, 3. Forest neighbouring communities, Farmers', Pastoralists & Women Unions. Putting feelers towards peoples' aspirations, introduce them to REDD and assess what they require of their forest surroundings
2.	Mr. Mohamed Ahmed Abbas	Deputy D.F.G.State	<i>Eucalyptus</i> Forests,		
3.	Mr. Osman Omer Abbakar	A.C.F. Medani Circle	2. Abu Galfa <i>Acacia radiana</i> Forest and Awayda Village,		
4.	Mr. Khalil Hussein	A.C.F.Rufaa Circle	3. Bankew Nilotic <i>A. nilotica</i> (Sunt) Forest		
5.	Mr. Buraie Bella	Director of Forests, Gadaref State	1. Irrigated <i>A.seyal</i> (Talh) belts in Rahad Scheme, with bee honey production	28/02/2012	
6.	Ms. Taghreed Ali Siddig	Assist. D. Extension & Community Forests	2. Rain-fed assorted <i>Acacia</i> Belts, Ghadambalyya		
7.	Mr. Ibrahim Doka	FNC, Gadaref			
8.	Mr. Esam Abdel Karim	Rehabilitation, Refugee Affected Areas, Gadaref.			
9.	Mr. Mohamed Gisma Alla	FNC, Gadaref			
10.	Mr. Bakri Mahmoud	Rehabilitation Eastern Sudan Project,			
11.	Mr. Ahmed Abbasher Hassan	Gadaref Farmers'Union,	1. Meeting Unions in Mutwakil Hotel, Gadaref		
12.	Mr. Mohamed AbdelGadir Abdelmohsin	Gadaref Farmers'Union			
13.	Mr.Ibrahim Idris	Gadaref Pastoralists' Union			



S.N.	Person met	Designation	Venue	Date	Discussed aspects
14.	Mr. El Sir El Hag Mohamed	Director, Extension & Technology Transfer, Gadaref.			<p>1. Excursion &amp; Field Visit to four States viz. Gezira, Gadaref, Sennar and White Nile,</p> <p>2. To touch base with Ministers of Agriculture, Animal Resources &amp; Forests, Senior Ministry Officials, Senior Forests Personnel, their immediate and future plans and policies,</p> <p>3. Forest neighbouring communities, Farmers', Pastoralists &amp; Women Unions. Putting feelers towards peoples' aspirations, introduce them to REDD and assess what they require of their forest surroundings</p>
15.	H.E. Dr. Radwan Mohamed Ahmed	Minister of Agriculture, Irrigation & Forests, Sennar State	FNC Offices, Dinder Town.	29/02/2012	
16.	Mr. Mohamed Ibrahim	Director of Forests, Sennar State	<p>1. Okalma, Rainfed Natural &amp; Plantation State Forest,</p> <p>2. Briefing Forest staff and community about REDD and feeling their vision about maximizing their benefits from forest while managing it sustainably,</p> <p>3. Wad Behaiga, <i>A. nilotica</i> (Sunt) Nilotic Forest. Talking to forest community.</p>		
17.	Mr. Mutasim Ismail	A.C.F. Suki Forest Circle			
18.	Mr. Adil Kamal Adam	A.C.F. Singa Circle			
19.	Mr. Sayed Abdalla	Suki Sawmill Manger			
20.	Mr. Yousuf Mohamed	A.C.F. Dinder Circle			
21.	Mr. ElGizzouli Awad El Jack	Gum Producers' Association, Dinder	<p>1. Meeting Gum Arabic Producer Organizations, Singa FNC Office</p>	29/02/2012	
22.	Mr. El Makki Ali Ahmed Jubara	Gum Producers' Association, Dinder			
23.	Mr. Yousuf Ali Yousuf Dafa Alla	Gum Producers' Association, Singa			
24.	Mr. Abbas Yousuf Dafa Alla	Gum Producers' Association, Singa			
25.	Mr. El Fadil Ibrahim AlFoudah	Chairman, State Gum Producers' Union.			
26.	Mr. El Tahir Dafa Alla ElZaki	Chairman, Wifaq Gum Producers' Association			
27.	Mr. Ali Hamid Adli	Gum Producers' Association, Dali			
28.	H.E. Mr. Mohamed Ahmed Babiker Shinaibo	Minister of Animal Resources, Range & Forests White Nile State, Kosti	<p>1. Briefing H.E. Minister and soliciting his views regarding integrated land use,</p> <p>2. Kosti Forest Tree Nursery, briefing Resource Custodians and stake holders,</p> <p>3. Visiting Kenana Sugar Forest Plantations,</p>		<p>1. Excursion &amp; Field Visit to four States viz. Gezira, Gadaref, Sennar and White Nile,</p> <p>2. To touch base with Ministers of Agriculture, Animal Resources &amp; Forests, Senior Ministry Officials, Senior Forests</p>
29.	Mr. Musa Suffouri	Director of Forests, White Nile State.			
30.	Mr. Mohamadain ElAmin Mohamadain	A.C.F. Rebbek & Gabalain Circle			
31.	Mr. Mustafa Goda	Deputy Director, Technical Affairs			
32.	Mr. El Shaeikh Saad	A.C.F. Kosti Circle			

S.N.	Person met	Designation	Venue	Date	Discussed aspects
33.	Ms. Mahasin Abdel Bagi	Acting Extension Officer	4. Visiting biologically stabilized Sand dunes,	01/03/2012	Personnel, their immediate and future plans and policies, 3. Forest neighbouring communities, Farmers', Pastoralists & Women Unions. Putting feelers towards peoples' aspirations, introduce them to REDD and assess what they require of their forest surroundings
34.	Mrs. Ensaf Khair Alla	E. Director, Goly Women Association, W. Nile State			
35.	Mrs. Anna Omer El Gasim	Finance Secretary, Goly Women Association, W. N. State			
36.	Mrs. Layla Omer Osman	General Secretary, Goly Women Association			
38.	Mrs. Aisha Mahala Mohamed	Member			
39.	Mrs. Magida Yagoub	Member			
40.	Mrs. Alawya Yagoub	Member			
41.	Mrs. Sayeda ElTayeb El Tahir	Member	5. Visiting Women Forests Goly and talking to some members. Soliciting their views on best combination of trees and crops		
42.	Prof. Omer AbdelRahim	Director Productive Farm ( Animal Production & Forestry) Kenana Sugar Company			
43.	Mr. Awad Alla Hammad Ghabboush	Head Forestry Unit, Kenana Sugar Company			
44.	Mr. Awad Alla Suliman	Forestry Unit, Kenana Sugar Company	Kenana Sugar Complex, White Nile State		Private sector social responsibility: 1. 5% of estate under forests & tree formations, 2. Grazing resources for neighbouring communities.

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FNC Forests National Corporation

TS Technical Sector

SECS Sudanese Environmental Conservation Society

HCENR Higher Council for Environment and Natural Resources

C.TS Central Technical Sector

Annex 1b.4. Draft Sudan REDD+ Strategy

National REDD+ Preparedness Strategy  
of the Government of Sudan

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*ALL Figures & Maps removed for attachment limitations*

First Draft for Consultations

May 2012

## Abbreviations

AfDB	African Development Bank
AR-CDM	Afforestation / Reforestation scope under the CDM
CC	Climate Change
CDM	Clean Development Mechanism of the Kyoto Protocol
CFA	Central Forests Administration
CILSS	Permanent Inter-state Committee for Drought Control in the Sahel
CoP	Conference of the Parties
DFID	Department for International Development of the United Kingdom
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
FES	Fuel Efficient Stove
FNC	Forests National Corporation
FPGR	Forage Plants Genetic Resources
FRA	Forest Resources Assessment of the FAO
GDP	Gross Domestic Product
GEF	Global Environment Facility
GGWSSI	Great Green Wall of the Sahel - Sudan Initiative
GHG	Greenhouse Gas
GoS	Government of Sudan
ha	hectare
IDP	Internally Displaced People
IGAD	Intergovernmental Authority for Development
JECFA	FAO & WHO Joint Expert Committee on Food Additives
LFCC	Low Forest Cover Countries
LPG	Liquefied Petroleum Gas
masl	meter above sea level
MRV	Measurement, Reporting and Verification
NAPA	National Action Plan for Adaptation
NEA	National Energy Administration
NEFRFC	Near-East Forestry & Range Commission of FAO
NFP	National Forest Policy
NWFP	Non Wood Forest Products
OL	Other Land
OWL	Other Wood Land
PV	Photo Voltaic solar panel
PW	Produced Water
REDD	Reducing emissions from deforestation in developing countries
REDD+	Reducing emissions from deforestation and forest degradation; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
RoS	Republic of Sudan
RSS	Republic of South Sudan
SELEM	An Islamic Agricultural Finance System which Stipulates Repayment in Kind at a Price Determined at the time loan Disbursement
SPLA	South Sudan Liberation Army
SPLM	South Sudan Liberation Movement
STAR	System for Transparent Allocation of Resources of the GEF
TOE	Ton Oil Equivalent
TWW	Treated Waste Water
UN	United Nations
UNCBD	United Nations Conference on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Conference on Climate Change
UNFF	United Nations Forum on Forests
UN-REDD	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
WHO	UN World Health Organization
WFD	Woods & Forests Directorate

## *Introduction*

The Government of Sudan (GoS) is considering the REDD+ mechanism to be a priority area for development in the management of forest resources and rangeland in the country. Since the emergence of the REDD mechanism at the United Nations Framework Convention on Climate Change (UNFCCC) 11<sup>th</sup> Conference of Parties (CoP-11) in Montreal, 2005, the REDD+ mechanism has evolved to a state where the GoS considers it feasible for implementation. This is demonstrated by recent petitions to the UN-REDD Programme and the Forest Carbon Partnership Facility (FCPF) for technical and financial support.

The current high rate of deforestation and forest degradation for energy, crop cultivation, browse and grazing material and other important livelihood needs makes the forest sector one of the highest priority areas for Sudan to contribute to global climate change (CC) mitigation. Land use activities including forest and range sectors are also well recognized for their vital contribution to sustainable development in Sudan, where these sectors support the livelihoods for more than 70% of the population, provide habitat for wildlife together with shade, grazing and browse material for the national livestock herd. These facts are well articulated in Sudan's initial communication, national adaptation programme of action (NAPA) and second national communication. . The role forests play and need for their conservation is well recognized in the forest, agriculture, water and biodiversity policies and strategies. Sudan used its GEF STAR allocation to finance a forestry mitigation project, which includes afforestation/reforestation, forest management and biomass energy saving components. This project also includes a pilot on REDD+ for the purpose of building national capacity and gaining experience through practical examples. A recent report prepared with support from the African Development Bank (AfDB) highlighted land use activities including forestry and range resources as some of the high priority sectors for Sudan NAMAs and low carbon development strategy. Sudan contacted a number of potential donors and UN Agencies trying to raise support for preparation of its low carbon development plan as required by the Cancun Agreements of COP-16 of the UNFCCC.

Sudan's stand in this respect is articulated and in line with international and regional happenings. Many relevant international and regional gatherings such as the 20<sup>th</sup> Session of the FAO's Near East Forestry & Range Commission (NEFRC), held in Antalya, Turkey, February 2012, stressed that dry lands require greater attention at the international level, including in the context of REDD+. The gatherings also emphasized the need for greater attention to forests and range issues at the policy level, to recognize the importance of these areas to livelihoods of millions of people, the necessity of improved governance for broader national social and economic development, the mitigation of and adaptation to CC and the urgent need for finance for forests and rangelands. The gatherings also pointed to the opportunities to strengthen attention to dry land issues including in the UN Convention to Combat Desertification (UNCCD) and the United Nations Forum on Forests (UNFF). In this regard NEFRC posed many recommendations to FAO and member countries, such as (FAO 2012):

- Recommendation for countries to give strong emphasis to Sustainable Forest & Rangeland Management including in protected areas in Low Forest Cover Countries (LFCCs),
- Recommended FAO to undertake studies on barriers between forest and range resources in Near East countries,
- Recommendation for FAO to integrate CC into forest and range sectors at both policy and field levels.



### **The Commission:**

- Highlighted areas where assistance is needed, including monitoring for CC impacts and adaptation as well as for mitigation (i.e. REDD+), assessing ecosystem vulnerability and adaptation options, addressing heightened risks of pests & diseases,
- Stressed the importance of Treated Waste Water (TWW), including Produced Water (PW) in forestry and the role of this in meeting peoples' needs, restoring degraded landscapes, combating desertification, contributing to CC mitigation by expanding the carbon pool in forests and transferring knowledge and technology in these areas; all this using participatory approaches to involve all stakeholders.
- Noted the Region's changing climatic conditions and the potential of agro-forestry in meeting local peoples' needs and requested FAO to support member countries to build inter-sectoral approaches that promote agro-forestry systems as a tool for sustaining food security,
- Stressed the need to observe good practices of sustainable utilization of Non Wood Forest Products (NWFPs),
- Noted the importance of raising awareness on the importance of urban and peri-urban forestry.

### **Purpose of this document**

The Government of Sudan is developing its National REDD+ Strategy and Action Plan, in response to the Cancun Decisions (COP-16). This Strategy shall be developed in full consultation with all stakeholders in Sudan. This document forms the basis for the consultations on the Strategy.

This document provides a comprehensive overview of the current condition of the physical resources and socio-economic indicators that are relevant for the development of the Strategy. In addition, a preliminary analysis of the drivers of deforestation and forest degradation is given, as well as the principal objectives of the National REDD+ Program. This document is not complete and final; it is living document that will be updated upon inputs from the consultation process.

### ***The REDD+ mechanism as defined by the UNFCCC***

#### **History**

The REDD+ mechanism is still under negotiation at the level of the UNFCCC. Over the past few years the contours of the mechanism have emerged, however, such that the Government of Sudan may start preparing for the implementation of the National REDD+ Program. A brief overview of the history of REDD+ follows.

In 1997 the UNFCCC adopted the Kyoto Protocol, with binding emission reduction targets for Annex I countries – roughly the rich, industrialized countries. Some of these emission reductions could be achieved in non-Annex I countries – roughly the developing countries – using the instrument of the Clean Development Mechanism (CDM). Under the latter instrument there are 15 “scopes” of which one was afforestation or reforestation, also known as AR-CDM. Under AR-CDM plantations could be laid out in developing countries on non-forest land or forest land that did not bear forest cover at any time after 1<sup>st</sup> January 1990. Management of existing forest was specifically excluded. Due to the restrictions and the complexity of implementation only a handful

of projects were approved and became operational. Sudan has registered some CDM projects, but not for afforestation or reforestation.

In response to the failure of including a comprehensive instrument for the forestry sector in the Kyoto Protocol, the Coalition for Rainforest Nations was established. This Coalition – whose members include some 20 nations from tropical regions – proposed an additional instrument and Papua New Guinea, supported by eight other tropical countries, requested the Secretariat of the UNFCCC to add an item to the agenda CoP-11 of the UNFCCC, in Montréal, December 2005, to discuss this. Papua New Guinea and Costa Rica submitted a document for discussion at the CoP-11: “Reducing emissions from deforestation in developing countries: Approaches to stimulate action” (REDD). This document called upon the CoP to consider including reducing emissions from deforestation as an option under the Kyoto Protocol or as a new instrument altogether. The CoP accepted the call from Papua New Guinea and Costa Rica and called upon Parties and the Subsidiary Body on Scientific and Technological Advice (SBSTA) of the UNFCCC to further develop options for discussion at CoP-13.

At CoP-13, Bali, December 2007 – REDD was further discussed and its scope was expanded to include reducing emissions from forest degradation, enhancement of forest carbon stocks, conservation of forest carbon stocks and sustainable management of forests; all in response to assertions from Parties that the REDD mechanism would otherwise be deficient. The mechanism was renamed to its current form: “Reducing emissions from deforestation and forest degradation; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries”, abbreviated to REDD+. CoP-13 called upon Parties to start piloting approaches – supported by financial contributions from Annex I Parties – and to report back to the CoP at its 15th session. CoP-13 also saw the launch of the UN-REDD Programme – a collaborative programme of FAO, UNDP and UNEP to pilot REDD+ in developing countries – and the FCPF of the World Bank.

CoP-15 – Copenhagen, December 2009 – did not provide much progress for REDD+ as such, but it did provide a clearer definition of the framework for Measurement, Reporting and Verification (MRV) and the need to establish a “national forest monitoring system”, for the recording, analysis and reporting of reduced emissions and enhanced removals. A year later at CoP-16 – Cancun, December 2010 – more progress was made on technical issues such as National Communications – biannually for non-Annex I countries, including Sudan – and phased implementation of the national forest monitoring system. The most recent meeting of the UNFCCC, CoP-17 – Durban, December 2011 – recognized the secondary benefits from REDD+, specifically that it can “promote poverty alleviation and biodiversity benefits [and] ecosystem resilience”. Otherwise the deliberations on REDD+ were mostly focusing on financial mechanisms in support of REDD+.

## UNFCCC request to participating countries

The negotiations between the Parties to the UNFCCC have led to a number of Decisions on REDD+ with instructions for countries choosing to implement REDD+. Paragraph 1 of Decision 4/CP.15 of December 2009 is especially instructive and its provisions are reflected in this strategy:

*“[The Conference of the Parties] Requests developing country Parties, on the basis of work conducted on the methodological issues set out in decision 2/CP.13, paragraphs 7 and 11, to take the following guidance into account for activities relating to decision 2/CP.13, and without prejudging any further relevant decisions of the Conference of the Parties, in particular those relating to measurement and reporting:*

- (a) To identify drivers of deforestation and forest degradation resulting in emissions and also the means to address these;*
- (b) To identify activities within the country that result in reduced emissions and increased removals, and stabilization of forest carbon stocks;*
- (c) To use the most recent Intergovernmental Panel on Climate Change guidance and guidelines, as adopted or encouraged by the Conference of the Parties, as appropriate, as a basis for estimating anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes;*
- (d) To establish, according to national circumstances and capabilities, robust and transparent national forest monitoring systems and, if appropriate, sub-national systems as part of national monitoring systems that:*
  - (i) Use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating, as appropriate, anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes;*
  - (ii) Provide estimates that are transparent, consistent, as far as possible accurate, and that reduce uncertainties, taking into account national capabilities and capacities;*
  - (iii) Are transparent and their results are available and suitable for review as agreed by the Conference of the Parties;”*

This request from the Conference of the Parties was adopted with the support of the Government of Sudan and it is reflected in the elements of this strategy such that it will be implemented in the National REDD+ Program.

## REDD+ as a participatory mechanism

The UNFCCC recognized early on that local communities need to be comprehensively involved in the implementation of REDD+ at country level. Decision 2/CP.13 on REDD+ recognized that the “needs of local and indigenous communities should be addressed” when implementing REDD+. Two years later, this recognition was upgraded in Decision 4/CP.15 to “the need for full and effective engagement of indigenous peoples and local communities in, and the potential contribution of their knowledge to, monitoring and reporting of activities”. In Cancun these statements are more forcefully defined in Decision 1/CP.16 as a number of safeguards that should

be “promoted and supported” in the implementation of the REDD+ activities. The two relevant safeguards for participation are:

- “(c) Respect for the knowledge and rights of indigenous peoples and members of local communities, by taking into account relevant international obligations, national circumstances and laws, and noting that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples;*
- “(d) The full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities, in the actions referred to in paragraphs 70 [the REDD+ activities] and 72 [development and implementation of national strategies and action plans] of this decision.”*

The Government of Sudan is committed to the full and effective participation of all resource custodians and relevant stakeholders, which explicitly includes government agencies at central, state and local levels; members of local communities cropping land and managing forests; pastoralists herding livestock on the range; and civil society organizations engaged in environmental management, poverty reduction, gender equality, education and other relevant topics. This comprehensive participation implies that all stakeholders will jointly develop and execute programs and activities that define and implement this Strategy.

## ***The current situation in Sudan***

### **Basic features of the country**

Located in North Eastern Africa, The Republic of Sudan (RoS) is bound by Egypt, The Red Sea, Eritrea, Ethiopia, Republic of South Sudan (RSS), Central African Republic, Chad and Libya. The total area is 1, 886,000 km<sup>2</sup>.

The highest point is Jebel Marra at 3,024 meters above sea level (masl); the lowest is the Red Sea. The most salient geographical features of the country are the Nubian and Bayuda Deserts in the north, the Nile Valley, Jebel Marra, Nuba, Ingessena & Red Sea Hills. The Blue Nile originates in the Ethiopian Highlands. The White Nile runs from the Equatorial Lakes. The two rivers unite at Khartoum and with their tributaries form the River Nile which runs north to the Mediterranean Sea.

The soil in about 60% of the country, particularly in the northeast, north and northwest is predominantly sandy. Heavy cracking clay soils form a triangular central eastern plain which makes up some 25% of the country. Red soils of different types are characteristic of the remaining south-western portion.

The rainfall varies from zero in the northern desert to more than 1,200 mm in the High Rainfall Woodland Savannah in the south western portion of the country.

The vegetation can be divided into six principal types which in general follow the isohyets and form consecutive series from north to south : 1. Desert; 2. Semi-Desert; 3. Acacia Short Grass Scrub; 4. Acacia Tall Grass Scrub; 5. Broad-leaved Woodlands & Forests; 6. Swamps (permanent swamps, seasonally inundated land), Grassland and Mountain Meadow. The effect of the topography on vegetation is limited and confined to mountain massifs, hills, upland country and Nile Valley and its tributaries.

## Population

Total population is about 33.4 million, with an annual growth rate of about 2.8% (1993-2008). It is a combination of indigenous Nilo-Saharan- speaking Africans and descendants of migrants from the Arabian Peninsula. The main ethnic groups are Sudanese Arabs (approx. 70%), Fur, Beja, Nuba and Fallata. Due to the process of Arabisation common throughout the rest of the Arab world today, Arab culture predominates in Sudan. The greater majority of the population of Sudan adheres to Islam. Official language is Arabic; English is widely used together with several local dialects in Northern, S. Kordofan, Kassala, Darfur and Red Sea States (Anon 2011).

About 29.8% of the population lives in urban centres and 63.2% in rural areas. The remaining 7.0% lives a nomadic lifestyle. About 71% of all males are literate, which is the case for only 51% of women.

The situation of women in Sudan is protected by Law and provides them with equal rights and privileges in many aspects of the society.

- Sudanese women obtained:
  - The right to vote in 1953
  - Equal pay and pension for equal job in 1964
  - Right of election in 1964
- Sudanese women were the first to hold judiciary post in Africa:
  - The first woman in the country's supreme court was Justice Ihsan Mohamed Fakhry,
  - The first woman State Governor was Mrs. Agnes Lukudu, Governor of Eastern Equatoria 1991,
  - The first Sudanese woman Minister without portfolio was Mrs. Nafisa Ahmed El Amin in 1971,
  - The first Sudanese woman Minister with portfolio was Dr. Fatima Abdel Mahmoud 1973,
  - Women in current National Assembly (Parliament): 78 =25% of seats,
  - Women Ministers in current cabinet (2012): 5 (Social Care, Labour, Parliamentary Affairs, Education, Information),
  - Women Supreme Judges: 78,
  - Women Attorneys, Councillors: 254 (40% of sector),
  - Women police officers :10% of force,
  - Women lawyers: 41% of total,
  - Women in Education: 69%,
  - Female university students: 67%,
  - Female diplomats: 7%
  - Sudanese Women Union branches: 27,000.

## Land use and water resources

### Land use

Arable land: 200 million feddans<sup>1</sup>. Irrigated cropped land: 11 million feddans, rain fed cropped land: 29 million feddans. Stable, cash and export crops: Sorghum, wheat, millet, cotton, sugar cane, ground nuts, sesame, dates, sunflower, citrus, tropical fruits and vegetables (Anon 2011).

## **Water Resources**

Total water resources: 30.8 billion cubic meters (bnm<sup>3</sup>). Average River Nile discharge is 93 bnm<sup>3</sup>, of which 50 bnm<sup>3</sup> is from the Blue Nile, 27 bnm<sup>3</sup> from the White Nile, Atbara 12 bnm<sup>3</sup>, Rahad 3 bnm<sup>3</sup> and Dinder 1 bnm<sup>3</sup>. Sudan's share of Nile waters as per 1959 Nile Water Treaty is 18.5 bnm<sup>3</sup>. The average annual precipitation is about 400 bnm<sup>3</sup>, renewable ground water is about 4 bnm<sup>3</sup> and other water sources (Khors & wadis) 6 bnm<sup>3</sup>.

The total consumption of water of 18.5 bnm<sup>3</sup> derives from the Nile 15 bnm<sup>3</sup>, renewable ground water 1.2 bnm<sup>3</sup> - of which 0.7 bnm<sup>3</sup> is used in agriculture, and 0.5 bnm<sup>3</sup> for drinking water - and Khors and wadis 2.5 bnm<sup>3</sup>.

## **Agriculture**

Although most of the country is arid, the economy has predominately depended on the agricultural sector, including livestock production, forestry and fishing; together, they contributed about half of the GDP before the discovery and exploitation of oil. Despite the emergence of Sudan as an oil exporter and the diminishing share of agricultural sector in overall export earnings, agriculture continues to be the backbone of the country's economy in terms of its contribution to GDP. It contributed 31.6% to the GDP in 2011 (of which 20% was from crop production and 11.6% from livestock) and around 35% during the years 2007-2010; in comparison to about 70% contributed by the petroleum sector. Agriculture also remains the main source of employment as about 70% of the work force is employed in agriculture and related activities such as agro-industries, transport and trade and the main source of household income in rural areas where 70.2% of the population live.

Farming systems have evolved mainly as a function of agro-ecological conditions, acquired technology, market and socio-economic conditions. Crop production is practiced in three main farming systems, namely: irrigated, mechanized rain-fed and traditional rain-fed (Anon 1999).

## **Irrigated agriculture**

Irrigated agriculture covers some 11 million feddans (Anon 2011), watered basically from the Nile and its tributaries through gravity irrigation from dams, pumps or flood irrigation from seasonal rivers like Gash and Tokar. A small area is irrigated from ground water. Five dams (Sennar, Jebel Awlia, Roseires, Khasm el Girba and Meroe) have been erected during the 20th and early part of 21st centuries to provide irrigation water and hydropower.

A twin dam on Atbara and Setit Rivers is under construction. Large irrigated schemes such as Gezira & Managil, New Halfa, Rahad, Suki and sugar schemes such as Kenana, White Nile and West Sennar dominate this sector.

The main crops in the irrigated sector are Sugar cane, sorghum, cotton, wheat, ground nuts, winter pulses, vegetables, fruit and green fodder. The sector uses the bulk of imported agricultural inputs (Anon 2000). Irrigation means are government owned. Land is under government control

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<sup>1</sup> One feddan (60x70meters) = 4,200m<sup>2</sup> = 0.42 hectare (ha). One ha = 2.38 feddan.

and is allocated to tenants in holdings of 15-40 fed. Production relations are based on water rate and administration. These are undergoing drastic changes especially in Gezira Scheme.

### **Mechanized Rain-fed Agriculture:**

Mechanization is considered a most suitable means of cropping in Sudan's central clay plains as the soil is heavy clay and areas are expansive with low population density and short of drinking water during harvest time. Mechanized cropping started in the mid 1940s in small areas in Gadaref area then expanded to encompass nowadays some 14 million fed\*. in the 400-800 mm rain belt, concentrated in four areas: Gadaref, ed Damazine, Kosti and Dilling.

There is considerable potential for expansion provided that natural resources are conserved and land protected against degradation. Land is government owned and is leased to investors for 25 year periods in holdings of 1000, 1500 and 2000 feddans for individuals, cooperatives and companies respectively. These may reach 100,000 fed for big companies. Individual holdings make up some 78% of all holdings and 65% of entire area.

Sorghum is the leading crop in this sector followed by sesame, sunflower, millet and cotton. Productivity is generally low and fluctuates with rainfall. Of the major constraints in the sector is partial mechanization whereby ploughing is mechanical whereas weeding and harvesting are manual; creating labour shortage during weeding and harvest.

### **Traditional Rain-fed Agriculture**

The area of traditional rain-fed agriculture is estimated at 15 million fed. It is practiced primarily in west and central Sudan. Productivity is low and fluctuates with rainfall. Land is mostly collectively owned and usufruct is granted according to family needs. Since the practice depends on family member's efforts using hand implements, the area a family can manage is small. The sector is vital for the nation's food security as it contributes 90, 48, 28, 11 and 100% of millet, ground nuts, sesame, sorghum and gum Arabic respectively.

### **Ecological Classification of Vegetation in the Sudan**

The vegetation of the Sudan has been ably described by Harrison and Jackson (1958) and the following account is largely based on this work with some modifications based on several works such as Agriculture in the Sudan, Arabic version (Anon 1999), a study on sustainable modern technologies for Forest Resources Development in the Arab Region, Arab Organization for Agricultural Development (AOAD 1998), and Wickens (1991).

Map 1: Ecological Classification of the Vegetation of Sudan (1858).

**The Vegetation of the Sudan could be divided into the following zones:**

#### **Desert**

This zone covers some 38.6% of the total area of the Sudan, estimated at 716,800 km<sup>2</sup>. Average rainfall is less than 75 mm per annum and vegetation is confined to the seasonal watercourses. *Acacia ehrenbergiana* is the common type of tree species with ephemeral plants following the

scanty and erratic rainfall. The Gizzu group of plants is important for grazing in this zone though the major part of the formation occurs outside the Sudan.

The cultivatable area is confined to the Nile banks, to the flood plains, in addition, to a limited utilization of underground water. The zone has relatively cool winter that suits the cultivation of temperate crops such as wheat, legumes, vegetables, fruits, medicinal plants and date palms. With time, all low lands with fertile silty soils have been utilized and efforts are now directed, extensively, to the upper lands and the wadis to maximize the use of the comparative advantage of the zone in growing the aforementioned crops. The zone is overlain mainly by the Nubian sandstone, which is rich in underground water; a promising potential that avails future utilization using available suitable modern technology.

The zone is threatened by ecological hazards such as drifting sand that buries habitations, installations and agricultural lands, together with floods and *Haddam* (gully erosion) along the Nile banks.

### Semi-Desert Scrub and Grassland

This zone covers some 26.2% of the country's total area, estimated at 486,400 km<sup>2</sup> and through which extends the Nubian sandstone. The rainfall varies from 75 mm to 400 mm and is divided into the following divisions:

- *Acacia tortilis* – *Maerua crassifolia* Desert scrub: *A. tortilis* is the main feature with *M. crassifolia* and *Leptadenia pyrotechnica*,
- Semi-desert grassland on clay – the Butana area: The main feature is *A. mellifera* with *Blepharis edulis* and *Cymbopogon nervatus*,
- Semi-desert grassland on sand with *A. tortilis*, *Commiphora* spp, *A. senegal*, *Leptadenia pyrotechnica*, *Aristida plumosa* and *Blepharis* spp.,
- *Acacia mellifera*, *Commiphora* desert scrub with *A. mellifera*, *Commiphora africana*, *Boscia senegalensis*, *Aristida* spp, *Schoenefeldia gracilis* and *Panicum turgidum*.

### Low Rainfall Woodland Savannah

- **On sandy soils:** average annual rainfall 250 to 450 mm. *Acacia senegal* is the dominant tree with *Aristida sieberiana* and *Eragrostis* sp. as the dominant grasses. The main crops are millet, sesame and sorghum.
- **On clay soils:** average rainfall 400 to 800 mm. Pure stands of *Acacia mellifera* scrub occur between 400 and 500 mm annual rainfall with *A. seyal* and *Balanites aegyptiaca* dominant **in the higher rainfall areas**. The major grasses include *Schoenefeldia gracilis*, *Cymbopogon* sp. and *Brachiaria obtusiflora*.

On sandy soils, the zone covers some 11.4% of the total area, estimated at 212,000 km<sup>2</sup>, which is basically Nubian sandstone, mostly with sandy *Goz* soil. Droughts often occur due to irregularity of rainfall, which varies spatially and temporally. Traditional cultivation is dominant. The main crops are millet, sorghum, groundnut and a number of other crops. Animal herding and gum Arabic collection are main activities. Desertification, in all its manifestations, is an imminent threat particularly deforestation, overgrazing and over cultivation.



On clay soils, the zone forms some 15.9% of the total area of the country, estimated at 295,000 km<sup>2</sup>. All current and potential mechanized rain fed farming is situated in this zone, in addition to the largest irrigation projects covering an area of about 5 million feddans. The zone is known for its forest resources (mainly gum Arabic) and traditional cultivation and the vast grassland areas that serve as dry season grazing area. The zone suffers from large-scale tree clearance, repeated floods during the rainy season, fires and sometimes conflicts between nomadic herders and farmers. The zone has a large potential for investment in all sectors and promising sustainable development.

### **High Rain-fall Woodland Savannah**

Average annual rainfall 450 to 1000 mm. The main tree species are: *Combretum hartmannianum* and *Anogeissus leiocarpus*, *Terminalia brownii*, *Albizia amara*, *Khaya senegalensis*, *Isobertia doka* with *Aristida* sp. *Eragrostis* spp., *Pennisetum* sp. and *Hyparrhenia* spp. as the dominant grasses.

The zone constitutes some 0.9% of the total area of the country, estimated at 17,000km<sup>2</sup>. It includes the major watershed areas of the country and has a vast potential for development. The area is threatened by annual fierce late fires and is vulnerable to gully erosion.

### **Flood Region**

Average annual rainfall of 800 to 1,000 mm. The vegetation includes the perennial *Cyperus papyrus* swamps and the seasonally flooded “toichi” area with *Hyphaene thebaica*, *Borassus aethiopum*, *Acacia seyal*, *A. siberiana* and *Balanites aegyptiaca* among the tree species.

The Flood Region covers 0.5% of the country, covering an area of some 7,000km<sup>2</sup> and is rich in fisheries and wildlife. The major threats to the zone include water hyacinth, hydrocarbon pollution from petroleum extraction.

### **Special areas**

These are regarded as isolated areas of savanna woodland vegetation surviving on hill slopes in areas where similar communities are no longer to be found in the surrounding low lands. They occupy an area of some 119,000 km<sup>2</sup> making up 6.5% of the total area of the country.

### **Montane vegetation**

These are upland areas often with temperate and tropical species that are only known from similar upland areas in Africa. The montane areas include the Red Sea Hills and Jebel Marra. They occupy an area estimated at 4,000km<sup>2</sup> which makes some 0.2% of the total area of the country.

The forest extent and estate in the two brother countries can be extrapolated by super imposing the map of Harrison & Jackson's 1958 'Ecological Classification of the Vegetation of Sudan' (Harrison & Jackson 1958) on the maps of the two countries (AbdelNour 2011). See Map 1 and Tables 1 and 2 for details.

Table 1: Ecological Classification of vegetation in the Republic of Sudan (RoS) and the Republic of South Sudan (RSS)

	Major Division	Subdivisions	Area	RoS	RSS
			x 1,000km <sup>2</sup>		
I.	Desert	-	716.8	716.8	-
II.	Semi-Desert	1. <i>Acacia tortilis</i> - <i>M. crassifolia</i> Scrub	184.3	184.3	-
		2. Semi-Desert Grassland on Clay	102.4	102.4	-
		3. Semi-Desert Grassland on Sand	84.5	84.5	-
		4. <i>Acacia mellifera</i> - <i>Commiphora</i> Scrub	84.5	84.5	-
		5. <i>Acacia glaucophylla</i> - <i>Acaica etbaica</i> Scrub	30.7	30.7	-
		<b>Total</b>	<b>486.4</b>	<b>486.4</b>	<b>-</b>
II.	Woodland Savannah	A. Low Rainfall			
		1. On Clay			
		(a) <i>Acacia mellifera</i> - thorn land			
		(i) Dark cracking clays alternating with grass	94.7	94.7	-
		(ii) On soils formed <i>in situ</i> , with <i>Commiphora</i> and <i>Boscia</i>	51.2	51.2	-
		(b) <i>A. seyal</i> - <i>Balanites</i> savannah alternating with grass areas	117.7	100.1	16.6
		(c) <i>Anogeissus-Combretum hartmannianum</i> S. Woodland	48.6	48.6	-
		<b>Total on Clay</b>	<b>312.2</b>	<b>294.6</b>	<b>16.6</b>
		2. On Sand			
		(a) <i>Acacia seyal</i> savannah	64.5	64.5	-
		(b) <i>Combretum hartmannianum-Albizzia sericcephala-Dalbergia</i> savannah woodland	84.5	84.5	-
		(c) <i>Terminalia</i> - <i>Sclerocarya</i> - <i>Anogeissus</i> - <i>Prosopis</i> savannah woodland	64.5	63.2	1.3
		<b>Total on Sand</b>	<b>213.5</b>	<b>212.2</b>	<b>1.3</b>
		3. Special Areas			
		(a) Toposa Hills	35.8	-	35.8
		(b) Hill Catenas	69.1	69.1	-
		(c) Baggara Catena	17.9	17.9	-
		(d) Raqaba Catena	33.3	31.6	1.7
		<b>Total Special Areas</b>	<b>156.1</b>	<b>118.6</b>	<b>37.5</b>
		<b>Total Low Rainfall Woodland Savannah</b>	<b>681.8</b>	<b>625.4</b>	<b>56.4</b>
		B. High Rainfall			
		(a) <i>Anogeissus</i> - <i>Khaya</i> - <i>Isobertlinia</i> Savannah woodland	307.2	30.7	276.5
		(b) Woodland savannah recently derived from rain forest	35.8	-	35.8
		<b>Total High Rainfall Woodland Savannah</b>	<b>343.0</b>	<b>30.7</b>	<b>312.3</b>
IV	Flood Region		243.2	7.3	235.9
V.	Montane Vegetation		6.4	3.8	2.6
	<b>Total Area</b>		<b>2477.8</b>	<b>1850.2</b>	<b>627.6</b>

Table 2: Percent-wise coverage of Forests &amp; Woodlands in The Republic of Sudan (2011)

Desert	Semi Desert	LRS		HRS	Special Areas	Montane	Flood Region	Total
		Clay	Sand					
38.6	26.2	15.9	11.4	0.9	6.4	0.2	0.4	100
Arid				Sub-humid			Humid	
92.1				7.5			0.4	100

## Forestry in the Sudan

Following the Battle of Omdurman at Karare between the Mahdist and the Anglo-Egyptian army, and the start of condominium rule in 1898, forestry activities started in the Sudan in 1901. The Government commissioned an Indian forester, Mr. C.E. Moriell to tour the country and produce a report about the state of forests in the country. As a result of his report the Woods & Forests Ordinance was promulgated in 1901 and the Department of Woodlands & Forests established the same year. The Ordinance was replaced in 1908 by the First Forest Act. Adoption and implementation of administrative & legislative measures continued ever since. The most salient of these are the endorsement of Sudan's Forest Policy in 1932, the Central & Provincial Forest Ordinances (1932), the Local Government Act of 1972, Regional Government Act 1980, the amendment thereof in 1985, the revision of Forest Policy in 1986 and the creation of the Forests National Corporation (FNC) and Revision of Forest Act in 1989.

Civil war erupted in South Sudan in August 1955, barely four months before independence in January 1956. The Addis Ababa Accord of 1973, which was reached to stop the civil strife in the South, created three ministries for agriculture; one in each of the three provinces, for which the forest sector was added. Since then forestry matters formally went out of the jurisdiction of the Central Government and Director of Forests in Khartoum.

The Civil war was rekindled in 1983. The Comprehensive Peace Agreement signed between the Government of Sudan and South Sudan Liberation Movement (SPLM) and Army (SPLA) in 2005 which ended a 50 years civil war embodied a self-determination referendum. In the referendum which took place on January 9<sup>th</sup> 2011, a majority of voters in Southern Sudan voted for cessation from Sudan Republic. Six month later, on July 9<sup>th</sup> the whole world starting with the Government of Sudan recognized the Republic of South Sudan (RSS) as member n° 193 of the United Nations and member n° 54 of the African Union. Maps 2 and 3.



Map 2: Republic of Sudan, post 9 July 2011.



Map 3: Republic of South Sudan

The RSS goes away with some 619,745 km<sup>2</sup> of the area and 8.26 million people of Sudan. It will also go with some 50% of the forest & woodland area of Sudan. The Republic of Sudan retains an area of 1,886 km<sup>2</sup> and some 50% of the forest & woodlands of its pre **July 9<sup>th</sup> estate**.

### ***Forest Cover and Inventory***

Sudan is well endowed with valuable timber trees. Examples include Suntu (*Acacia nilotica*), which grows on the banks of rivers and is suitable for railway sleepers and building material. Many endogenous species such as mahogany (*Khaya senegalensis*), gimbeel (*Cordia africana*), humeid (*Sclerocarya birrea*) and exotic species such as teak (*Tectona grandis*), Sarru (*Cupressus lucitnica*) provide high-quality wood for joinery and construction.

Monitoring of forest cover and biomass changes in Sudan is obtained from successive inventories and remote sensing images taken at various times and sites. This includes several studies conducted, including Andrews (1948), Harrison and Jackson (1958), Lewis (1953), Ferguson (1954). In 1982 the National Energy Administration (NEA), in collaboration with Forests Administration, University of Khartoum and the Regional Remote Sensing Facility (Nairobi) conducted a forest resource survey to assess the country's energy requirements. In 1987 Lund University conducted a survey covering an area of 0.58 million km<sup>2</sup>. The widest inventory was launched during the period (1995-1997), covering an area of 62.27 million hectares. In 1997 the Africover project commenced its activities covering 10 Nile Basin countries in addition to East African countries, including the Sudan. The state of forests can only be extrapolated from these ad hoc surveys and from the global Forest Resource Assessment (FRA) such as that by FAO (1990), 2000, 2005 and 2010.

Because of the limited resources these forest inventories have not been successful in establishing regular forest monitoring and data collection systems. The only frequent inventory activities available in Sudan are confined to plantations and some of the reserved forest where resource spending is more justifiable because of both productive and protective outputs. Therefore the current forest monitoring system is based on a bottom up system of reporting from the forest circles (the smallest management unit) up to the state forest and then to FNC at the national level. The data reported includes both qualitative and quantitative information on forest resources with more focus on reserved forests, afforestation and reforestation areas, harvest and production, fires, personnel, etc. This reporting system is done on monthly and annual basis. The current national reporting does not include estimation of GHGs emission/removal. However, FNC reports GHGs estimate to FAO and has at least six of its technical staff trained on GHGs inventory estimation and they participated in the two national GHGs conducted so far in Sudan for National Communication purposes. This is in addition to a large number of its experts and experts from other related institutions who received training on technical issues related to GHGs inventory, AR-CDM and REDD+.

Sudan's report to Global Forest Resource Assessment (FRA 2010) discussed the state of natural forests in Sudan depending on the statistics provided by previous FRAs. Complementary data related to forest cover and biomass changes and deforested areas are extrapolated from successive inventories and remote sensing images taken at various sites as well as forest products consumption surveys carried at the national level. The annual loss figures are also based on estimates of biomass consumption per region and on responses to such questionnaires sent to Forest Offices at the state and region levels.

In FRA (2010) forest is defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 per-cents, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use. Other wood land (OWL) is land and not classified as "Forest", spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these

thresholds *in situ*, or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use. Other land (OL) is land that is not classified as “Forest” or “Other wooded Land”.

The global forest resource assessments indicated a decreasing trend in the forest cover from 76.4 million ha in 1990 to 70.49 million ha in 2000 and 69.95 million ha in 2010 (30.5% to 28.1% and 27.9% of the country total area, respectively). For the period 2000-2008 the estimated area of actual forest loss was 907599 ha/year and that of regeneration was 853350 ha/year. These figures were used in FRA (2010) report to estimate the forest area in 2010 using the following formula: Forest in 2000 + (Annual regeneration x 10 years) - (annual forest consumption x 10 years).

The removal rate for OWL during the period 1990-2010 was based on the assumption that the total removal of forest and OWL is proportional to the area of each of the two classes (57% for forest and 43% for OWL). Although some OWL may have been converted into forest during this period, some of this loss was outweighed by the substantial increase in the area invaded by mesquite (*Prosopis chilensis*), which is classified as OWL and was estimated to be 149,420 ha/yr (FRA 2010). Accordingly, the figures in Table 3 suggest that the OWL area as percentage of the country area decreased from 23.2% in 1990 to 21.6% in 2000 and 20.0% in 2010.

**Table 3: Sudan forest cover and areas in 1990, 2000 and 2010**

FRA categories	Area (x 1,000ha)		
	1990	2000	2010
Forests	76,381	70,491	69,949
Other wooded land	58,082	54,153	50,224
Other land	103,137	112,956	117,427
Inland water bodies	12,981	12,981	12,981
Total area	250,581	250,581	250,581
Percent of forests area %	32.1	29.7	29.4
Percent of OWL area %	23.2	21.6	20.0

Source: FRA (2010)

The data also indicate that about 6,432,000 ha of Sudan’s forest land was deforested between 1990 and 2010, and this is equal to 2.57% of the total country area and to over 8.4% of the forest area. During the same period, about 7,858,000 ha of OWL were removed (3.14% of the total country area and over 13.53% of the OWL area). The great loss in both categories paved the way to desertification and diminution of water resources. The loss of forestland in the marginal areas of the north, accelerated by mechanized farming and drought, resulted in a steady encroachment of the Sahara southward. The main causes of deforestation in all regions of Sudan are land clearance for agriculture and the unsustainable extraction of wood through legal and illegal cutting of trees mainly for fuel wood (FNC 2011b). In conflict regions such as Darfur the rate of loss is significantly greater partly due to the destructive nature of fighting and partly due to the concentrated needs of displaced people, especially in the vicinity of camps. Moreover, the absence of a clear framework of land tenure constrains the development of incentives for communities/households to take responsibility for protecting trees.

Sudan forests are basically natural formations in reserved (government and community tenure) and non-reserved forests. Although afforestation and reforestation activities have been practiced in

the Sudan since 1911, so far their area is very small. In 1982 the area of all plantations in the country was about 52,000 ha (Badi *et al.* 1989). In 2009 it reached a total of 1,440,861 ha (FNC 2011b) and it represents about 2% of the total forest area and 12.7% of the reserved forests area. About 187,750 ha are in the Southern states and 1,253,111 ha in the Northern states. The largest share of plantations is grown in reserved forests (42.7%) and gum Arabic orchards (43.7%) in comparison to private (companies) forests (8.8%) and other community forests (4.8%).

Government plantations rely mainly on rain-fed system in the savannah region. About 5% of the plantation area is supported by irrigation in irrigated agricultural schemes and community tree formations. In spite of the small area and limited contribution of plantations, Sudan possesses a great experience in plantation establishment and management which goes back to the middle of the 20<sup>th</sup> century. These forests are grown in variable rotations and their management is based on working plans that attempt to maintain a sustainable flow of goods and services at community and national levels. However, the small area of plantation upsets the goals that aim at demand satisfaction of forest products from these plantations. (FNC 2011b)

The annual afforestation and reforestation programs ranged from 2,100 ha to 2,520 ha during the period 1910–1950 (FNC 2011b). The planting areas between 1990 and 2009 are given in Table 4. There was a declining trend in the total plantation area from the early 1990's to the first half of the first decade in 21<sup>st</sup> century. The data indicate that the average annual plantation area ranged between 23,190 ha during 1995-99 to 48,330 ha during 2005-09 (Table 4).

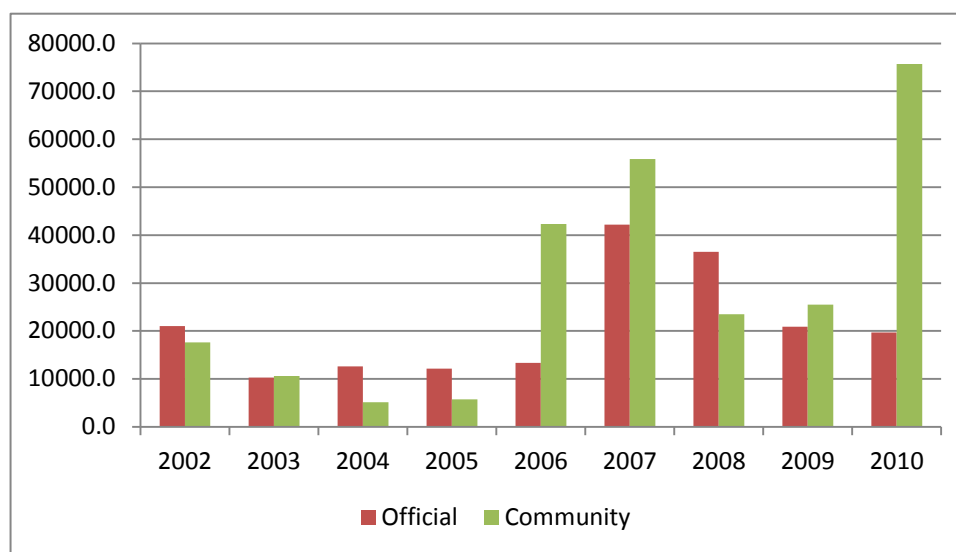
The area of forest regenerated within the period 2002-2010 through planting, sowing and natural regeneration were extracted from FNC annual reports and is illustrated in Figure 1 using data given by FNC (2011b). The annual plantation areas include afforestation, reforestation, natural regeneration of existing forest lands and natural expansion of forests into land not previously forested. The data on regeneration include areas which are cleared and then regenerated on both forests and other wooded land, but they exclude natural regeneration under existing tree cover. The data indicates the fluctuating nature of the annual planting, which depends on the availability of resources, perhaps mainly the foreign aids. It also shows that community plantations are significantly increasing during recent years (Figure 1).

**Table 4: Afforestation/reforestation areas (in ha) from 1990 to 2009**

Period	Public (in and outside reserved forest)		Community		Total
	Total	Average/yr	Total	Average/yr	
1990-1994	122,940	24,590	56,390	11,280	179,330
1995-1999	117,230	11,160	60,170	12,030	177,400
2000-2004	69,870	13,970	52,440	10,490	122,310
2005-2009	133,630	26,730	107,980	21,600	241,610

Source: FNC (2011b)

Figure 1: Annual planting areas during 2002-2010



### Benefits of Sudan Forests

Forests and rangelands in the Sudan have significant protective and productive functions and as such offer many opportunities to contribute to the economic, environmental and social development of the country. As such, they can contribute to poverty alleviation and the enhancement of the well-being of people living in the vicinity of forest and of the country at large.

- Protective functions of forests, trees and rangelands in Sudan encompass their safeguard of watersheds; protection & fixation of soil; shielding of agricultural systems; habitat for livestock & wildlife and shelter to human settlements.
- Productive functions of forests, trees, shrubs and rangelands in the country include provision of wood and non-wood products (NWFPs).
- Wood products include lumber, sawn timber, industrial wood, building poles, firewood and charcoal.
- NWFPs on the other hand include a wide range of products such as browse & range material; ivory; bush meat; bee-honey & wax; gums & resins; bark derivatives such as tanning material; fruits, nuts & seeds such as Gonglais (fruit of *Tabeldi=Boabab-Adansonia digitata*), Goddeim (fruits of *Grewia tani*), Aradaib (fruit of *Tamarindus indica*), Lalob= Desert dates (Fruit of *Balanites aegyptiaca*), Dom (fruit of *Hyphane thebaica*), Dolaib (Fruit of *Borassus aethiopum*) and Nabag (fruit of *Ziziphus spina-christi*) together with medicinal plant parts such as Senna pods & leaves (*Cassia senna*), Garad pods (of *Acacia nilotica*).
- Products from forest tree leaves include robes, baskets, mats, food covers and hats made from Dom and Doleib fronds together with bark of Tabeldi.
- Range products include browse and grazing material from thorny trees & shrubs together with thatching material and food covers made from Banu (*Arigrostis spp.*).

The most valuable non-wood forest product in Sudan is gum Arabic (G.A.). GA is defined by the Joint Expert Committee of FAO & WHO on Food Additives (JECFA) as the dried oxidates from stems and branches of Hashab (*Acacia senegal*) and Talh (*A.seyal*). Exports in 2010 totaled around 55,000 tons with a value of around US\$78 million (Sudan Customs 2010). Other products include live animals, honey, hides, fruits, handicrafts and medicines (see Table 5 ). Trees also represent an important diet for livestock in the dry months; however, precise data on this value are not available.

## 5 . Non-wood forest products in Sudan ranked in terms of value

Rank	Product	Unit	Quantity	Value (1000 SD) *
1	Gums (Arabic, talih, kakamout and Luban)	Ton	55,000	US\$78 million
2	Living animals	Unit	664	132,384
3	Wild honey and bee-wax	Ton	1,350	297,000
4	Hides, skins and trophies	Unit	1,389	5,626
5	Fruits		-	4,400
6	Fodder		-	-
7	Raw material for utensils, handicrafts and construction		-	100
8	Other plant products		-	-
9	Raw material for medicine and aromatic products		-	1,000
10	Ornamental plants		-	-

Sources: World Bank 2007; FAO 2010. \*except gums which are in US dollars

## Range resources

Sudan has the largest livestock inventory in Africa after Ethiopia. The nomadic pastoral sector accounts for more than 90% of the huge animal population. See Table 6 for details.

Rangelands cover an estimated area of 96.4 million hectare composed of 53,424,842 ha of grassland and 42,928,334 ha of woodlands containing scattered trees and shrubs (Afri-cover 2003). This vast area encompasses different ecological zones extending from desert and semi-desert in the north to low and high rainfall savannah to the south. Nearly 80% of all rangelands are located in semi-desert and low rainfall savannah ecological zones that are characterized by variable and unpredictable rainfall.

The rangelands of importance to traditional livestock raising are confined to the semi-desert, low rainfall savannah, and the northern fringes of the high rainfall areas. In the semi- desert the plant cover is a mixture of grasses and herbaceous plants intermingled with *Acacia* trees and shrubs representing the main grazing areas for camel and sheep. The low rainfall savannah on clay and sand have a plant cover of a mixture of *Acacia* species, shrubs and a number of herbaceous plants.

Sudan's total national herd is estimated in 2010 at 103.6 million head of livestock (sheep, cattle, goats and camels), 8.3 million head of equine (donkeys and horses) and 36.6 million head of poultry.

Rangelands are estimated to have a total production of 34.8 million tons of forage. Total available feed is 50 million tons composed of 34.8, 14.1, 0.5 and 0.2 million tons of forage from



rangelands, crop residues, irrigated pastures and concentrates, respectively. Total animal feed is estimated at 93 million tons. See Table 7 for details.

Rangelands contribute substantially to the income and subsistence of a large sector of the population who are either pastoralists (nomads) or agro-pastoralists by providing important forage feed resource. It supplies about 80% of the total feed requirement of national herds. Cattle, sheep and goats provide an important capital asset and a risk management tool for pastoralists and farmers at times of drought. Income from the sale of livestock is used to meet household food requirements, market goods, drugs, vaccines, salt, feeds, pay water fees and tax.

**Table 6: Estimates of livestock population by States, 2010**

State	Cattle	Sheep	Goats	Camels	Total
North Kordofan	960,503	7,223,357	3,605,603	1,212,613	13,002,076
South Kordofan	7,349,936	3,098,701	3,366,678	519,163	14,334,477
North Darfur	668,176	3,760,104	2,888,827	578,337	7,895,444
South Darfur	4,217,861	3,843,430	2,997,429	155,795	11,214,515
West Darfur	4,050,817	3,905,925	4,387,541	417,919	12,762,202
Elgadarif	1,044,025	2,135,239	1,055,616	334,705	4,569,586
Kassala	960,503	2,020,665	1,668,134	674,496	5,323,798
Red Sea	125,283	416,632	716,777	280,154	1,538,845
Blue Nile	2,004,528	3,905,925	451,786	13,869	6,376,108
Sennar	1,461,635	1,374,886	1,633,382	114,188	4,584,090
Elgezira	2,463,899	2,473,753	2,137,297	120,660	7,195,609
White Nile	3,466,163	2,551,871	2,549,987	34,673	8,602,693
Northern	250,566	979,085	1,146,842	48,079	2,424,573
River Nile	83,522	1,005,125	1,203,316	111,877	2,403,839
Khartoum	250,566	442,672	642,927	6,472	1,342,637
<b>Total</b>	<b>29,357,983</b>	<b>39,137,369</b>	<b>30,452,141</b>	<b>4,623,000</b>	<b>103,570,493</b>

**Table7: Available forage resources (Million Ton), 2011**

States	Rangeland	Crop residues	Irrig. forage	Concentrates	Total
North Kordofan	4.70	0.910	0.09	0.01	5.71
South Kordofan	8.19	1.400	0.00	0.03	9.62
North Darfur	1.05	0.08	0.00	0.00	1.13
South Darfur	0.50	0.770	0.005	0.015	1.29
West Darfur	12.06	0.037	0.0014	0.005	12.10
Elgadarif	2.70	2.700	0.02	0.035	5.46
Kassala	1.30	2.423	0.009	0.015	3.75
Red Sea	0.38	0.037	0.00	0.00	0.42

Blue Nile	1.90	1.00	0.00	0.02	2.92
Sennar	0.26	1.070	0.020	0.02	1.37
Elgezira	0.49	2.600	0.030	0.01	3.13
White Nile	0.47	0.790	0.041	0.02	1.32
River Nile	0.35	0.250	0.155	0.02	0.78
Khartoum	0.42	0.08	0.18	0.0009	0.68
<b>Total</b>	<b>34.77</b>	<b>14.15</b>	<b>0.54</b>	<b>0.20</b>	<b>49.67</b>

The importance of pastoral sector goes beyond its influence on the economy to its role in securing national and strategic food. It allows self-sufficiency in meat (100%) estimated to be about \$2.2 billion/yr while animals export amounts to about 24.6% of the non-petroleum exports. In addition, the contribution of the sector in the national income estimated as 18–25% and it represents a livelihood activity for about 60% of the population as well as providing labour for about 40% of the population.

Rangeland is endowed with a great diversity of forage plants genetic resources (FPGR) and a total count of 704 plant species was reported (over and understory), however the loss of FPGR is being experienced at an alarming rate. Immense changes occurred within the different vegetation zones compared with the 1958 base line survey (Harrison and Jackson Report, 1958) but little work was carried out thereafter. Many of the valuable range plants species are endangered while others become rare. Species such as *Andropogon gyanus*, *Blepharis linariifolia*, *Chrosophora brochidiana*, *B. edulis*, *Ischaemum ishaemoidis*, *Dismodium dichotomum*, *Aristida papposa* are among the most endangered. Forage plants are not only source of livestock feed, they constitute the origin of many crops of the present day and in future.

Trends of decreasing annual rainfall and increased rainfall variability have contributed to drought conditions in many parts of Sudan, which occurred in the northern and central parts. Average annual rainfall has declined from about 425 mm/year during the 1941-1970 period to about 360 mm/year in the 1970-2000 period. This represents a decrease of annual rainfall of about 0.5% per year.

The unreliable nature of rainfall, together with its concentration in short growing seasons, heightens the vulnerability of grazing and rain-fed agricultural systems. Accordingly, agro-climatic zones shifted southward, negatively affecting pastoralists and agro pastoralists living in many parts of the country who became increasingly unable to sustain production levels of animal feed and subsistence agriculture. The potential impact of these changes on national food security could be severe. The rangelands are the most vulnerable to climate variability and climate change; this vulnerability is further exacerbated by misuse and mismanagement of the land resource. Furthermore, rangelands are used in common with animal being in the move searching for feed and water. The impact of the climate change in FPGR is clearly manifested in:

- Steady deterioration of both the productivity and biological diversity of the rangelands in the area coupled with dominance of undesirable range plant species, disappearance of valuable forage species, loss of biodiversity and change in species composition,
- intensifying pressure on the fragile and deteriorating resource base and

- reduction of rangelands productivity per unit area from 1.2 ton/hectare in 1980s to 0.2 ton/ha in 2009 (Range and Pasture Administration 2009).

Consequently, these further resulted in inability of the dependent livestock to produce well paving road for poverty and food insecurity; and exacerbating the vulnerability of pastoralists and exposing them to unsustainable livelihoods associated with poverty and food insecurity.

Nomads in the east and central clay plains of the Sudan were allocated certain areas for grazing of their animals and access routes to the rivers and other watering places. Those allocations were made since 1904 to avoid conflicts over land resources between the nomads and the settled farming communities. While the nomads were strictly cautioned against trespassing on crop fields they make agreements with the farmers to permit foraging of herds on crop residues after harvest. The cultivators were equally restrained from encroaching upon the nomadic grazing areas or passage corridors. The land use systems went on smoothly with mutual benefits between the farmers and the nomads until the advent of mechanized farming into the area. More importantly, the systems were sustainable because of the resilience of the communities, who were able to cope with the environmental hazards while maintaining ecological equilibrium (Seif Eldin 1986).

#### **Land Ownership and Usufruct Rights:**

Traditional land tenure in rural areas of Sudan is mainly based on the concept of customary tribal homelands. Even in the northern riverine regions land has become a commodity only during the 18<sup>th</sup> century. A detailed review is in Annex 3. The Funj and Fur Sultanates empowered the ruler to grant land rights to administrators and reputed religious figures. The Turco-Egyptian Government (1820- 1885) consolidated this system. The Madhya (1886-1898) changed the tribal leadership and put it in the hands of army leaders. It has also encouraged population movement and tribal interwoven relations. The colonial government (1898-1953) issued in 1899 the 'Titles to Land Ordinance' and registration as private property started for continuously cultivated lands in north and central Sudan. This excluded the rain-fed and all lands in Southern Sudan. (Mohamed 2007).

Areas classified as government-owned was divided into Subject to No Right and Subject to Customary Rights.

As a guarantee for having the power to withdraw the customary rights, the government issued the following legislations (Egemi 2006).

1. Land Acquisition Ordinance 1903,
2. Land Settlement Ordinance 1905,
3. The Native Disposition of Lands Restrictions Ordinance,
4. The 1920 Declaration on the Gash,
5. The 1925 Land Settlement & Registration Ordinance,
6. The 1927 Gezira Land Ordinance,
7. The 1930 Land Acquisition Ordinance.

Land tenure legislation after independence in 1956 remained similar to that of the colonial era.

All in all land tenure legislation and policies are highly elaborate compared to other natural resource legal frameworks in Sudan. In part, this is a legacy of the colonial system of land ownership and user rights, which was semi-codified and reasonably well developed. These were

largely effective and contributed to creating a basis for preservation of the traditional subsistence based livelihoods in rural communities (IFPRI, 2006). Today the interface between statutory and customary land laws and legislation is complex, and is partially the result of changes in both, which have their roots in the colonial period.

The Title to Land Ordinance (1899) and the Land Settlement and Registration Ordinance (1925) addressed land tenure prior to independence. The 1899 Act recognized private property in north and central riverain Sudan (not considering land tenure in the rest of the country), while the 1925 Ordinance listed the criteria for registered land, noting that all unregistered land was to be considered as government property (Section C). The Ordinance did, however, allow space for land claims to be verified with various authorities, both statutory and customary. The Ordinance describes in detail the process of determining land rights and other rights attached to it, and defines the formation of land committees and the appointment of land registration officers to discuss competing land claims.

Although the 1925 Ordinance was designed to allow for land registration, all registration was centred in Khartoum to register riverine lands and large agricultural schemes (like the Gezira Scheme 1912) (IFPRI 2006). In peripheral regions like Darfur, land continued to be allocated according to customary rules and regulations such as the Fur Agricultural System and the Baggara Pastoral Production System.

Other laws that were enacted in the colonial period extended government entitlement to forests. The Central Forest Act (1932) and the Royalties Act (1939), extended government entitlement to forests, granting the government access to wood fuel for transportation and urban development.

The Unregistered Land Act was passed in 1970. Its application was country-wide, including the peripheral regions of Darfur, Kordofan, Blue Nile, East Sudan and what is now the Republic of South Sudan, which have or had no previous system of land registration. Article 4 (1) states that: "All land of any kind whether waste, forest, occupied or unoccupied, which is not registered before the commencement of this Act shall, on such commencement, be the property of the Government and shall be deemed to have been registered as such, as if the provisions of the Land Settlement and Registration Act, 1925, have been duly complied with" (Sudan Government, 1970)

In effect, the 1970 Unregistered Land Act served to nationalize all unregistered land across the country and, in doing so, established the concept of land as a commodity that could then be further privatized and transferred to individual ownership. The impacts of the Act were disproportionally borne by pastoralist communities. As the Act did not recognize customary land arrangements, groups of pastoralists were left disenfranchised from their traditional homelands, and practically prevented from user access rights to water and land for grazing (IUCN 2007). According to the Act "if any person is in occupation of any land which is registered or deemed to be registered in the name of the Government, it may order his eviction from such land and may use reasonable force if necessary" (Government of Sudan, 1970). The Act also deprives prior land users from the right to compensation for the loss of land or for the opportunity to be generated from the use by the government or the private sector.

The 1970 Unregistered Land Act came into force in a prevailing situation of intense environmental pressure for rural populations in Sudan, serving to compound the concurrent phenomena of widespread and severe drought, population displacement, and expansion of urban agricultural enterprise into rural areas (Young and Osman *et al.*, 2009). The dissolution of the

Native Administration had also left an apparent governance gap at community level, especially in relation to conflict and disputes over land. Although the Native Administration was, to some extent, reinstated in 1987, by this time the authoritative strength of customary leadership and tribal chiefs had diminished, and in later years the credibility and legitimacy of the tribal leadership of some groups also came into question (Abdul Jalil *et al*, 2007). In spite of this, tribal institutions remain one of the key actors in relation to land and have recognition by the State, although their relationship to other levels of governance is not entirely clear.

The 1970 Unregistered Land Act was repealed by the 1984 Civil Transaction Act which articulates the legal framework regarding land access. Importantly, the Act asserts that registered usufruct rights have equal legal weight to registered ownership. The Act also includes provisions of Sharia Law, whereby it guarantees in some instances rights to access formerly unregistered land (urf), however reaffirms the State as a land owner. The primacy of the state is enshrined by the Act, which removes jurisdiction from any court to receive complaints that “go against the interest of the state” (Government of Sudan, 1984)

The Local Government Act 1998 was an attempt to restore the land management and administration vacuum at the local level created by the abolition of the Native Administration system in 1971 (De Wit, 2001). According to the latter, the Act confers important responsibilities to the States and localities (mahaliyya) and calls for:

identification of territories of jurisdiction that reflect rural reality with the possibility of identifying territories of local governance that coincide with customary land management territories.

. Setting and functioning of land management committees. These committees exist in every locality (for example, in Darfur) and are functional. The committees are made up of representatives of various sectoral departments and contribute to decision-making on validation of land claims to allow registration. A similar over-arching committee exists at State level, usually linked to the Ministry of Agriculture, which performs a similar function.

Development of transhumance routes. For example, there are committees at State and Locality level whose function it is to determine bylaws on grazing land and transhumance routes, as dictated by the State Acts which regulate grazing and farming.

Active and legal involvement of customary authorities and land users in land management. For example, the Act gives States the authority to formulate their respective Native Administration State Acts.

Accountability for proper land management.

Sudan’s 1998 Constitution, based on the philosophy of federalism (adopted since 1994) provided for the rights and duties of the States over land and resource management. However, the division of powers remained unclear and there were no means of verification on implementation of the law. According to the Constitution:

The States have competence to exclusive jurisdiction in relation to States lands, natural resources, animal wealth and wildlife resources.

The States are competent to exercise concurrent jurisdiction in relation to the environment.

.The extent of jurisdiction and share of revenue out of land and forest resources will be defined by constitutional mechanism or by Federal Act. For example FNC shares 40% of its revenue from Royalties with State Ministry of Agriculture in all states (see Council of Ministers Decree No.40,

1997 and the Memoranda of Understanding between FNC and the States regarding division of authority and forestry revenue of the state).

The Interim National Constitution of Sudan (2005) provided specific articles for the ownership of land and the management of natural resources, thereby giving impetus to socially informed land tenure policy and legislation. The Interim Constitution called for competency in land administration and provided for the incorporation of customary laws and practices. It stipulated the creation of four Land Commissions for the purposes of arbitration, entertaining claims against the relevant government or others in relation to land, assess appropriate land compensation, and make recommendations on land reform policies and recognition of customary land rights or law (Interim National Constitution of Sudan, 2005). The Constitution also gives each State the right to the “development, conservation and management of State Natural Resources and State Forest Resources” (ibid, pp.104). This raises the challenge of institutional arrangements that would ensure inclusive, just and equitable use and management of land and natural resources. Land Commissions stipulated under the Interim Constitution face considerable challenges, including:

. The Commissions, where created, are mandated to make recommendations only. The Darfur Land Commission, however, is also empowered in matters of policy development and monitoring. In addition, it has the mandate to arbitrate on disputes related to land rights and assess relevant compensation for applications that are brought before it. (DDPD, Art 201) How claims to rights are to be made, re-made, legitimated and contested and whether claims to rights are to be made on an individual or collective basis is unclear.

Recognition of customary rights in the Interim Constitution also raises the question of the position and mandates of customary structures and institutions, and the way in which they relate to formal institutions at various levels of governance.

It is not clear whether the National Land Commission should be centralized or decentralized and the Interim Constitution does not clarify this.

The rights of representation of pastoralists and farmers in the Land Commissions are not reflected in The Interim Constitution.

Traditional land tenure in rural areas of Sudan is mainly based on the concept of customary tribal homelands. Even in the northern riparian regions land has become a commodity only during the 18<sup>th</sup> century. The Funj and Fur Sultanates empowered the ruler to grant land rights to administrators and reputed religious figures. The Turco-Egyptian government consolidated this system. The Mahdiya changed the tribal leadership and put it in the hands of army leaders. It has also encouraged population movement and tribal interwoven relations. The colonial government (1898-1953) issued in 1909 the ‘Titles to Land Ordinance’ and registration as private property started for continuously cultivated lands in north and central Sudan. This excluded the rain-fed and all lands in Southern Sudan. (Mohamed 2007).

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- The 1925 Land Settlement & Registration Ordinance,
- The 1927 Gezira Land Ordinance,
- The 1930 Land Acquisition Ordinance.

Land tenure legislation after independence in 1956 remained similar to that of the colonial era. Some tribal systems of land tenure are still in force such the Fur Agricultural System and the Baggara Pastoral Production System.

Sudan's Forest Policy (1986) defines and recognizes several levels of forest ownership. These include:

- i. Federal Forests which fulfil national protective, productive & social functions (such as the *Acacia nilotica* forests along the banks of the Blue and White Niles & tributaries thereof, montane forests on watersheds and forests on the fringes of the desert curbing further spread of the latter), owned by the Federal Government and managed on its behalf by the national forest service, currently the Forests National Corporation (FNC),
- ii. State Forests which fulfil productive and social roles at the State (Provincial) level, contribute to national protective functions, owned by the State Government and managed on its behalf by State Forest Service or by FNC,
- iii. Institutional Forests such as the ones in large agricultural schemes e.g. Gezira, New Halfa and Rahad Schemes and sugar estates as in Kenana, Assalya, W. Sennar N.Halfa, Guneid and White Nile Sugar Companies. These fulfil productive / protective / social functions in the vicinity but contribute to the national environmental matrix and carbon dynamics. They are owned by the respective institutions and are managed by on their behalf by own forest units,
- iv. Community Forests which fulfil a multitude of functions to their respective communities, are owned and managed by them,
- v. Private Forests which fulfil various functions and are owned and managed by their initiators.

The status of forest reservation is reflected by the data given in Table 8. The total reserved area consists of public, institutional, community, private and wildlife forest reserves and by the end of 2005 it reached 29,214,240 ha. The reserved public forests represent 4.54% while, that occupied by other protected areas (including wildlife reserves) represent about 7.12% of the total area of the country. The public (FNC) reserved forest area was remarkably increased (by nine times) from 1.25 million ha, which were reserved before 1986, to approximately 11.4 million ha by the end of 2005. Community and private forest reservation started in mid-1980s and is showing an increase of over six and twelve times, respectively, between the periods 1986–2000 and 2001–2005. The area of institutional forest reserves is very small. It increased by nearly 8,687 ha (2.7 folds) from 1986 to 2005 and remained at that figure till now (FNC 2011b).

Currently, only 11.65% of the total area of the country is reserved to forests and other natural resources uses, while the Quarter Century Strategy (2003–2027) entails that 25% of the total area should be assigned for natural resources. This gives a great opportunity to more than double up

the area of reserved forests for various purposes allowing for better protection and development of the forest resources and environment. Future reservation of productive forests would likely be either state or community forests because since the establishment of federal system all unregistered (governmental) land became under the administration of state governments. The Decree No. 40 (1997) issued by the Council of Ministers specifically stated that forests protecting inter-state water, watersheds and federal structures and forests arresting the process of desertification are federal forests to be managed by FNC. Other forest reserves are to be managed by the states, and private, community and institutional forests are to be managed by their owners. This is expected to encourage further reservation by various tree growers.

**Table 8: Area (hectares) of reserved forests by type of ownership**

Type of land ownership	1901–1985	1986–2000	2001–2005
Public forests	1,253,280	10,032,323	11,362,205
Institutional forests	5,040	13,724	13,724
Community forests	0	4,150	26,056
Private forests	0	4,753	59,770
Wildlife protected reserves	17,740,800	17,740,800	17,740,800
<b>Total</b>	<b>18,999,120</b>	<b>27,795,750</b>	<b>29,202,555</b>

Source: FNC (2011b)

## Drivers of deforestation and forest degradation

### Main drivers

#### Wood products – wood fuel and other products

Demand for wood fuel and cut timber are likely to be key drivers of deforestation in Sudan. Current supply and demand data for wood products is not available. However, studies undertaken before the oil boom suggest that demand for wood products, particularly wood fuel, was unsustainable. This provides circumstantial evidence that the recent rise in deforestation rates from 0.7 to 2.2% may be due in part to the secession of South Sudan and a significant switch back from oil to wood fuel.

The oil boom has changed the use of wood fuel dramatically. Over the last 20 years, Liquefied Petroleum Gas (LPG) companies have expanded their operations in distribution of gas cylinders for the domestic and services sectors in Sudan. Companies include Aman, Abarssi, Iran, Total and Agip gas. Over that time, most bakeries in urban centres shifted from wood fuel to electricity or gas. Many brick kilns, however, continued to use wood fuel. Under Sudan's structural adjustment and liberalization project, which started in 1992, subsidies and investment concessions were lifted which led to LPG companies expanding their activities. A switch to LPG was accelerated following the commencement of Sudan's oil exports, with LPG prices dropping by around 50%. While the use of LPG is still widespread in Sudan, the recent secession of South Sudan and the associated drop in gas supplies, has very likely led to many energy users switching back to wood fuel.

The most important forest product is wood fuel, making up around 87% of the wood consumed in Sudan and supplying around 73% of Sudan's energy requirements. Poles and sawn wood



accounted for 13% of the wood consumed in the country. The sawmilling and furniture industries are the main wood processing industries in the Sudan. Wood-based panels and paper products are imported. Poles and other forms of round wood are important in housing construction. In southern and western Sudan nearly all houses are built from, and repaired using, round timber.

FAO data from 2000 also suggest that demand for wood may have been unsustainable. Total wood consumption (including fuel wood, charcoal, poles, locally produced saw logs/sawn wood and imported sawn wood) was 22.6 million m<sup>3</sup>. The total annual input (allowable cut) was around 11 million m<sup>3</sup> from northern parts of Sudan. This left an annual deficit of around 11.6 million m<sup>3</sup>. As plantation programmes did not fill this demand gap, pressure on wood products were probably unsustainable (though the lack of data on the supply and demand sides should be borne in mind).

Sudan's survey of forest products consumption and the national forest inventory conducted under the National Forest Programme (nfp) attempted to quantify supply and demand of wood products. As highlighted by Abdel Nour (2000) both studies had limitations. The demand survey was conducted in a distorted demographic situation; with around 3 million people from Southern Sudan (10% of the total population) displaced by the civil war to the most wood-deficit areas of Sudan. At the same time, the forest inventory was restricted to the north of Sudan due to the civil war. Consequently, the surplus forested areas of Southern Sudan, Southern Blue Nile and Southern Darfur were not included in the inventory. The demand survey indicated that total consumption of wood in 1994 was around 15.8 million m<sup>3</sup>. Projected to 1998, the total consumption was around 18.2 million m<sup>3</sup>. From the forest inventory, the annual allowable cut was estimated at around 11.7 million m<sup>3</sup>, representing 7% of the total standing volume. This would leave an annual deficit of around 6 to 7 million m<sup>3</sup>.

### **Crops and cultivation**

Expanding cultivation over the last 30 years to feed a growing population and to supply demand in export markets has been a key economic driver of deforestation. This is likely to continue as the poor harvest of 2011/12 pushes up prices.

Over the last 30 years, mechanized rain-fed farming expanded on millions of hectares of Savanna woodlands (Abdel Nour, 2000). Large investments have been made in mechanized, irrigated and rain-fed cultivation, with their combined areas accounting for roughly two-thirds of Sudan's cultivated land in the late 1980s. In 1981 the Government offered a range of incentives for increasing productivity to cultivators of irrigated land who were almost entirely government tenants. However, most of the increase in crop production has been due to expanding the area of cultivated land, which in turn has driven deforestation and woodland degradation rates.

Following a very good harvest in 2010/11, the cereal harvest for 2011/12 has dropped substantially due to reductions in area planted; reductions in area harvested and lower yields per unit area (Robinson 2012). The FAO's 2012 Assessment Mission estimates total cereal production of 2.7 million tons comprising 2.1 million tons of sorghum; 0.4 million tons of millet; 0.3 million tons of wheat, 51,000 tons of maize and 28,000 tons of rice.

Inadequate domestic production will result in a cereal deficit in 2011/12 of -2.86 million tons. By November 2011, the wholesale market price of sorghum increased to 120 SDG/ 90 kg in the main production zones, almost double the selem price (70 SDG/ 90 kg). As a result, the local sorghum price is similar to export parity prices. The other main rain fed crops grown in Sudan

are sesame, groundnut and sunflower. All have suffered from the poor rains in 2011 with the sesame harvest estimated to be 60% lower than the previous year, groundnuts down 10% and sunflower down 75%.

### **Livestock**

Export demand for meat, particularly in the Middle East, has led to increased livestock production. This suggests that livestock is an important driver of deforestation and degradation, particularly as agricultural cultivation of crops has simultaneously reduced the area of woodlands on which livestock graze for part of the year.

As livestock-raising provides significant employment, modernization proposals have been based on improving existing practices and marketing for export, rather than moving toward the modern ranching that requires few workers. In 2011/12, livestock are generally in good condition throughout the country despite poor rains (Robinson, 2012). Animal prices are firm reflecting buoyant export and domestic markets with pastoralists benefitting from improved terms of trade. Livestock data provided by the Sudan Ministry of Agriculture suggest a 9% overall rise in 2011/12. While the assumptions underlying these data are weak, this suggests that livestock will continue to put pressure on wooded areas, particularly where expanded cultivation may lead to overgrazing in reduced areas of woodland.

### **The decline of forest cover in the Sudan in the last two decades of the 20th century**

The area of the Sudan under forest cover was estimated by Jackson (1960) at 585,000 km<sup>2</sup> of productive forests, or 58.5 million ha, being 23% of Sudan's land area. Jackson admits that adequate data are not available for sound estimates and the figures he gives are merely guesswork to provide some sort of a picture of the forest resource as a guide to future policy.

World Bank (1986) explains that productive forests are interpreted in the narrow forestry sense of containing commercially exploitable trees in areas where the tree cover is greater than about 40%. The World Bank (1986) estimates the forest cover at 94 million ha in 1983 stating that no national inventory has been done to verify that datum, and only limited inventories were made for specific purposes such as sawmilling and forest production were carried out. FNC (2001) adds that in response to the environmental crisis that befell the country during the 1970s and the surge in agricultural expansion, forests denudation for fuel, the intensification of overgrazing and desertification that the environmental and energy problems were the prime concern. The National Energy Administration undertook the task of a nationwide survey to assess the country's energy resources and needs. The Forests Administration co-operated in the forest inventory component. NEA (1982) used 1970s Land sat photo-imagery covering the country, supported by ground surveys in the provinces of Kassala, Blue Nile and White Nile. The document gives details of the forest cover by province in the Sudan. The total area was shown to be 112.5 million ha of woody biomass vegetation. NEA explains that Land sat and ground survey reveal clearly that forest distribution within the northern provinces was heavily skewed, with the provinces of southern Kordofan and Darfur containing more forested area than all the other northern provinces combined.

FNC (1998) conducted a national inventory covering the northern Sudan south of 16°N latitude, excluding the desert region and areas of conflict in southern Kordofan and southern Blue Nile. Stock survey was conducted in 20 x 100 meter plots systematically located in a grid 10 x 10 km covering an area of 622,700 square km. The document provides the overall result of the inventory

showing areas under tree or shrub cover and area under forests where the crown cover according to FAO definition of forest, exceeds 10% of the land area. The northern Sudan had 41.5 million ha of forest and shrub land. In 1998 after a gap of 16 years, the northern Sudan had a forest and shrub covers of 38.3 million ha an annual change of 193,000 ha and at an annual rate of change -0.5%.

FAO (1992) published estimates of forest and deforestation rate in tabular form for countries in the five continents. For developing countries FAO defines forest as an ecosystem with a minimum of 10% crown cover of trees and/or bamboos, generally associated with wild flora and fauna and natural soil conditions, and not subject to agricultural practices. The backbone of the data is based on information and knowledge provided by the countries, verified and supplemented with the studies and remote sensing analysis using the latest technology. The estimates of forest area for the Sudan given by FAO between the years 1980 - 1990 were 47.79 million ha and 42.98 million ha, respectively, or an annual change of 481,700 ha (-1.0%/yr). FAO (1999) gave similar data for the Sudan over the period 1990-1995 as 43.38 million ha and 41.61 million ha, respectively, or an annual change of 353,000 ha (-0.8%/yr).

The forest cover data provided in FAO (2001) for the year 1990 are quite different from those given in FAO (1992). FAO (2001) explains that recent figures represent the most current global data set available for forest area and forest area change. The source of the data is FAO Forest Resources Assessment 2000 project adjusted by FAO to the standard reference years 1990 and 2000. Accordingly the data for Sudan 1990 and 2000 are 71.2 million ha and 61.6 million ha, respectively, or an annual change of 959,000 ha (-1.4%/yr).

Ali and Bayoumi (1999) attempted to assess and map desertification (deforestation) in Kordofan and Darfur, using Normalized Difference Vegetation Index images created from Advanced Very High Resolution Radiometer Sensor on board the National Oceanic and Atmospheric Administration satellite. The result produced from the images gave good indicators of vegetation degradation through the period 1982-1994. The areas affected were divided into four classes as follows (in km<sup>2</sup>):

<b>Light desertification</b>	<b>101,836</b>
<b>Moderate desertification</b>	<b>68,367</b>
<b>Severe desertification</b>	<b>20,817</b>
<b>Very severe desertification</b>	<b>8,163</b>
<b>Total area desertified</b>	<b>199,183</b>

The area of the desert increased from 205,000 km<sup>2</sup> in 1958 to 340,000 km<sup>2</sup> in 1994 at the rate of 8 km<sup>2</sup> per annum (2.1% per annum).

The forest and woodlands have decreased at a rate of 598,000 ha/yr, equivalent to 0.8%, during 1990-2000 and 54,000 ha/yr during the period 2000-2010. As such Sudan is among the ten countries in the world with largest net loss of forest area during the last decade of the 20<sup>th</sup> century (FAO 2010).

### **Underlying causes of deforestation and forest degradation**

Many such interwoven causes can be cited (see Box 1). These include:

1. **Climatic & Environmental Variables:** These include intrinsic aridity and erratic rainfall coupled with recently setting in vagaries of climate change and the attendant extremes of climatic phenomena such as drought and floods. As such tree establishment is difficult

and expensive. *There is a standing order for search for adapted and tolerant multi-purpose plant species and varieties and measures to mitigate the effects of climate change and associated phenomena* (Nair and AbdelNour 2011),

2. Population growth, demographic changes and change in societal aspirations and consequent pressure on scarce resources like land & water and changes in demand for goods & services from forest and range sector:
  - 2.1. Rising human and animal populations,
  - 2.2. Demand for food and food security considerations; pretexts easily echoed by politicians to justify putting forests and woodlands under the plough. In many situation this is what triggers horizontal expansion of agriculture at the expense of forest and rangelands and resulting deforestation. *There is evident need to reconcile forest policy with policies of other sectors like agriculture,*
  - 2.3. Requirements of wood, wood products & NWFPs, browse & range material and habitat for wildlife,
  - 2.4. With a high segment of young people in the population and their changing requirements, demand rises for such commodities as building material and learning material (paper).
3. Influx of political and environmental refugees and internally displaced people (IDP) due to wars and civil strife:
  - 3.1. Their heavy dependence on wood for shelter building, energy requirements and sale for income,
  - 3.2. Lack of control: The physical absence of forest authorities from the scene, domination by war lords or the explicit directives from government and humanitarian activists to them not to intervene,
4. Urbanization:
  - 4.1. Sprawl on forests & woodlands,
  - 4.2. Requirements of building timber and fuel wood for brick and lime-making and bakeries,
  - 4.3. Requirements of charcoal for domestic & service sectors,
  - 4.4. Requirements for leisure and the consequent demand for parks and greeneries,
5. Resource degradation:
  - 5.1. Destruction by seasonal wild land fires,
  - 5.2. Genetic pollution through invasive alien species such as Mesquite (*Prosopis spp*),
6. Economic, industrial, physical & infrastructure development:
  - 6.1. Deforestation and forest degradation by petroleum extraction, mining activities and power transmission lines,

- 6.2. Pollution and gas emissions by petroleum extraction and associated activities of transport, refining, petrochemical products,

*There is need for forest institutions to accommodate all these requirements on a sustained basis.*

7. Institutional Variables:

- 7.1. Response by forest & range institutions to the changing and rising demands and the drive for institutions to change forest & range functions,
- 7.2. Change of forests and range institutions mandates in response to calls by various level of government, communities, ethnic or other interest groups and international community in sharing the benefits from and management of the resource,
- 7.3. Lack of appreciation of forest & woodland values:
- 7.3.1. There has been a serious attempt to assess the contribution of forests & woodlands to such aspects as protection of watersheds, GDP, employment, etc.
- 7.3.2. There has there been serious studies to assess the contribution of home grown wood to the national energy budget and wood-based industries,
- 7.3.3. There is an official tally of the value of exported NWFPs like gum Arabic, Senna, Garad pods (of *Acacia nilotica*),

All in all the lack of appreciation of the role of forests & woodlands in Sudan as indeed in many countries in Africa and the Near East stems from the facts that:

- Wood and NWFPs are largely directly collected by people from forests or are traded in informal markets,
- The science of environmental and natural resources accounting is in its infancy,

*As a reflection of the lack of appreciation coupled with a variety of economic difficulties in Sudan forestry is marginalized and placed low in national agenda and public expenditure on it is generally low.*

8. Political variables:

- 8.1. The rapid growth in human and animal populations and the corresponding rise in demand for forest & range goods and services in the absence of rational land-use mapping have led and are likely to lead to conflict and political struggle. The case of Darfur is fresh in mind. Conflict between Sudan and the newly borne Republic of South Sudan over Abeyi District is already brewing up. Conflict inevitably strains the national economy and limits the options for public expenditure on more pressing needs of health and education let alone aspects like forestry. On the contrary, such situations tempt authorities' especially local governments to cash in forest resources.
- 8.2. Response to demands from parts of countries for decentralization, devolution or even cessation,

9. The need for forestry to adapt to and keep abreast with all the changes:

- 9.1. The need for forestry and institutions to raise their profile and place in national agenda,

- 9.2. Revision of entire nfp together with policy and legislation,
- 9.3. Reconciliation of forest policies and streamlining with policies of other economic sectors particularly Agriculture, Livestock & Range, Industry, Mining, Tourism and Finance
- 9.4. Revision of mandate and functions of forest and rangelands,
- 9.5. Revision and accreditation of educational curricula to generate a new breed of forester/range ecologist capable of meeting societal changing demands and address contemporary socio-economic, climatic and other variables.
- 9.6. Revision of and support to research programmes to accommodate variables.

It is thus difficult to differentiate between deforestation and degradation in Sudan. Therefore the estimates mentioned may include both deforestation and degradation. Situation analysis of Sudan concluded that still the annual deforestation is 542,000 ha and the annual deforestation rate is estimated to be 2.4%. *The most important drivers of deforestation and forest degradation are:*

**Box 1: Major causes of deforestation and forest degradation in Sudan**

**Agricultural expansion:** The biggest direct cause of deforestation in Sudan is the conversion of natural forests to cropland and pasture. Some 40 million feddan (17 million ha) have been converted into mechanized and traditional rain fed and irrigated agriculture during the period 1940-2012. The country is home to some of the largest irrigation schemes in the world (Gezira, Rahad, New Halfa, Suki, Kenana and White Nile Sugar Schemes).

**Energy consumption:** The energy sector is closely linked to deforestation through wood extraction for fuel and charcoal. Sudan depends mainly on the forestry sector as a household, services and industrial energy source. Forests contribute the equivalent of 4.11 million TOE, representing 70-81% of energy supply in the country (FNC, 1995). Demand for wood fuel increased in the last two decades due to rapid population growth, urbanization and shortage in supply of other forms of energy. Sudan consumed 21 million m<sup>3</sup> round wood in 2010 including wood fuel, construction, maintenance and furniture wood. The wood fuel share of the total is estimated to be 87.5%.

**Refugees and internally displaced people:** Contribute to the removal of forests to obtain their requirements of fuel-wood and building houses (IDPs in Darfur and refugees in the Eastern and Western Sudan).

**Factors affecting forest health:** Little information is available about insects, diseases and other hazards impacting forests and the forest sector in Sudan. One report estimated that 102,874 km<sup>2</sup> of forested areas in four states - Darfur, Kordofan, Eastern and Central - were affected by insect pests and diseases. Fire, fungal and insect attacks and overgrazing hinder natural regeneration. Fires are used for land preparation for cultivation but it also destroys the range land and large animals leave their habitats to remote areas or may be subjected to death. Fire is a serious problem in nearly all forest areas in the Sudan.

**Natural Disturbances:** Mainly drought, related to climate change.

## **Land and forest policies**

Policy Changes in Sudan that have a bearing on natural resources conservation started with the passing of a new Forest Policy for 1986 by H.E. the Minister of Agriculture , which formed the basis for the strategy for forestry sector in the country. It was an update for an earlier statement, the Forest Policy 1932. The Prime objective of both statements was the reservation, establishment and development of forest resources for the purpose of environmental protection and meeting the needs of population for forest products. Over and above, the Forest Policy 1986:

- a. Stressed the role of forests in environmental protection,
- b. Recognized and encouraged the establishment of community, private and institutional forests,
- c. Subjected tree cutting outside forest reserves to the discretion of the Director, Central Forest Administration (CFA) provided that these areas are reserved immediately following their utilization for the purpose of their protection and regeneration,
- d. Made obligatory the utilization of tree stocks on land allocated for agricultural investment (not to be burnt into ashes) and to leave specified percentage of tree cover inside and around agricultural investment schemes in the form of shelterbelts and windbreaks,
- e. Stressed the mobilization of popular and international efforts for participation in afforestation, tree planting and forest protection,
- f. Raised the national goal of forest reserves from 15 to 20% of the total area of the country for environmental protection and meeting the population's needs for forest products,
- g. Stressed the role of forest extension,
- h. Conceptualized the multiple use of forest,
- i. Divided forest administration responsibility between the Central Government and the Regions (states and provinces),
- j. Made the Director, CFA, the official counsellor to the regional authorities and institutions on forestry matters.

At the policy making level the forestry sector started to receive increasing attention and the environmental role of forests and trees, including the containment of desertification and land degradation, has been appreciated.

The Forest Act 1989 prescribed the allotment and upkeep of 10% and 5% of rain fed and irrigated agricultural land respectively to forests in the form of wood lots and shelter belts. The Comprehensive National Strategy 1992-2002 stipulates the allotment of 25% of the country's land area to forest, rangelands and wildlife.

## **Climate and climate change**

### **The effect of forests on rainfall**

According to Shiklomanon and Krestovsky (1988) forests create additional roughness that slows down the air masses causing turbulences which leads to the uplifting of the air flux and consequent cooling and condensation into rain, greater precipitation occurs in forests areas as for each 10% increase in forest area, results in 8-44 mm increase in annual rainfall.

El Sayim (2002) states that all the clouds that form in the sky rise up from the land surface and then cool at higher elevation. The clouds need moisture laden air masses to lift them up. There are several ways to lift up the air, the most important are the convection air currents that rise when heated up on contact with the land surface to form cumulus clouds. Most of the rains in central Sudan are convectional rains that are transported by the south westerly moist winds during the rainy season from July to October. El Sayim adds that depletion of the tree cover from extensive areas of land causes decline in rainfall and triggers a slow climate change towards desert conditions. Both Ibrahim (1984) and Harrison (1987) agree that the destruction of the vegetative cover increases the albedo which is the reflectance of the land surface to the solar radiation that bounces straight back into space, reducing the heat balance in the atmosphere and hence convection and convectional precipitation. Conversely a vegetative cover reduces the albedo as indicated by El Tom (1972) who states that cultivation reduces the albedo by up to 30% all over the Sudan belt promoting a very marked increase in precipitation.

Badi (2004) concluded that: The rainfall averages at short periods of five years between 1930-2000 show a trend towards decline since 1965 in the stations of Gedaref, Wad Medani, ed Dueim, el Obeid and el Fasher. The latter two stations were the most affected. The year 1965 represents a turning point in the rainfall regime in central Sudan. The rainfall prior and after that year show significant difference in the stations with the exception of Gedaref. The change was characterized by long periods of drought that seriously disrupted the life of the rural population in central Sudan.

The change may well be within the climate cycles of wet and dry periods mentioned by El Sayim (2002), but it is accentuated by man's interference depleting the forest cover through over-cutting for fuel and building materials, clearance of virgin forest land for mechanized rain fed agriculture horizontal expansion, overgrazing and bush and grass fires. . Deforestation leading to the depletion of the forest cover nullifies the evapo-transpiration contribution from the vegetation towards the annual rainfall, increasing the albedo thereby reducing convection specially so in sandy areas and perpetuating drought and desertification. The recovery of the vegetation and the forest cover and the increasing rainfall after 1992 indicate that the change to drought and desertification is reversible.

### **Drought, desiccation and desertification**

When drought is mentioned in everyday language it is linked in most cases with desiccation and dry land degradation. The linkage may be apparent in the definitions of the terms as given by UNSO (1992) stating that drought is a period of two years or more with rainfall well below average, while desiccation is a process of aridification resulting from dry periods lasting on the order of decades. Dry land degradation is land degradation in dry lands brought about mainly by inappropriate land use under delicate environmental conditions. Land degradation is a persistent decrease in the productivity of vegetation and soils. UNSO (ibid) continues to assert that while the interaction between drought, desiccation and dry land degradation may be confusing, the three calamities were so intimately associated in the Sudano-Sahelian countries since the late 1960. The aforementioned dry land degradation is synonymous with desertification as defined by Hellden (1991) as land degradation in arid, sub-humid areas resulting mainly from adverse human impact, a man-made phenomenon. The adverse human impact is same as the inappropriate land use under delicate environmental conditions. The intimate association of the three calamities and the sufferings they inflicted on the people of the region has in 1970s obliged the governments of the affected countries of Djibouti, Ethiopia, Kenya, Somalia, Sudan and Uganda to establish the



Intergovernmental Authority for Drought and Desertification (IGADD) to deal with the crisis of drought and desertification that prevailed in the region. Two decades later the name of the organization was changed to the Intergovernmental Authority for Development (IGAD), Khalid (2003). A similar organization, CILSS, the Permanent Inter-state Committee for Drought Control in the Sahel, covering the rest of the Sahelian countries in west Africa was formed, UNSO (1992).

Stebbing (1954) maintains that desiccation is held to be primarily due to over-utilization of vegetative covering of soil under which productivity is reduced; water supplies decrease in the springs, streams, rivers and wells, the water table sinks in the soil strata and rainfall decreases. That may be due to (a) erosion in varying forms through the over utilization of the soil, (b) presence of neighbouring desert and sand penetration and (c) a combination of (a) and (b) accompanied by dry hot or cold winds.

FNC (2001) quotes el Sayim (1991) stating that Sudan was exposed during the last three decades to some stupendous and gruesome changes in the rainy season reflected in the continuous decline in rainfall, increasing temperatures and reduced atmospheric humidity. Those changes increase in the direction that transforms the sub-tropical climate of central Sudan to a harsh uninhabitable desert climate. The strong relationship between the forest cover and the elements of desiccation leaves no doubt that the current desiccation is clearly connected to the ongoing practices of tree felling and the denudation of the forest cover.

The decline in the forest cover in the decades mentioned by Sayim (1991) can be followed starting with Ibrahim (2001) who maintains that the forest cover in the Sudan in 1958 was 34-36% the area of the country. Subsequent FAO global estimates of the forest cover record declining percentage for the Sudan. FAO (1992) gives a forest cover of 20% in 1980 and 18% in 1990. FAO (1999) shows a minor drop to 17.5% in 1995.

Rainfall depletion has been most severe in central Sudan where between 1921/50 - 1956/85, annual rainfall has declined by 15% and the length of the wet seasons has contracted by three weeks and the rainfall zones (isohyets) migrated southwards by between 50-100 kilometres, Hulme (1989), (Map 4). Dry years are more of a rule rather than an exception. Rainfall, being the most critical climate element its failure may bring large scale suffering, its availability despite its meagreness, accounts for the present human occupation and the existing pattern of land use, DECARP (1976). The distribution of the rainfall among the month of the wet season differs between wet and dry years. In this respect Ibrahim (1984) stated that the peak of rainfall occurs in August with 47.7% of the amount total, while wet years have their peak in July with 37.6% of the total. He adds that 57.5% of el Fasher's share of rainfall falls on five single days of which (39% of the total was received in only three days).

In describing the environmental situation in the Sahel during the 1970s and 1980s, the word environmental "catastrophe" was used by Gregory and Walling (1978) and "crisis" by Timberlake (1985) and Harrison (1990). The dictionary definition for catastrophe is "an event which causes great suffering or ruin". Catastrophe is usually caused by a natural phenomenon that happens suddenly, unexpectedly and unpredictable, such as tornadoes, hurricanes, earthquakes, floods, etc, causing severe damages, loss of life and destruction of property and economic structures. Crisis is defined as a turning point in history, a moment of great danger just before the change. "Crisis" as a turning point in history is influenced by man and can therefore be predicted through the historical course of events. In that respect it can be deferred or avoided by sound policies and

practices. Whichever difference that might exist between the two words, they convey the same sense, that something critical catastrophically unpleasant has happened.

### **Inappropriate land use**

In view of the contribution of evapo-transpiration towards the local rainfall and in other areas, UNEP (2002), it is logical to conclude with certainty that the removal of trees and other types of vegetation will reduce rainfall and promote drought. Deforestation or the removal of the tree vegetation is one of the inappropriate land uses, UNSO (1992), over utilization of the vegetation, Stebbing (1954) are according to DECARP (1976) the causes of desert encroachment in the Sudan stating that it is a man-made phenomenon caused by such land misuse pressures as overgrazing, irrational cultivation, wood cutting and deforestation, uprooting shrubs for fuel, lowering of water tables due to increased water use and burning of grasslands, forests and shrub lands. With the exception of the lowering of the water table, the remainder of the misuse pressures can be grouped under one misuse pressure to which they lead-deforestation. Deforestation is treated in this study using the contemporary FNC (2001) terminology: Irrational fellings, mechanized rain fed agricultural expansion, overgrazing and bush and grass fires.

### **Environmental degradation and conflicts**

The relationships between the settled farming communities and nomadic pastoralists were governed by deep rooted tribal traditions and agreements over the centuries. This system seems to have collapsed on the advent of drought and desertification as from the 1970s. According to Abu Sin and Takana (2002), Darfur witnessed more than 40 armed conflicts mostly related to the environmental changes caused by drought and desertification that affected the region since early 1970. A number of tribes were driven from their homelands to the south. The large movement provoked severe competition over land, pasture and water. The tribes in the south resisted the invasion and conflicts became a common phenomenon. The consequences of drought have enfeebled the social structure endangering the inter-tribal relationships that were well established over the centuries. Lately the conflicts amounted to an all out civil war. Over a million persons were affected by the war including 100,000 who took refuge in neighboring Chad, BBC (2004).

### **Governance**

#### **Administration**

As of 2012, Sudan is administratively arranged into 17 States (Wilayat; singular Wilayah). Wilayat are further divided into localities (provinces). Each Wilayah is governed with an elected Legislature and an elected Wali (Governor), assisted by a cabinet of 5-8 appointed ministers. Each locality is governed by an appointed Commissioner and an elected legislature. With their capital cities, and in order of population, the Wilayat are as in table 10 (Anon 2011).

Table 10: States and Localities of Sudan 2012

	Wilayah	State	Capital
1.	Al Khartoum	Khartoum	Khartoum
2.	Al Jazira	Gezira	Wad Medani
3.	Shimal Kordofan	N.Kordofan	El Obeid
4.	Janub Darfur	S.Darfur	Nyala
5.	Janub Kordofan	S. Kordofan	Kadugli
6.	Shimal Darfur	N. Darfur	El Fasher
7.	Kassala	Kassala	Kassala
8.	Sharq Dar Fur	E. Darfur	Ad Daian
9.	An Nil Al Abyad	W. Nile	Rebek
10.	Al Bahr Al Ahmar	Red Sea	Port Sudan
11.	Al Gadaref	Gadaref	Gadaref
12.	Sennar	Sennar	Singa
13.	Nahr an Nil	River Nile	Ed Damar
14.	An Nil Al Azraq	Blue Nile	Ed Damazine
15.	Gharb Dar Fur	W. Dar Fur	El Gincinah
16.	Ash Shimaliyya	Northern	Dongola
17.	Wasat Dar Fur	C. Dar Fur	Zalingi

### Legislature

Bicameral National Legislature which consists of a Council of States (50 seats, members indirectly elected by State Legislatures to serve six-years terms) and a National Assembly (450 seats , 60% from geographic constituencies, 25% from a woman's list and 15 from party lists; members to serve six-years terms).

### Judicial branch

Constitutional Court of nine justices; National Supreme Court; National courts of Appeal; other national courts; National Judicial Service Commission undertakes overall management of the national Judiciary.

### Political Pressure Groups & Leaders

Umma Party (Sadig al-Mahdi); Popular Congress Party (PCP) (Hassan al Turabi); Democratic Unionist Party (Mohamed Osman al-Mirghani).

### Line Ministries

As per Presidential Decree No 20 for 2011, The Cabinet is made up of 34 line ministries. Six of these have activates that have an impact on renewable natural resources, namely: Agriculture & Irrigation, Animal resources, Fisheries & Range, Electricity& Dams, Minerals, Environment, Forests & Physical Planning and Water Resources.

### Sudan and the International Community

Sudan is member of the following Regional & International Organizations: ACP, AfDB, AFESD, AMF, AU, BADEA, CAEU, COMESA, FAO, G-77, IAEA, IBRD, ICAO, ICRM, IDA, IDB, IFAD, IFC, IFRCS, IGAD, ILO, IMF, IMO, Interpol, IOC, IOM, IPU, ISO, ITSO, ITU, LAS,

MIGA, NAM, OIC, OPCW, PCA, UN, UNCTAD, UNESCO, UNIDO, UNWTO, UPO, WCO, WFTU, WHO, WIPO, WMO, WTO(observer).

### **Forest Legislation**

The Woods & Forests Directorate (WFD) was established in 1902 with the start of the colonial rule in the Sudan. The department, under the principles of sustained yield in perpetuity and rational exploitation of the resources, commenced to manage wood- stations along the Nile and its tributaries to supply steam paddle boats with firewood and establishing forest reserves where future felling and regeneration can be concentrated, protect the forests against fires and introduce fast growing tree species. A substantial number of legislations have since been promulgated addressing such issues as forest reservation, levying of a royalty on wood collection from outside forest reserves, sharing of authority over, benefits from and responsibility towards forest resources and promulgation of a series of forest policy statements. The most prominent of these legislations were perhaps:

- 1901: Enactment of the first forest act,
- 1932: Announcement of the first policy statement together with enactments of provincial & central forests ordinances,
- 1939: Endorsement of the Royalty Ordinance,
- 1948: Reform of the provincial forest act to delegate power to the local level,
- 1970: Land Act 1970
- 1971: Endorsement of the local people government act,
- 1972: Endorsement of the Southern Sudan self-autonomous government,
- 1980: Endorsement of the regional government Act,
- 1981: Endorsement of the local people government Act,
- 1985: Re-centralization of central forests authority,
- 1986: Amendment of the 1932 forest policy & adoption of 1986 forest policy,
- 1989: Enactment of Forests National Corporation (FNC) and new forest act,
- 1994: The adoption of the federal system,
- 2002: Endorsement of the forests and renewable natural resources law replacing the forests & (FNC) acts of 1989,
- 2006: Development of a new forest policy under the process of approval,
- 2007: Agricultural Revival & Revitalization,
- 2011: Cessation of Southern Sudan,

### **Areas where legislation needs to be reviewed, revised or modified include:**

- Sharing of authority over, benefits from and responsibility towards forest resources especially in view of the experience since the Ministerial Decree 40 (1997) authorizing the division of revenue from outside forest reserves between the Federal authorities (FNC) and State Governments,
- Institutional, Administrative and Academic cooperation between forest and range resources management particularly after the Cessation of South Sudan and the deficit in range & animal feed faced by Messairia and other North/South border tribes

## **Governance structure**

The Decree No. 40 (1997) issued by the Council of Ministers specifically stated that forests protecting inter-state water, watersheds and federal structures and forests arresting the process of desertification are federal forests to be managed by FNC. Other forest reserves are to be managed by the states, and private, community and institutional forests are to be managed by their owners. This is expected to encourage further reservation by various tree growers.

## ***Objectives of the National REDD+ Program***

**The ultimate objective of the National REDD+ Programme (NRP) of Sudan is:**

*“The inventory of the country’s renewable natural resources particularly forests, woodlands, range resources and wildlife habitats, assessment of their present condition and subsequently subject them to sustainable management with the aim of conserving them and maximizing their direct and indirect benefits in a participative, transparent and equitable manner.”*

**The specific objectives of Sudan’s NRP include but are not confined to:**

1. Detailed quantitative and qualitative inventory of the country’s forests, woodlands, tree formations, trees outside forests, range & pasture resources and wildlife habitats inclusive of national parks, sanctuaries and private holdings,
  - 1.1. Ascertain their status in terms of ownership, registration and disputes,
  - 1.2. Judicious assessment of their present condition in terms of diversity, health and vigour,
  - 1.3. Careful evaluation of their designated functions, actual and expected goods provided and services rendered for surrounding communities, the country at large and beyond,
  - 1.4. Appraisal of modalities of their management,
2. Review of relevant policies, institutional arrangements and legislations in force,
  - 2.1. Revise, amend and/or promulgate relevant legislation and undertake institutional reform conducive to the fulfilment of ultimate objective.

## **National economic policy instruments for REDD+**

In order to realize the objectives of the National REDD+ Program the Government of Sudan could use two broad types of economic policy instrument to reduce deforestation and forest degradation:

- Non-financial instruments (e.g. regulation, levies)
- Financial instruments (subsidies through REDD+ finance and other public sources of funding).

To date, the mechanisms that have been used for financing forestry development in Sudan include:

- Self-financing mechanism from FNC own resources;
- The National Development funding mechanism which finances development projects;

- Projects funded by other donor organizations and private sector;
- Forestry investment.

While funding for forestry development needs to be a crucial component of REDD+ strategy, this on its own will not be sufficient. For policies to have an effective impact on deforestation rates, financial and non-financial policy instruments will need to target the drivers of deforestation directly – particularly demand for wood fuel and agricultural land.

The following section explores options for REDD+ activities that use a combination of both types of economic policy instrument. A combination of instruments, if designed well, will be the most effective and cost efficient means of reducing deforestation and degradation.

### **Activities that can reduce deforestation**

Activities that reduce deforestation will incur opportunity costs (foregone profits from wood, agricultural and livestock sales) as well as forest protection policy and administration costs. The mitigation costs can be divided into two categories: capacity building costs (e.g. carbon measuring and monitoring capacity) and on-going costs (including opportunity costs and forest protection costs).

The following sections cover options for reducing and eliminating the opportunity costs of reduced deforestation and degradation (e.g. through economic policy instruments that lower the price of LPG in the private market relative to the price of wood fuel) as well as options for providing public subsidies to make up the gap between the value of standing trees compared to cut trees (e.g. through carbon finance that incentivizes landowners and tenants to reduce the rate of deforestation and degradation).

The most effective means of reducing deforestation and degradation through economic instruments is to use an integrated approach. Many of the options below are inter-related, and even those that are mutually exclusive will be more effective if used in combination with other options.

### **Option 1: The carbon balance and incentives for energy substitution to LPG**

A thorough understanding of the carbon balance of using wood as a source of energy and non-renewable resources such as LPG needs to be developed, based on the eco-physiological properties of the forests. In the current situation of over-consumption of forest products the resource is depleted to a level where productivity is seriously impaired. Reducing the pressure on the forest to a level where the productivity reaches a higher level will lead to a point where forest exploitation is sustainable. At this point the use of non-renewable energy resources should not be further encouraged.

Under sustainable exploitation of forest resources wood fuel is carbon-neutral as opposed to non-renewable energy resources. While a further reduction of wood consumption may have a net positive effect for the National REDD+ Program, it will negatively impact the carbon balance of Sudan and counteract the ultimate objective of the UNFCCC of limiting the anthropogenic interference with the atmosphere.

Ultimately the success of the National REDD+ Program depends on the acceptance of the provisions of the Program by the local communities living in or near the forest; to them it is a question of their livelihood rather than climate change. The analysis of the carbon balance

therefore needs to be supplemented by an econometric analysis of how the individual households or communities perceive the options from an economic perspective. The alternative of non-renewable energy sources should be considered in this context.

Energy alternatives have been promoted before in Sudan to reduce wood fuel consumption. For example, the Ghabat Gas Project aimed to reduce firewood and charcoal consumption by 50% over 3 to 5 years. Any further research on the financial and other incentives required to meet the current wood fuel challenge should use this project as part of the analysis.

Research could also draw on examples of fuel substitution projects in nearby countries. For examples, a 2001 DFID report in Kenya identified a number of barriers to substitution from wood fuel to LPG including (1) high prices of LPG relative to wood fuel; (2) high cost of LPG stoves; and (3) low competition in the LPG sector as LPG companies compel consumers to purchase separate valves/regulators for gas cylinders that are brand specific: this acts as a disincentive to change company, thereby reducing consumer choice and maintaining higher prices. In Senegal, a DFID project to switch from charcoal to kerosene and LPG directly benefited around 250,000 families in the principal urban and surrounding areas of Senegal. Training and micro-credit schemes helped overcome the relatively high upfront costs of purchasing an improved stove.

Significant switching from wood fuel (firewood and charcoal) will occur when the cost per unit of energy from LPG stoves meets or drops below the cost per unit energy of wood fuel. These costs will depend on subsidies, consumption taxes and import tariffs on the different energy sources. Furthermore, even if the unit costs of LPG are lower, the upfront costs of purchasing an LPG stove may still act as a barrier to their take-up.

As fuel substitution has large potential for reducing wood fuel consumption – one of the key drivers of deforestation and degradation – it is recommended that further research is undertaken in the following areas:

- Eco-physiological analysis of current and sustainable extraction of wood from forests, and determination of the carbon footprint of non-renewable resources.
- Economic analysis of the unit costs of wood fuel and alternative fuels including tax and subsidies.
- Examination of non-cost demand factors that could act as barriers to fuel substitution (e.g. traditional cooking styles such as using wood fuel for roasting meat) including an analysis of price elasticities.
- Examination of the fiscal instruments linked to REDD+ finance that would make LPG cheaper at point of sale.
- Examination of the costs and benefits of micro-financing initiatives to provide upfront funding for purchasing stoves.

## **Option 2: Incentives for using sustainable charcoal**

While fuel substitution from wood fuel to LPG could be an important means of reducing wood fuel demand, it may not be sufficient in itself to halt deforestation even if the opportunity costs of switching are eliminated. For example, charcoal has unique cooking properties (e.g. meat roasting) that make it more attractive than other fuels. In the past, when the price of LPG fell to a

third that of charcoal in Sudan, many homes still purchased charcoal (Ibrahim 2003 quoted in Mugo and Ong 2006). Furthermore, evidence suggests that as living standards rise, household demand for cooking charcoal may actually increase.

One option is to develop a more sustainable industry for charcoal, based on sustainably managed plantations. There are already precedents for sustainable charcoal production in Sudan that FNC have managed. Plantations of *Acacia nilotica*, *Acacia seyal* and other species are grown in 15 to 20 year rotation cycles, and the wood burned in conical earth mound charcoal kilns. Specific legislation covers the charcoal industry.

The Sudan Charcoal Producers Association was created to negotiate with the government on behalf of traders. Some members produce between 2,000 and 5,000 bags of charcoal, earning up to US\$50,000 a season. However, some members have complained of high taxes, unclear boundaries and conflicts due to animal routes through contracted land.

Given the potential for the government and the private sector to increase sustainable charcoal production to meet international export markets, further research is recommended in the following areas:

- Analysis of the international export market for sustainably produced charcoal.
- Analysis of the fiscal incentives/disincentives that drive the expansion/contraction of charcoal plantations.
- Analysis of the risks and opportunities of liberalizing the sustainable charcoal market both domestically and internationally with regard to plantation expansion and protection of acacia natural stands.

### **Option 3: Incentives for firewood efficiency**

Even with incentives to switch from firewood to LPG and sustainable charcoal, demand for firewood will still remain, particularly in rural areas. Using firewood more efficiently could reduce overall demand for firewood further. A 2010 FAO report estimated that a Fuel Efficient Stove (FES) programme in rural and urban areas could reduce consumption by up to 1.1 million m<sup>3</sup> (from 5.9 to 4.8 million m<sup>3</sup> or from 3.5 to 2.8 million oven-dry tons).

A detailed economic study would be needed to compare the costs and benefits of implementing an FES programme compared to incentives for substituting to LPG stoves. However, this could be an option for reducing deforestation and degradation perhaps as a transition measure.

Consideration of means to reduce siltation in Riverine *Acacia nilotica* forests. Siltation of ox-bow lakes, the ideal habitat for *A. nilotica* tends to bury the bottom log, literally the cream of 30 year rotation.

Efficient felling system in *Acacia nilotica* plantation forests. Current methods of using axes leave a 25-50 cm stumps

### **Option 4: Subsidizing renewable energy production and grid infrastructure**

The majority of the Sudanese population (around 5 to 10%) has no access to electricity grids. For this reason, people have no electric alternative to wood fuel or LPG. One potential area for public subsidies from carbon finance is investment in grid infrastructure as well as renewable sources of energy such as hydro, solar, wind and geothermal.



In 2007, hydro made up around 0.8% of Sudan's energy mix after wood fuel (73%) and oil (26%). Following the drop in oil supplies following the secession of South Sudan, there may be potential to increase the efficiency of existing hydro plants to fill the energy gap at least partly. Furthermore, according to some sources, more than 200 suitable sites may exist for the use of in-stream turbines along the Blue Nile and the main Nile.

Average solar insolation in the country is about 6.1 kWh/m<sup>2</sup>/day, providing a high potential for solar energy use. A recent GEF/UNDP-funded project installed solar PV to electrify 13 communities. Around 45,000 households in Sudan are now using PV systems. However, the carbon abatement cost of solar PV is generally relatively high compared to other mitigation measures, and an economic analysis would be needed to determine whether the subsidies for meeting the opportunity costs of switching from wood fuel to solar would be cost effective.

Wind energy in Sudan is currently used for pumping water from deep and shallow wells to provide drinking water and irrigation through the use of wind pumps. Geothermal has been estimated to have a potential of 400 MW generation capacity with potential geothermal fields near the Jabel Marra volcano, the Tagbo and Meidob hills, the Bayud volcanic field and the Red Sea coast. Both of these renewable energy sources would be high cost and alternative sources of funding may be available for their development.

In conclusion, given the existence of hydro in the Sudanese energy mix (albeit on a small scale compared to wood fuel and oil), and the relatively high cost of alternative renewable sources of energy, it is recommended:

- Economic analysis of the cost effectiveness of increasing the efficiency of existing hydro plants and the development of small hydro plants along the Nile.
- Economic analysis of extending the electricity grids (both public and private) to reach a higher proportion of the Sudanese population.
- Analysis of alternative sources of carbon finance, including REDD+ and funding for renewable energy.

#### **Option 5: Incentives for increased gum Arabic production**

Around 95% of gum Arabic is produced by small scale farmers, with the remaining 5% being produced from plantations. Exports totalled around 55,000 tons in 2010, with a value of US\$78 million. A World Bank study in 2007 estimated that Sudan's gum Arabic export market could potentially be worth around US\$150 million, assuming a world market of around 60,000 MT per annum. That compares to an average value of US\$40 million over the last twenty years. Their assumptions in the study included:

- Additional raw gum export concessions granted (beyond the exclusive concession to the Gum Arabic Company),
- Government provision of a transparent and enabling business environment for domestic processors to develop,
- Formation of producer voluntary organizations with access to improved technology and credit.

Lifting the concession has been controversial. However, targeted economic and other instruments that incentivize increased gum Arabic production should have positive effects on reducing the rate of acacia removals. The following additional research is recommended:

- Analysis of the impact of concession lifting and the growth in exports.
- Potential for expansion of public and private sector gum Arabic plantations and associated economic incentives.
- Developing a ‘protocol’ for production of talha gum (*A. seyal*). With the acceptance of Europe and USA for gum talha as a soluble fibre and a food additive, demand for the friable gum is on the rise. *A. seyal* is Sudan’s national tree. It produces gum all over the country.
- Developing a ‘protocol’ for Kakamut gum (*Acacia polyantha*). *A. polyantha* is closely related to Hashab gum (*A. senegal*). *A. polyantha* regenerates prolifically in abandoned mechanized farming areas particularly those affected by war in South Kordofan. According Kakamut gum due consideration is conducive to more gum production and will avert adulteration of gum Arabic.

#### **Option 6: Incentives for forest conservation and sustainable forest management**

While the most effective instruments for reducing deforestation and degradation are economic incentives that eliminate the opportunity cost of keeping trees standing, government regulations for forest and woodland conservation remain very important for protecting natural stands and their associated biodiversity.

Based on 2000 figures, Sudan currently has 24 million feddan of forest reserves and 42 million feddan of wildlife reserves. In total these reserves represent around 11% of Sudan’s land use. The area of these reserves could be increased. However, forest conservation is generally more effective when local communities have buy in – this means that they gain economic benefits of conservation compared to the benefits of cutting down trees. In many cases the benefits can come from sustainable forest management that enables the local community to benefit economically from the forest while avoiding deforestation and degradation. Economic benefits of standing forest in Sudan include non-wood forest products such as gum, honey and arts and crafts. Tourism could also be promoted in forest reserve areas.

Currently, the FNC is funded by means of a self-financing budget largely through levying of value and royalties on wood and non-wood forest products and from support by Government through Developmental Expenditure. The total budget for 2008 was 30.8 million Sudanese Pounds, equivalent to US\$13.4 million. An area for investigation would be a better understanding of the incentives and disincentives that these levies have on forest preservation and deforestation. For example, replacing a levy on firewood has the potential to shift incentives of the FNC towards forest conservation. However, removing the levy also has the potential to lower the costs of firewood relative to alternative fuels. Consequently, an integrated approach would be needed. At the same time, removing the levies on non-wood forest products could lead to an expansion of sustainable forest management in the private sector.

The following additional research is recommended:

- Assessment of the impacts on deforestation from switching FNC funding from levies on wood products and non-wood forest products to REDD+ funds.
- Analysis of the impacts of reserve expansion on wood fuel prices domestically.

### Option 7: Incentives for reforestation and plantations

Sudan already has significant plantations of both indigenous and exotic tree species. Sudan's 2004 National Report to the UNFF reported that the largest plantations (52,227 ha) comprised *Acacia senegal* raised to compensate for areas damaged by fire, illicit felling and senility. Other important plantations include *Acacia nilotica* (18,200 ha) planted as part of a managed rotation to produce millable timber, building poles and firewood; teak, *Tectona grandis*, (10,130 ha) and *Eucalyptus microtheca* (5,742 ha). Various other species are planted on a small scale. Forest Policy and Laws have encouraged local communities, private individuals and organizations to establish plantations. However, according to FNC, the areas annually planted fall well below the strategic and policy targets due to insufficient funding.

Prior to nfp implementation, the private sector's involvement in Sudan's forest sector was restricted to small-size sawmills, carpentry workshops and gum orchards on the sand plains (Abdel Nour 2000). Since the creation of the nfp, private sector partnership in forestry has widened to include:

- Sugar schemes such as Kenana, Assalaya, W. Sennar, Guneid, and N. Halfa have each established irrigated plantations.
- A Saudi Company, Gandil, is now active in tree planting for gum production.
- Many small holder farmers around Kordofan, in Gezira, Rahad Scheme, Jebel Marra, etc have established irrigated plantations.
- Mechanized scheme owners in Gadaref are now involved in tree planting around the schemes for gum production and environmental rehabilitation.

Afforestation and reforestation activities are restricted to areas constituted as reserves and subsequently put under management, almost exclusively owned by FNC, institutional forests such as those owned by agricultural schemes e.g. Gezira, Rahad and Kenana, community woodlots, private woodlots, forests or windbreaks or shelterbelts (Abdel Nour 2000). In afforestation inside forest reserves, trees/shrubs usually used are indigenous in areas of less than 500 mm rainfall and exotic in more humid areas. Indigenous trees most commonly used are Acacias particularly *A. senegal*, *A. nilotica*, *A. seyal* and *A. mellifera* and *Khaya senegalensis*.

Incentives for expanding reforestation and afforestation include supply side measures – particularly subsidies – and demand side measures that increase domestic and international demand for sustainably managed plantation wood products. Consequently, it is recommended:

- Analysis on the profitability of plantations with and without state subsidies.
- Economic analysis of the domestic and international market demand for sustainably managed plantation timber, charcoal and firewood (see also option 2 on sustainable charcoal), including examination of certification schemes and fiscal instruments such as levies, tariffs and consumer taxation.

### **Option 8: Incentives for crop intensification and more balanced livestock production**

One of the key drivers of deforestation and degradation in Sudan has been the previous agricultural policy programme that encouraged the expansion of crops. Reducing overall food production is not a viable option. Sudan is already facing major challenges in terms of food security with a poor crop harvest in 2011/12. REDD+ strategies will be successful only if they address the challenge of food security and international demand for commodities produced on cleared land (such as cotton) or livestock that can lead to over-grazing.

Agricultural intensification has significant potential to reduce pressure on forests and woodlands by meeting food demand more efficiently. Productivity for cereals has been stagnant in sub-Saharan Africa for around 30 years. This is in contrast to cereal yields in East Asia that have risen by 2.8% a year from 1961 to 2004.

As well as crop intensification, agroforestry can be an effective method to maintain woodlands and forest. Using rotations of farming and forestry can promote the sustainability of tree cover while diversifying production to reduce the impact of crop specific failures (e.g. from drought).

The following additional research is recommended:

- An analysis of the supply and demand effects of integrated policies for agricultural intensification and sustainable forestry and forest protection.
- Cost-benefit analysis of agroforestry schemes, including examination of diversification benefits.

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## Annex 2a: Assessment of Land Use, Land Use Change Drivers, Forest Law, Policy and Governance

### 2A.1. Details of Cropping Systems in Sudan

As mentioned in chapter 2a, crop production is practiced in three main farming systems, namely: irrigated, mechanized rain-fed and traditional rain-fed:

Crop production is practiced in three main farming systems, namely: irrigated, mechanized rain-fed and traditional rain-fed

#### *Irrigated Agriculture:*

Irrigated agriculture covers some 11million feddans (2011), watered basically from the Nile and its tributaries through gravity irrigation from dams, pumps or flood irrigation from seasonal rivers like Gash and Tokar. A Small area is irrigated from ground water. Six dams ( Sennar, Jebel Awlia, Roseires, Khasm el Girba and Meroe) have been erected during the 20<sup>th</sup> and early part of 21<sup>st</sup> centuries to provide irrigation water and hydropower.

A twin dam on Atbara and Seteit Rivers is under construction. Large irrigated schemes such as Gezira & Managil, New Halfa , Rahad, Suki and sugar schemes such as Kenana, White Nile and West Sennar dominate this sector.



Plate (1). Long Farrow irrigation -Kenana Sugar.



Plate (2). Cotton-Gezira

The main crops in the irrigated sector are sugar cane, sorghum, cotton, wheat, ground nuts, winter pulses, vegetables, fruit and green fodder. The sector uses the bulk of imported agricultural inputs (Anon 2000). Irrigation facilities are government owned. Land is under government control and is allocated to tenants in holdings of 15-40 fed. Production relations are based on water rate and administration. These are undergoing drastic changes especially in Gezira Scheme.

#### *Mechanized Rain-fed Agriculture:*

Mechanization is considered a most suitable means of cropping in Sudan's central clay plains as the soil is heavy clay and areas are expansive with low population density and short of drinking



water during harvest time. Mechanized cropping started in the mid-1940s in small areas in Gadaref area then expanded to encompass some 14 million feddans in the 400-800 mm rain belt, concentrated in four areas: Gadaref, ed Damazine, Kosti and Dilling. There is considerable potential for expansion provided that natural resources are conserved and land protected against degradation.



**Plate (3). Ground nuts**



**Plate (4). Traditional rain-fed millet**

Land is government owned and is leased to investors for 25 year periods in holdings of 1000, 1500 and 2000 feddans for individuals, cooperatives and companies respectively. These may reach 100,000 fed for big companies. Individual holdings make some 78% of all holdings and 65% of entire area.

Sorghum is the leading crop in this sector followed by sesame, sunflower, millet and cotton. Productivity is generally low and fluctuates with rainfall. Of the major constraints in the sector is partial mechanization whereby ploughing is mechanical whereas weeding and harvesting are manual; creating labour shortage during weeding and harvest.

#### *Traditional Rain-fed Agriculture*

The area of traditional rain-fed agriculture is estimated at 15 million feddans. It is practiced primarily in west and central Sudan. Productivity is low and fluctuates with rainfall. Land is mostly collectively owned and usufruct is granted according to family needs. Since the practice depends on family member's efforts using hand implements, the area a family can manage is small. The sector is vital for the nation's food security as it contributes 90, 48, 28, 11 and 100% of millet, ground nuts, sesame, sorghum and gum Arabic respectively.

## 2A.2. Ecological Classification of Forests in Sudan

The forest extent and estate in the two brother countries can be extrapolated by super imposing the map of Harrison & Jackson's 1958 'Ecological Classification of the Vegetation of Sudan' (Harrison & Jackson 1958) on the maps of the two countries. Tables (II.4 & II.5).x.

Map 4. Ecological classification of vegetation of Sudan 1958



**Table II.4. Ecological Classification of vegetation in the Republic of Sudan (RoS) and the Republic of South Sudan (RSS)×**

[illegible]

Table II.5. Ecological classification of Forests &amp; Woodlands in RoS (2011) ×

Desert		Semi Desert		LRS				HRS		Special Areas		Monatne Veg.		Flood Region		Total	
				Clay		Sand											
000 km²	%	000 km²	%	000 km²	%	000 km²	%	000 km²	%	000 km²	%	000 km²	%	000 km²	%	000 km²	%
717	38.6	486	26.2	295	15.9	212	11.4	17	0.9	119	6.4	4	0.2	7	0.4	1857	100
Arid								Sub-humid						Humid			
92.1								7.5						0.4		100%	

□. En.wikipedia.org/wiki/South\_Sudan.

×. Estim. Figures. Boundaries between RoS and RSS outstanding Issues.



Plate (5).Acacia desert scrub River Nile State.      Plate (6). Biodiversity: Water lilies W.N. State.

### *Forest & land cover Inventory:*

Monitoring of forest cover and biomass changes in Sudan is obtained from successive inventories and remote sensing images taken at various times and sites. This includes several studies conducted, including Andrews (1948), Harrison and Jackson (1958) and Lewis (1953), Ferguson (1954). In 1982 the National Energy Administration (NEA), in collaboration with Forests Administration, UoK and the Regional Remote Sensing Facility (Nairobi) conducted a forest resource survey to assess the country's energy requirements. In 1987 Lund University conducted a survey covering an area of 0.58 million km<sup>2</sup>. The widest inventory was launched during the period (1995-1997), covering an area of 62.27 million ha. In 1997 the Africover project commenced its activities covering 10 Nile Basin countries in addition to East African countries, including the Sudan. The state of forests can only be extrapolated from these ad hoc surveys and from the global Forest Resource Assessment (FRA) such as these by FAO (1990), 2000, 2005 and 2010.

According to recent Land Cover Atlas of Sudan Forests & woodlands together with Rangeland represent 35.6% of the total country area (FAO, 2012)-Table (II.6.)- **(Annex II.1)**

Because of the limited resources these forest inventories have not been successful in establishing regular forest monitoring and data collection systems. The only frequent inventory activities

available in Sudan are confined to plantations and some of the reserved forest where resource spending is more justifiable because of both productive and protective outputs.

### **2A.3. Indigenous knowledge on Forestry & Natural Resources**

According to Sundamari and Ranganathan (2003) cited in Abiola et al, (2011), indigenous knowledge is an unwritten body of knowledge. It is held in different brains, languages and skills, in as many groups, cultures and environment as are available today. “It covers the whole range of human experience”, it provides a basis for local-level decision making in: Food security, human and animal health, education, natural resource management and various other community-based activities.

Edmund (2012) stated that indigenous knowledge is generally an under-utilized resource. It is important and relevant for the development process.

- It provides a basis for problem solving strategies for local communities particularly the poor.
- A lot of indigenous knowledge systems are at risk of getting extinct; e.g. (the system of passing on knowledge to young generation by grandparents at an informal gathering).
- It is possible to create sustainable livelihood systems through Indigenous Knowledge Development.

The Sudan has been home to indigenous civilization, such as Meroe, and road for others, namely Pharaonic, Christian and Islamic civilizations. The country has been heavily influenced by fusion of different cultures. The immigrant Arab culture and the neighbouring cultures (mainly Egyptian and West African cultures) have strongly influenced Sudanese culture. However, there is a wide range of practices, which fall under the umbrella of traditional medicine (Al-Khalifa, 2003). Medicinal plants represent an important component of traditional medicine in Sudan and the flora of Sudan is relatively rich in medicinal plants corresponding to the wide range of ecological habitats and vegetation zones.

Traditional knowledge and practices on forestry, range and natural resources management in Sudan has recently been reviewed by Abdel Magid (2012)-Annex (6). That knowledge spans a wide array of aspects and activities such as:

- a. Traditional & herbal medicine,
- b. Indigenous Agro-forestry & Agro-silvo–pastoral Systems, Plate (8) - (Box II.1.),
- c. Gum tapping. Collection & post-harvest handling Plate (9),
- d. Date palm culture & husbandry,
- e. Nutritive, economic, cultural & social forestry-related knowledge in rural communities,
- f. Traditional fermented foods,
- g. Traditional coping with climate variability & environmental phenomena: Water harvesting; Rain-makers; Society mobilization to combat locust swarms (Dambari),
- h. Sudanese pastoralist’s local knowledge in rangeland management- Transhumant pastoralism,
- i. The role of traditional institutions in resolution of conflicts over natural resources.



### Box II.1. Animosity of Haraz to rains-genesis of agro-silvo-pastoral system

Communities in Darfur Region of Sudan have for generations deployed their knowledge of the phenology of such Acacias as Haraz (*Faidherbia albida*). It goes in sayings and proverbs of people of Darfur 'Haraz's animosity to rain'. Knowing that the trees shed their leaves during the rainy season, they sow their crops right to the tree bole with sufficient sun light penetrating through the open crown. After they harvest their crops in the summer, the trees flush their leaves and flower to yield thick shade and nutritious pods for livestock to seek as refuge and food source. In so doing the animals reciprocate by adding their 'animal manure', which together with the decomposed twigs and roots add to soil fertility; thus practising what we forestry science people took to the classroom and taught as 'agro-silvo-pasture',



Plate (8). Haraz Agro-silvo-pastoral system



Plate (9). Gum tapping

#### 2A.4. Rangelands & resources

Sudan has the largest livestock inventories in Africa next to Ethiopia. The nomadic pastoral sector accounts for more than 90% of the huge animal population (Table 2.9). Rangelands cover an estimated area of 96.4 Mha composed of 53.4 Mha of grassland and 43.0 Mha of woodlands containing scattered trees and shrubs (Afri-cover 2003). This vast area encompasses different ecological zones extending from desert and semi-desert in the north to the Low Rainfall Woodland Savannah (LRWS) to the south. Nearly 80% of all rangelands are located in semi-desert and LRWS ecological zones that are characterized by variable and unpredictable rainfall.

The rangelands of importance to traditional livestock- raising are confined to the semi-desert, LRWS, and the northern fringes of the High Rainfall Woodland Savannah (HRWS). In the semi-desert the plant cover is a mixture of grasses and herbaceous plants intermingled with *Acacia* trees and shrubs representing the main grazing areas for camel and sheep. Two areas of pure grassland form a distinct feature of this rangeland type namely, the Butana plains (grassland on clay) and Baja area (grassland on sand). LRWS on clay and sand have a plant cover of a mixture of *Acacia* species, shrubs and a number of herbaceous plants.

Sudan's total national herd is estimated in 2010 at 103.6 million head of livestock (sheep, cattle, goats and camels), 8.3 million head of equine (donkeys and horses) and 36.6 million head of poultry. Table (II.9).

Rangelands are estimated at 67million ha with a total production of 34.8 million tons of forage. Total available feed is 50 million tons composed of 34.8, 14.1, 0.5 and 0.2 million tons of forage from rangelands, crop residues, irrigated pastures and concentrates respectively. Total requirement of animal feed is estimated at 93 million tons. Table (II.10).

Rangelands contribute substantially to the income and subsistence of a large sector of the population who are either pastoralists (nomads) or agro-pastoralists by providing important forage feed resource. It supplies about 70% of the total feed requirement of national herds. Cattle, sheep and goats provide an important capital asset and a risk management tool for pastoralists and farmers at times of drought. Income from the sale of livestock is used to meet household food requirements, market goods, drugs, vaccines, salt, feeds, pay water fees and tax.

**Table (II.9). Estimates of livestock population by States, 2011**

State	Cattle	Sheep	Goats	Camels	Total
North Kordofan	960,503	7,223,357	3,605,603	1,212,613	13,002,076
South Kordofan	7,349,936	3,098,701	3,366,678	519,163	14,334,477
North Darfur	668,176	3,760,104	2,888,827	578,337	7,895,444
South Darfur	4,217,861	3,843,430	2,997,429	155,795	11,214,515
West Darfur	4,050,817	3,905,925	4,387,541	417,919	12,762,202
El Gadarif	1,044,025	2,135,239	1,055,616	334,705	4,569,586
Kassala	960,503	2,020,665	1,668,134	674,496	5,323,798
Red Sea	125,283	416,632	716,777	280,154	1,538,845
Blue Nile	2,004,528	3,905,925	451,786	13,869	6,376,108
Sennar	1,461,635	1,374,886	1,633,382	114,188	4,584,090
El Gezira	2,463,899	2,473,753	2,137,297	120,660	7,195,609
White Nile	3,466,163	2,551,871	2,549,987	34,673	8,602,693
Northern	250,566	979,085	1,146,842	48,079	2,424,573
River Nile	83,522	1,005,125	1,203,316	111,877	2,403,839
Khartoum	250,566	442,672	642,927	6,472	1,342,637
<b>Total</b>	<b>29,357,983</b>	<b>39,137,369</b>	<b>30,452,141</b>	<b>4,623,000</b>	<b>103,570,493</b>

The importance of pastoral sector goes beyond its influence on the economy to its role in securing national and strategic food. It allows self-sufficiency in meat (100%) estimated to be about \$2.2 billion US\$/Year while animals export amounts to about 24.6 % of the non-petroleum exports. In addition, the contribution of the sector in the national income is estimated at 18-25 % and it represents a livelihood activity for about 60% of the population as well as providing labour for about 40% of the population.

Rangelands are endowed with a great diversity of forage plants genetic resources (FPGR) and a total count of 704 plant species was reported (over and understory). However the loss of FPGR is

being experienced at an alarming rate. Immense changes occurred within the different vegetation zones compared to the 1958 base line survey (Harrison and Jackson Report, 1958) but little empirical work was carried out thereafter. Many of the valuable range plants species are endangered while others became rare. Species such as *Andropogon gayanus*, *Blepharis linariifolia*, *Chrosophora brochidiana*, *B. edulis*, *Ischaemum ishaemoidis*, *Dismodium dichotomum*, *Aristida papposa* are among the most endangered. Forage plants are not only source of livestock feed, they constitute the origin of many crops of the present day and in future.

**Table (II.10). Available forage resources (Million Ton), 2011**

States	Rangeland	Crop residues	Irrig. forage	Concentrates	Total
North Kordofan	4.70	0.910	0.09	0.01	5.71
South Kordofan	8.19	1.400	0.00	0.03	9.62
North Darfur	1.05	0.08	0.00	0.00	1.13
South Darfur	0.50	0.770	0.005	0.015	1.29
West Darfur	12.06	0.037	0.0014	0.005	12.1034
El Gadarif	2.70	2.700	0.02	0.035	5.455
Kassala	1.30	2.423	0.009	0.015	3.747
Red Sea	0.38	0.037	0.00	0.00	0.417
Blue Nile	1.90	1.00	0.00	0.02	2.920
Sennar	0.26	1.070	0.020	0.02	1.37
El Gezira	0.49	2.600	0.030	0.01	3.13
White Nile	0.47	0.790	0.041	0.02	1.321
River Nile	0.35	0.250	0.155	0.02	0.775
Khartoum	0.42	0.08	0.18	0.0009	0.6809
<b>Total</b>	<b>34.77</b>	<b>14.147</b>	<b>0.5404</b>	<b>0.2009</b>	<b>49.6693</b>

Trends of decreasing annual rainfall and increased rainfall variability have contributed to drought conditions in many parts of Sudan, which occurred in the northern and central parts. Average annual rainfall has declined from about 425 mm/year during the 1941-1970 period to about 360 mm/year in the 1970-2000 period. This represents a decrease of annual rainfall of about 0.5% per year.

The unreliable nature of rainfall, together with its concentration in short growing seasons, heightens the vulnerability of grazing and rain-fed agricultural systems. Accordingly, agro-climatic zones shifted southward, negatively affecting pastoralists and agro pastoralists living in many parts of the country who became increasingly unable to sustain production levels of animal feed and subsistence agriculture. The potential impact of these changes on national food security could be severe. The rangelands are the most vulnerable to climate variability and CC; this vulnerability is further exacerbated by misuse and mismanagement of the land resource. Furthermore, rangelands are used in common with animal being on the move searching for feed and water. The impact of the CC in FPGR is clearly manifested in:



- steady deterioration of both the productivity and biological diversity of the rangelands in the country coupled with dominance of undesirable range plant species, disappearance of valuable forage species, loss of biodiversity and change in species composition,
- intensifying pressure on the fragile and deteriorating resource base and
- reduction of rangelands productivity per unit area from 1.2 ton/hectare in 1980s to 0.2 ton/hectare in 2009 (RPA 2009)

Consequently, these have further resulted in inability of the dependent livestock to produce well paving road for poverty and food insecurity; and exacerbating the vulnerability of pastoralists and exposing them to unsustainable livelihoods associated with poverty and food insecurity.

Nomads in the east and central clay plains of the Sudan were allocated certain areas for grazing of their animals and access routes to the rivers and other watering places. Those allocations were made since 1904 to avoid conflicts over land resources between the nomads and the settled farming communities. Nomads were strictly cautioned against trespassing on crop fields hence they made agreements with the farmers to permit foraging of herds on crop residues after harvest. The cultivators on the other hand were equally restrained from encroaching upon the nomadic grazing areas or passage corridors. The land use systems went on smoothly with mutual benefits between the farmers and the nomads until the advent of mechanized farming into the area. More importantly, the systems were sustainable because of the resilience of the communities, who were able to cope with the environmental hazards while maintaining ecological equilibrium (Seif Eldin 1986).

#### *Cultural Factors Influencing Forest and Rangeland Conservation:*

The socio- cultural significance of rangelands is a major factor favouring conservation of certain range plants in some parts of Sudan. Chieftains (Sheikhs) in some rural areas observe local norms & enforce local orders, which prohibit illicit and excessive use of resources and this gives them a sense of empowerment.

Rangelands also furnish opportunities for harvesting wild animal and plant products. There are also certain cultural and religious beliefs attached to certain range plants or animals (South Kordofan). Range plants and livestock are also used in some cultural festivals in many parts of Sudan. In most parts of the Sudan some plants are very important for traditional medicine (*Cassia senna*), traditional food flavour (*Cassia obtusifolia*), or food (*Sonchus oleraceus*, *Chenopodium album*).

Rangelands are important for providing a ‘sense of place and identity for many tribes.

Generally the land held by pastoral tribes in Sudan is owned and grazed communally. On the other hand, individual or family ownership of livestock is normal and it is often customary for each owner to aim at keeping as many animals as possible, irrespective of the quality of the beasts or the availability of pasture. This is partly because livestock are regarded as wealth ‘on the hoof’, and a man's social position and prestige depend on the number of stock he has rather than on money or other possessions. It is also because cattle are needed to fulfil certain obligations under tribal customs, such as the payment of Dowry and settlement of Diyah (compensation for unintentional manslaughter) under Islamic Law which are basic features of the social life of many pastoral tribes.

## 2A.5. Biodiversity of Sudan

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

Although Sudan is rich in diverse ecosystems, habitats, species and genetic resources, yet no coordinated or comprehensive surveys and assessments were carried out. Most surveys or studies were fragmented and tailored for academic, research and scientific purposes. The collected data or information were mostly site-specific, local and at institutional levels.

Harrison and Jackson (1958) estimated the tree cover in Sudan at 36-43%. The FAO Forest Resources Assessment 2005 indicated a tree cover of 29%. The decline was explained as a Consequence of expansion in agriculture, urbanization, wood removal and grazing. Forests provide protection for a variety of genetic resources. There are some 184 species of trees and shrubs including 33 exotics together with a few endemic and near endemic. Special areas with a wealth of rare species are found in the Red Sea Coast and the tropical rain forests in south west and east. About 204 range species were identified. However, no ecological surveys of wood or rangelands were made since mid-1950s.

Most of the wildlife resources of the country are to be found within the HRWS. Recent surveys indicated that there in spite of losses and disturbance to wildlife in the region due to wars and civil strife there still remain substantial numbers of migratory wildlife between RoS and neighbouring countries particularly Ethiopia, RSS and Central African Republic.

Information on wildlife, livestock, human activities and habitat contribute to the assessment of threats to and formulation of specific recommendations for strategic planning of wildlife protected areas and sustainable management of natural resources.

Fire is a serious problem in all forest, range and wildlife areas except the semi-desert area where the grass is sparse and the small areas of the moist closed forests in the South West.

Wetlands on the Red Sea Coast, desert oases, dams, reservoirs and in-land lakes are important habitats for resident and migratory birds. The River Nile and the Red Sea Coast are part of the fly over for soaring and migratory birds from Eurasia to Africa.

The Sudanese Red Sea is still fortunate to have attractive and mostly pristine habitats, particularly its coral reefs. There are mangrove stands, sea grass beds, and associated marine fisheries and biodiversity including sharks, dugongs, turtles, and variety of sea birds. Two protected areas are established; Sanganeb and Dongonab-Mukawar Island with good representation of the Red Sea marine ecosystems.

Dungonab Bay and Mukawwar Island is a turtle nesting site of regional and possibly international significance and it is internationally recognized as an Important Bird Area. The Dugong population may be the most important remaining on the coast of Africa. Regional action plans (following regional surveys) were developed for corals, mangroves, turtles and breeding seabirds and are being implemented nationally via national action plans.

Cereal crops grown in Sudan include sorghum, pearl millet, wheat, maize, rice, finger millet and barley (Anon 2009). The important oil crops grown are sesame and groundnut. Recent years witnessed expansion in the areas allotted for sunflower. Sesame (*Sesamum indicum*) is grown under rain-fed conditions by subsistence, semi-commercial and commercial farmers. Cow pea

(*Vigna unguiculata*) is among the important summer legumes. Other summer legumes include pigeon pea (*Cajanus cajan*) and hyacinth bean (*Lablab purpureus*). A number of vegetables such as okra, onion, tomato, potato, peppers, eggplant, melons, watermelon, pumpkins, squash, sweet potato, radish, Jews mallow = molukhia (*Corchorus olitorius*), purselane (*Portulaca oleracea*), rocket (*Eruca sativa*) and chard (*Beta vulgaris* subsp. *cicla*) are grown. Several fruit species are grown, some of which date back in ancient history while others were recently introduced. The most widespread are date palm, banana, guava, citrus and mango.

Many improved high yielding varieties of different crops are released or introduced at the expense of indigenous landraces and cultivars. The inhabitants migration from rural areas to cities and big towns due to insecurity or economic reasons, abandoning their farms or adopting other jobs, has negatively affected the agro biodiversity used and conserved by the people.

Pests and diseases on crops have negative impacts on the genetic variability within the crops. A number of pests, fungal, bacterial and viral diseases are known to attack crops. Quarantine measures are not effective enough to restrict the introduction of new pests and diseases. Farmers are used to select the outstanding strains for cultivation, guided by their inherited knowledge on the environment and crops. Such practice leads to the dominance of few genotypes at the expense of others.

#### *The Status of Wildlife in the Sudan:*

The wide variety of ecosystems and vegetation types in the Sudan is reflected in its fauna. Brocklehurst (1931) in his book titled: Game Animals of the Sudan outlined their habitats and distribution and provided useful information on the "game animals" at historic times. Setzer (1956) reported that 224 species and sub-species of mammals, other than bats, belonging to 91 genera, have been described in the Sudan. It is worth mentioning that out of the thirteen mammalian orders in Africa, twelve occur in the Sudan. Nimir (1984) produced a list of 52 major wildlife species and their distribution in Northern Sudan. Holsworth (1968) produced a list of 83 major wildlife species and their distribution in 19 protected areas in the Sudan. Cave and Macdonald (1955) reported on the distribution of 871 species of birds in the Sudan. Nikolaus (1987) produced the distribution atlas of Sudan's birds with notes on habitat and status, which included information on 931 species.

There is only limited information on amphibians, reptiles and insects in the Sudan. The orders *Coleoptera* and *Lepidoptera* are the most dominant insect species, while *Siphonaptera*, *Isoptera*, *Ephemeroptera*, *Dermoptera* *Trichoptera* are less spread. Several insect predators and parasites on crop insect pests were reported. The predators and parasites under favourable conditions of population build-up check the outbreaks of crops pests. The orders *Hymenoptera*, *Diptera*, *Coleoptera*, *Dermoptera*, *Hemiptera* and *Neuroptera* include natural insect enemies. These insect groups play a role as pollinators of flowering plants. Several insects such as tree locust (*Anacridium melanorhodon melanorhodon*), Dura antad (*Agonoscelis pubescens*) and the queens of termites are eaten. Insects serve as food for birds and fishes.

Dieback of Sunt (*Acacia nilotica*) is the most serious epidemic affecting many riverine forests. Termites are a serious problem in Eucalyptus plantations. Insect attack on seeds has probably more effect on natural regeneration of certain species like *Acacias*, *Balanites aegyptiaca*, *Combretum* spp. etc. The tree locust attacks acacias especially the gum tree *Acacia senegal*. The outbreaks affect gum Arabic production.

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

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

#### *Conservation Status in the Protected Areas:*

About twenty-four areas are gazetted and declared protected areas and an equal number of areas are proposed. Some of the areas were gazetted as far back as 1936, while others were relatively recently established. The civil wars in Southern Sudan and Darfur had serious impacts on the wildlife resources of these regions. Only a few of the protected areas have game scouts present.

The Sudan was, until not very long ago, one of the most important wildlife countries in Africa. Its wildlife rich biodiversity has been threatened by many hazards, on top of which are armed conflicts, poaching, drought and desertification as well as unsustainable land use patterns. The affiliation of the Wildlife Administration shifted at least ten times in the past thirty years. It now belongs administratively to the Ministry of Interior (as part of the Unified Police Forces) and technically to the Ministry of Tourism Antiquities & Wildlife. Subsequent to the droughts and famines of the 1970s and that of 1984 and the expansion of the semi-mechanized agriculture, the Sudan lost a large amount of its wildlife. Some species disappeared such as the Oryx, Addax, the Dama Gazelle and the Sommering's Gazelle. Due to the aggressive trade, the numbers of elephants had shrunk (in the then unified Sudan). Both species of Rhino are probably extinct by now, while numbers of leopards and other spotted cats are greatly reduced and consequently confined to scattered isolated areas, confronted with extinction.

The conservation status of National Parks is uncertain. The Rahad Game Reserve was opened to mechanized agriculture and human settlement, in the early 1990s. The Radoum National Park has recently lost many species including: elephant, hippo, Giant Eland, Hartebeest and Roan Antelope. Wadi Hawar and Jebel Al Hassania National parks were never established on the ground. Dinder National park became an isolated 'island' in serious land use conflict. The Sommering's Gazelle, hippo, the Nubian Giraffe, Tiang the African Hunting Dog and leopard have been lost to poaching. Numbers of Reed Buck, buffalo and Oribi decreased after the outbreak of rinderpest. Elephants no longer visit the park during the rainy season. The numerous Bird Sanctuaries are no longer recognized by the Federal or State governments.





Plate (12). Surt (*A. nilotica*) Saw logs



Plate (13). Charcoal kiln



Plate (14). Firewood stack



## Box II.2. Benefits of Sudan Forests & Rangelands

Forests and rangelands in the Sudan have significant protective and productive functions and as such offer many opportunities to contribute to the economic, environmental and social development of the country. As such, they can contribute to poverty alleviation and the enhancement of the well-being of people living in the vicinity of forest and of the country at large.

Protective functions of forests, trees and rangelands in Sudan encompass their safeguard of watersheds; protection & amelioration of soil; shielding of agricultural systems; habitat for livestock & wildlife and shelter to human settlements.

Productive functions of forests, trees, shrubs and rangelands in the country include provision of wood and NWFPs.

Wood products include lumber, sawn timber, industrial wood, building poles, firewood and charcoal.

NWFPs on the other hand include a wide range of products such as browse & range material; ivory; bush meat; bee-honey & wax; gums & resins; bark derivatives such as tanning material; fruits, nuts & seeds such as Gonglais (fruit of *Tabeldi=Boabab-Adansonia digitata*), Goddeim (fruits of *Grewia tanix*), Aradaib (fruit of *Tamarindus indica*), Lalob= Desert dates (Fruit of *Balanites aegyptiaca*), Dom (fruit of *Hyphane thebaica*), Dolaib (Fruit of *Borassus aethiopum*) and Nabag (fruit of *Ziziphus spina-christi*) together with medicinal plant parts such as Senna pods & leaves (*Cassia sennna*), Garad pods (of *Acacia nilotica*).

Products from forest tree leaves include robes , baskets, mats, food covers and hats made from Dom and Doleib fronds together with bark of *Tabeldi*..

Range products include browse and grazing material from thorny trees & shrubs together with thatching material and food covers made from Banu (*Arigrostis sp*)

### NWFPs:

NWFPs on the other hand include a wide range of products such as browse & range material; ivory; bush meat; bee-honey & wax; gums & resins; bark derivatives such as tanning material; fruits, nuts & seeds (Box II.1).



Plate.15. Dom Fruits



Plate.16. Gum Arabic



Plate.17. Gum Sorting



Plate.18 .Boabab Fruit



Plate.19.Bee Honey



Plate.20. NWFPs handicrafts



Plate.21. Silkworm cocoons



Plate. 22. Ziziphus fruit



Plate. 23. Browse material



## Annex 2c: Land use related policies with impacts on REDD+

### *Agricultural Policy*

It is strongly perceived that agriculture is the backbone of the economy of the Sudan and may be the main sector that continues to support the GDP development. Agriculture is an important sector in Sudanese societies and economy, constituting the primary livelihood support of the majority of Sudanese. The general feature of the agricultural policy contains an approach for horizontal expansion in agricultural development for crop production to satisfy grain export, supply agricultural industries and secure food. The policy includes statements on sustainable management of natural resources based on integration of land use.

Agricultural cultivation in Sudan is composed of three categories: The traditional rain-fed category; the mechanized rain-fed category and the irrigated agriculture. The traditional rain-fed agriculture is basically subsistence farming, providing livelihood to almost 70% of the rural people but also contributes by about 56 % of the share of the agricultural GDP (World Bank 2005). The Mechanized and the irrigated agriculture are grouped under modern agriculture. Mechanized farming started in early 1950s in central Sudan but because of its horizontal expansion it gradually shifted in southward direction into virgin lands. Abandoned degraded lands are annually increasing resulting in over fifteen millions hectare of wasted lands. The major causes of such huge areas of waste land are the unplanned management and absence of land use map.

Large irrigated schemes have been established, between 1925 up to the present, on the clay soils of central and eastern Sudan. However, various policy statements focused on the need for an integrated approach that combines forests and livestock with agriculture but their implementation is still staggering. The policies that focus on integration highlight on various successful pilot practices such as agro-forestry, shifting bush-fallow systems and shelterbelts inside irrigated schemes and mechanized farming.

### *Mechanized Farming*

Rain-fed mechanized farming expanded rapidly from about 2.0 million hectares in 1969 (after the establishment of the Mechanized Farming Corporation) to over 7.0 M hectares in mid-1990s (Ahmed, (1999). An FAO report (De Wit 2001) stated that the mechanized farms area fall within 10.5 - 12.6 million hectares. The figures are estimates and many reports indicate that the actual area of mechanized farms is difficult to assess. All of the used areas for mechanized farms are in fact government land and allocated to farmers on lease policy.

A mechanized farm scheme is leased as a large-scale farm to an investor farmer who signs a contract with the land distribution office in the State capital where the scheme falls. The area leased as a mechanized scheme is equal to 1000 feddan, (1.0 feddan = 0.42 hectares) as located within the master plan prepared by the Mechanized Farm Corporation (MFC). Because of the high level of investment capital required, the majority of small farmers at the local community level may not be able to invest in mechanized farms, the situation that makes most of the investors in this field, as big companies, business people and high rank officials who are outsiders to the area and who are able to pay the lease fees and put capital investment or are able to get loans.

The original settlers of the area, where a mechanized scheme is established, will have no benefit from the land other than working as wage labourers and most of them lost the land that they use as small holding farms or grazing lands.

### *Forest Policy*

The forests resource is very important for the people in the Sudan and worldwide. It will continue to be one of the main elements in the lives of the human beings and animals based on the relationship between the forest resources and social element which is usually defined by the forest functions.

Development planning in the forestry sector goes back to the year 1902, when the Forestry Department was first established, but the first written and clearly defined forest policy was issued in 1932 supported by forest acts. The policy emphasized on:

- The division of functions in the management of forest resources among the Central Government represented by the Forest Department and the Local Government Authorities (provinces).
- The Central Government was responsible for the national supply of wood products for the whole country while the Local Government was responsible for the provision of wood and other forest products at the province and district levels.
- Wood production should be confined within the forest reserves.
- Encouraging the rural people and farmers to introduce forestry crops on their lands.
- The policy levied taxes on forest produce extracted from outside the forest reserves.

Since 1932, the forest policy has undergone continuous changes presently reflected in the Forest Policy (1986) that encourages forest reservation, conservation and community and private sector participation in forestry development and management. The latest is the forest policy 2006 which is under the process of finalization.

The forest policies are strongly supported by the Comprehensive National Strategies (CNS) (1992 - 2002 and 2003 - 2027) both being concerned with the importance of forests in environmental conservation as well as a source of goods and services for the country and local communities. The CNS supported an increase in forest cover, range and Nature Reserves to an area equivalent to 25% of Sudan area. Presently the reserved area is equal to approximately 10.0% of Sudan area. However, the implementation of the CNS with regards to forest development was constrained by agricultural expansion and lack of coordination and integration between sectoral and national institutions. In addition, its implementation has very much been affected by the instability of the concerned government institutions as a result of changes in political affiliation (Abdel Ati and Awad 1996).

Prior to the 1980s, the concept of conservation was associated with protected area establishment as an activity rather than planning and this lead to slow process of reservation. Yet some achievements in forests and protected area reservation are contained in the establishment of forests and Nature reserves and this was based on the reservation policy that started early in the 20th century (Forest policy 1932). However, in association with the forest policy revisions (1986, 1989), several important changes have occurred with regard to the strategic framework including the reorganization of the administrative set-up of the forestry sector that culminated in the establishment of a parastatal semi-independent Forests National Corporation (FNC) (1989). In 1986, the National Economic Conference recommended adoption of policies on natural resources conservation, ecological balance, desertification control and environmental planning. This was later incorporated in the Four-year Salvation and Recovery Development Programme (1988-1992).

The forest policy of 1986 forms the basis for the new strategy for the forestry sector in the country and perceived as an update for the Forest Policy statement of 1932. The 1986 Statement of Forest Policy was approved in response to the drastic decline of the forest cover and the growing threat of deforestation coupled with the growing population and demands for forest products and services.

The 1986 Forest Policy Statement also responded to the new concepts that appeared since the seventies that put emphasis on the multiple uses of forests, environment protection and the concept of popular participation. The Statement recognized new forms of forest and tree tenure including: institutional, community, investment and private forests. A target of 25% of the area of the country is stated to be owned by the government as forest reserves (CNS 1992 - 2002 and CNS 2003 - 2017). The policy stressed the role of forests in environment protection by creating new obligations on a lessee in mechanized farming (the 10% forest component in mechanized rain fed schemes) or irrigated area (the 5% forestry component in irrigated schemes) in order to maintain or establish green belts within these schemes. In addition, the policy emphasized the role of the international community and public participation in afforestation and sustainable management of forests and recognized the need for research in forest development and emphasized the role of forest extension.

The prime objective of the two policies of 1932 and 1986 was the reservation, establishment and development of forest resources and compromising for the purpose of environmental protection and meeting the needs of the population for forest products. Over and above, the Forest Policy 1986 indicates the role of the different actors in the development, conservation and management of forest resources. The objectives of the 1986 policy:

- Stressed upon the role of forests in environmental protection.
- Recognized and encouraged the establishment of community, private and institutional forests.
- Subjected tree cutting outside forest reserves to the discretion of the Director of FNC provided that these areas are reserved immediately following their utilization, in order to enhance protection and regeneration.
- Made obligatory the utilization of tree stocks on land allocated for agricultural investment (not to be burnt into ashes) and to leave specified percentage of tree covers inside and around agricultural investment schemes in the form of shelterbelts, windbreaks and woodlots.
- Stressed upon the mobilization of popular and international efforts for participation in afforestation, tree planting and forest protection.
- Raised the national target of forest reserves from 15 to 20% of the total area of the country in order to set the environmental protection goals and to meet the population's needs for forest products.
- Stressed upon the role of forest extension.
- Conceptualized the multiple uses of forests.
- Divided forest administration responsibility between the Central and Local governments.

The proposed policy of 2006 defined as Sudan National Forest policy Statement, developed through technical support of FAO, is a recent update of Sudan's Forestry Policy 1986. The 2006 Statement, which has not yet been ratified, is expected to make major changes in forest

development and management. It is incorporating poverty reduction strategy, improvement of people standards, amelioration of physical environment and combating desertification.

The reservation of forest area as a community forest presupposes coordination between the native leader, the locality, the commissioner and the state minister of agriculture to establish rights of the community over the particular area. The federal Minister makes the reservation order upon the recommendation of the general manager of the Forest National Corporation (FNC).

### *National Water Policy*

Through a process of consultation with stakeholders the National Water Policy 2000 was prepared. Its main objective is to enhance the development and implementation of effective national water policies and strategies for integrated water resources management. The policy document assesses the water situation in the country and formulates the main policy principles and statements.

National Water Policy Issues, institutional and legal framework of water resource development, utilization and management are stated in the NCS 1992. The policy and strategy 1992 contains a strategy for irrigation and water management domestic water strategy. However, as Abdalla and Mohamed (2000) stated, a top-down approach failed in enabling proper definition of demand and staging of master plan. The water policy 2000 was based on policy group consultation and developed on the basis of a wide range of options and country development. Strategic statement emphasized on efficient use of water for agriculture in addition to more utilization of ground water for irrigation. The 2000 policy update stressed on the need for a balance between agricultural use and hydropower. The importance of increasing the water use particularly rain fed is stated in order to match with the available vast land area. The water policy stressed upon statement of regulation and coordination between the different water users in order to avoid fragmentation between government responsibilities and institutions particularly in the States.

The water policy indicated the need for excessive investment programs in the water sector. The policy also stressed on supporting issues such as the legislative framework and regulation acts to enhance capacity building and proper management and environment protection.

The Water Policy considered international water issues such as treaties and protocols and their reflection on trans-boundary issues and maintenance of share of regional water resources (Lake Shad and Nubian sandstone aquifer and that is to develop, conserve and use shared water resources in an integrated, sustainable and environmentally sound manner in order to achieve environmentally sound management of water catchment areas.

The policy stressed on the importance of protection of water quality and aquatic ecosystem in national and international water bodies and conservation of wetland and swamps. The National Water Policy of 2007 is a document that covers many aspects of water resources management, utilization and protection that should consider the lessons learnt from the implementation of the 1992 and the 2000 policies.

### *Range Policy*

With regard to range and pasture the Comprehensive National Strategy 1992 - 2002 (CNS) called for rehabilitation and maintenance of natural range of Sudan. Specific objectives include the consideration of the carrying capacity in the management of the rangeland, improvement of pasture, adoption of suitable grazing systems (specialized and rotational system) and protection of

rangeland against fires. This has been stated to be developed within the reservation policy stated to have a target of 25% of the area of the Sudan for forests, range and wildlife and this issue has been elaborated in The Forests and Natural Resources Act 2002 in relation to rangeland management.

For the animal welfare sector CNS focused on the expansion of the modern sub-sector and improvement of the traditional sub-sector which host more than 80% of the animal population. This improvement aims at making radical change in the breeding and animal production systems, encouragement of private sector investments, intensification of productions and integration of agriculture and animal production within the objectives of range and pasture improvement.

### *Wildlife Policy*

For wildlife, the strategy (CNS) concentrated on conservation of habitats, adoption of attractive economic policy, and enhancement of regional cooperation, establishment of more Nature reserves and national parks within the reservation policy that targets a 25% of the area of Sudan. The policy encourages research development in the field of wildlife.

### *Livestock Policy*

There is an urgent need for revision of livestock policy in Sudan. On account of current peace agreements, new policies and institutions are being established in Sudan that will influence livestock and livelihoods. There are several prospects to build new pro-poor initiatives on the relics of the inconsistent development policies of the past. The issues of overgrazing and desertification have been studied and identified among other causes of desertification and degradation in Sudan. The increases in the livestock populations during the last few decades have indisputably had effects on forests and grasslands. There is an urgent need to determine the human and livestock populations and survey the status of natural resources in Sudan. The increases in the livestock populations during the last few decades have indisputably had effects on forests and grasslands. There is an urgent need to determine the human and livestock populations and survey the status of natural resources in Sudan.

In accordance with the National Plan for Environmental Management in Post- Conflict Sudan, 2007, various natural and man-made factors have caused deterioration in Sudan's rangelands at a time when improvement in veterinary services and vaccination of livestock increased animal population. Consequently deterioration of range resources was accelerated due to overstocking. Stocking rates are estimated to have increased four or five fold within the past few decades. Due to the pattern of rangelands utilization, where range resources are used in common, large tracts of rangelands are subjected to overgrazing and inappropriate use.

Generally the land held by pastoral tribes in Sudan is owned and grazed communally. On the other hand, individual or family ownership of livestock is normal and it is often customary for each owner to aim at keeping as many animals as possible, irrespective of the quality of the herd or the availability of pasture. This is partly because livestock are regarded as wealth, and a man's social position and prestige depend on the number of stock he has rather than on money or other possessions. Large numbers of stock are also commonly kept as an insurance against years of drought and famine, on the mistaken assumption that the more cattle a man owns the more likely survive a bad year.

### *Environmental Importance*

In spite of the concern of governments about formulation of forest policy and natural resources policies since 1932, and continuous revision of policies between 1932 and up to the present, yet the Sudan could not halt the continuous decline of forest cover and natural resource degradation.

Severe environmental changes are taking place in the country. These are mainly caused by the removal of the tree and plant cover and exposing the surface soil to all agents of erosion. The expansion of agriculture and unplanned settlements on forest and rangelands resulted in land degradation and the creation of bare lands. Unorganized and uncontrolled grazing and tree felling in addition to fire outbreaks caused large damage to the natural resources. These factors are further exacerbated by severe climatic changes and erratic rainfall causing widespread desertification and serious destruction of forests.

Efforts to be taken in the long term aim at a sustainable management strategy for the natural resources towards maintaining protected environment and support sustainable yield of timber, energy, fibre, fodder, and useful plants in addition to income generation from the natural resources. This will generate sustained mitigation benefits.

In fact the environmental and natural resources policies in Sudan lack integration and cooperation. Atta Elmoula (1985) stated that, among the factors affecting natural resource management is the lack of clear policy to provide a base for positive and concrete actions. Land use policy is essential to limit the negative impacts of sectoral policies.

Most strategies and programmes related to natural resource management in the country are directed to address these problems or at least mitigate their adverse environmental effects. Currently National Action Programmes concentrate on natural resources protection, by increasing protected areas with a target area of 25% of Sudan area (Nature Reserves, forest reserves and range lands). Awareness raising and community involvement are much emphasized to supplement the formal efforts in environmental protection.

The presence of formal institutions and community-based civil society organizations is necessary for the democratic processes related to environmental protection. What is important is not how many organizations are there but how effective is the role they play within the State structures, and how they are influential in the State decisions in the direction of sustainable development. At present, despite the large number of organizations, often they are not fully free to function. The declaration of an environmental policy, which guides actions at national, regional and local levels, as a starting point provides for further steps of coordination. It explained that a basic requirement of such a policy is the statement of national goals regarding resource utilization and the concern for sustainability. The presence of such an environmental policy is also important for the formulation of appropriate laws and regulations.

### *Land Tenure*

Since the early 1970s and 1980s concern has been focused on environmental and development policy issues in relation to land use categorization. Prior to that time, studies were concentrating on agriculture in relation to anthropological issues.

Most of the tenure rights for land and resources, including trees, pasture and water, come from customary practices and indigenous traditions usually based on tribal structure. Traditional land use systems, prior to the colonial era, were based on traditional tribal leadership and customary laws that organize resource use among communities. Agricultural practices were based on

smallholdings allocated to households while pasture and range on large tracts are managed as common resources for grazing. Other resources uses like water and forest products are under the control and management of the tribal leaders.

However, the post- 1970 land use policy gave the government the ownership over any wasteland, forest or unregistered land thus reducing the rights of the local people. The land tenure system in the post-1970 land use has some negative impacts on the natural resources, which apply to range lands, and forest lands because agriculture is a priority over the other resources. Three categories of land ownership systems emerged in association with the continuous issuance and amendments of the land use policies. These include: Private government and community lands. The majority of the land is under government control.

Some key policies which influence REDD+ are resumed in the following box:

**Box: Key National Development Policies that influence reducing deforestation and forest Degradation**

- A 5 year plan for Sudan (2012-2016): include the natural resources, wildlife, agriculture, minerals, energy, environment, animal resources and Range & pasture, electricity & dams.
- National economic policy instruments for REDD+ (2012).

**In order to realize the objectives of the National REDD+ Program the Government of Sudan could use two broad types of economic policy instrument to reduce deforestation and forest degradation:**

- Non-financial instruments (e.g. regulation, levies)
- Financial instruments (subsidies through REDD+ finance and other public sources of funding).

**To date, the mechanisms that have been used for financing forestry development in Sudan include:**

- Self-financing mechanism from FNC own resources;
- The National Development funding mechanism which finances development projects;
- Projects funded by other donor organizations and private sector;
- Forestry investment.

**While funding for forestry development needs to be a crucial component of REDD+ strategy, this on its own will not be sufficient. For policies to have an effective impact on deforestation rates, financial and non-financial policy instruments will need to target the drivers of deforestation directly – particularly demand for wood fuel and agricultural land.**

**The following section explores options for REDD+ activities that use a combination of both types of economic policy instrument. A combination of instruments, if designed well, will be the most effective and cost efficient means of reducing deforestation and degradation.**

## Annex 3: Develop a National Forest Reference Emission Level and/or a Forest Reference Level

### 3.1. Available Data Sources on forest cover

Several studies were conducted during the late forties and fifties including Andrews (1948), Harrison and Jackson (1958), Lewis (1953) and Ferguson (1954). The Forests Department conducted various surveys in the Central and Eastern regions mainly for the preparation of Working Plans in reserved forests. Later studies were based on remote sensing data, yielding a more uniform interpretation environment.

#### *Early studies*

**Andrews, 1948**, described seven plant types based on soil type and rainfall variations.

- Desert with no plant life.
- Semi-desert with scattered bushy acacias.
- Semi-desert with short grass.
- Open canopy acacia forests with tall grasses.
- Broad leafed forests with tall and large trees but with invariably open canopies.
- Tropical forests which are divided into "Gallery forests" on river and stream banks at high elevations, "Cloud forests" on mountain slopes and "Bowl forests" on lowlands and other plains. All these types are closed forests mainly found in the Southern border and Jebel Marra area in west Sudan and in the largest area of this type of forest now became part of the new RSS.
- Swamps which he divided into permanent and seasonal.

#### **Harrison and Jackson, 1958:**

"The Ecological Classification of the Vegetation of the Sudan" prepared by Harrison and Jackson in 1958 is still considered a reliable reference. The vegetation types described by Harrison and Jackson (1958) are presented in table Annex III-1. The map with that classification was used to extrapolate the vegetation of the two Sudans (RoS & RSS) in tables II.4 & II.5.

**Table Annex III-1: Vegetation Zones of the Sudan in relation to latitudes and rainfall.**

Class	Type of vegetation	Location and latitude	Annual rainfall (mm)	Variability (%)
I	Desert	North of 17°N	<50	35 - 60
II	Semi-desert Acacia scrub and short grasses	North central Sudan, between 14-17°N.	50-200	25 - 35
III	Low Woodland Savannah	Central Sudan, 10-14°N	200-750	25 - 30
IV	Deciduous High Woodland Savannah and Grassland	Southern Sudan 5-10°N	750-1,250	20 - 25
V	Modified Tropical Rain forests	Southern border land, 3½ - 5°N	>1,250	< 20

Modified from Harrison and Jackson (1958)

Since Andrews (1948) and Harrison and Jackson (1958) classifications, gradual changes might have been taking place in the forest cover resulting mainly from mechanized farming and shifting



cultivation. Effects of climate change are also evident, an example is related to rainfall changes and isohyets shift towards south. According to (ibid) the isohyets line 300 mm goes parallel to latitude 17°N while the ILO 1984 indicates that this line goes parallel to latitude 16°N.

### *Special areas*

Sudan has special areas characterized by distinct environmental conditions:

- **Montane Forest:** This special type covers an area which constitutes less than 1% of the country area. These include the Jebel Marra, Nuba, Ingessena & Red Sea Hills around some of them are important production forests derived from Rainforests.
- **Wet Lands:** Wet land sites need to be defined, geographically located, characterized and described.

### *1982 Survey of Forest Cover by Region*

In 1982, the National Energy Administration (NEA) in collaboration with Forests Administration, UoK, FRI and the Regional Remote Sensing Facility (Nairobi) conducted a forest resource survey to address the country's energy requirements. Satellite images produced by Landsat 1 Multi-Spectral Scanner (MSS) for the period 1972 -1975 were used. A composite vegetation map, divided into thirteen strata and one sub-stratum (forestry plantations), was designed for this period. The crown cover of forest strata ranged between 30-80%. The survey showed considerable depletion of forests in the Central and Eastern part of Sudan compared to earlier maps and more recent images. Consequently, an intensive ground survey was conducted during April and May 1982 in these areas to validate satellite images interpretations. Area measurement of strata and results are presented in table Annex III-2.

The **total forest area** in the North Sudan (with crown cover more than 30%) for the period 1972-75 was hence 41,398,155 ha - 4,200,000 ha (desert and semi-desert scrub) = **37,198,155 ha**. At the same time the total forest area in South Sudan was estimated as 71,095,683 ha making the total forest area in former Sudan as 112,493,838 ha

In 1982 the World Bank undertook an assessment of the issues and options in the country's energy sector and the subsequent report issued in July 1983 (4511-SU) contained the same forest area figures produced by the NEA survey (1982). The report also highlighted the serious over-cutting of fuel wood resources in the country and proposed recommendations directed to alleviate this problem.

In 1983-1984 an aerial photography was conducted by Canadian International Development Agency (CIDA) covering Blue Nile Provinces using randomly selected plots to determine the tree standing volume.

A table of land use was provided through the forest sector review conducted by World Bank in conjunction with several partners during 1984. A table of "Land Classification by Region" (1983), used the World Bank report (1983) with the Mission estimates; the Agricultural Sector Survey (1979) and the report on Investing for Economic Stabilization and Structural Change (1982). The resultant report issued in 1985 estimated the **woodlands and forests area in old Sudan (before separation of the South Sudan) to be 93.87 million ha**, with the base year 1983.

**Table Annex III-2: Forest areas based on the 1972 imagery, wood volume and allowable cut**

Region	State	Total forest area (ha)	Scrubs & semi desert (ha)	Average wood volume (m <sup>3</sup> /ha)	Total wood volume (m <sup>3</sup> )	Annual allowable cut (m <sup>3</sup> )
Eastern	Red Sea	-		-	-	-
	Kassala	2,748,065		2.55	7,007,855	234,602
	Total	2,748,065	*	2.55	7,007,855	234,602
Central	B. Nile	4,957,440		4.90	24,313,794	831,198
	W. Nile	157,450		3.93	618,051	21,602
	Gezira	8,900		67.47	600,480	33,456
	Total	5,123,790	*	4.98	25,532,325	886,256
Khartoum	Total	5,000	*	60.00	300,000	30,000
Kordofan	S. Kordofan	11,628,000		10.56	122,827,800	2,985,994
	N. Kordofan	-		-	-	-
	Total	11,628,000	*	10.56	122,827,800	2,985,994
Darfur	S. Darfur	17,693,300		26.97	477,199,800	9,587,083
	N. Darfur	-		-	-	-
	Total	17,693,300	*	26.97	477,199,800	9,587,083
Northern	Northern	-				
	Nile	-		-	-	-
	Total	-	*			
<b>Total Forest</b>				<b>15.77</b>	<b>652,859,780</b>	<b>15,056,735</b>
<b>Total Scrub and Semi-Desert*</b>			<b>4,200,000</b>	<b>4.76</b>	<b>19,992,000</b>	<b>1,332,800</b>
<b>Total Republic of Sudan</b>		<b>37,198,155</b>	<b>4,200,000</b>	<b>20.53</b>	<b>672,851,780</b>	<b>16,389,535</b>

\* Total area of desert and semi-desert scrub estimated at 4,200,000 ha occurring in different Northern Provinces are included in both Northern Sudan sub-totals and in the estimate of the Sudan total forestry resource (due to the difficulty of assigning these patches to any one region).

Source: Sudan National Energy Assessment (1982)

In 1987 Lund University conducted a survey commissioned by FAO covering an area of 0.58 million km<sup>2</sup> in Gadaref, Kassala and other areas in central Sudan, using Landsat TM images.

### *The National Forest Inventory (1995-1997)*

Sudan has never conducted a complete national forest inventory (NFI). The widest inventory was launched during the period 1995-1997 after completion of an energy demand survey in 1995. The 1995-1997 NFI covered most of the area north of latitude 10°N with crown cover ≥10% at that time, which now represents more or less the area of the Republic of Sudan after the separation of South Sudan. It covered an area of 62.27 million ha, spread over 15 of the 16 states of RoS (except the Northern State), equivalent to 33% of the total area of the RoS. The results were published in 1998. The objective of that inventory was partly to assess the available wood supply as compared to the demand indicated by the energy demand study (1995). In addition, there was a need to decide on the future forest development programmes needed to achieve a sustainable supply of wood and other forest products while maintaining a sound policy of environmental conservation. The inventory results showed that **forests cover** was found to occupy slightly less than **12%** of the inventoried area. When extrapolating this result to the territory of RoS provides a total national forest area of about **22.64 Mha**. This value is much smaller than the 1972-75 inventory in spite of the fact that the considered crown cover is 10% against 30% in the earlier inventory.

### *Sample satellite imagery analysis in support of the NFI*

The NFI was planned to be comprehensive with respect to its representation of every state, based on map sheets in dimensions 160x180 km, using GPS to visit every sample plot (10x10 km) within each map sheet. Automated image interpretation was not used in the NFI although the sample plots represent perfect distribution to support it. The Sudan forest cover assessment did not fully utilize the systematic sample plots by map sheets by state when remote sensing was applied for Sudan cover and the updated one.

A pilot for remote-sensing based analysis was carried out in Agadi and Boot area in Blue Nile State. The methodology of this study is summarized in the following sections.

### *Selection of the satellite imagery*

A total of four dated satellite imagerys were used in this study. Two Landsat Thematic Mapper (TM) dated of 27/10/ 1987 and 13/11/1999, with 3-band false colour composite (FCC) (band 2, 3, and 4); and two Landsat Enhanced Thematic Mapper+ (ETM+) dated of 25/10/2004 and 03/12/2010, with FCC (band 2, 3, and 4) were used to classify the area. The suitable data period for interpretation of most of the forest areas in Sudan is the dry season (October - May).

### *Image pre-processing*

In this study the geometric correction of the satellite data was performed and the images were georeferenced to the WGS1984 coordinate reference system.

The study area was covered by two path/row combinations, 172/51 and 172/52. Mosaicing was done for each of the two images to combine the images to create one large image. And then the images were sub-setted to the shape file of the study area which prepared using Geographical Information System (GIS) software ArcMap9.2 for mapping of the study area.

### *Image processing*

The image processing and analysis have been carried out using ERDAS Imagine 9.2 and ARC/GIS software. The process in detail includes radiometric enhancement, mosaic, subset, and supervised and unsupervised classification, change detection methods, and Microsoft Excel statistical programs was been used to analyze the data.

### *Field observations*

Ground truth data was collected from 34 randomly selected plots inside the study area, which identified by GPS, in 2010. Information on the driving factors of land use land cover change in the study area was collected by interviewing local people and forest officers as key informants. The interviews focused on the land use process

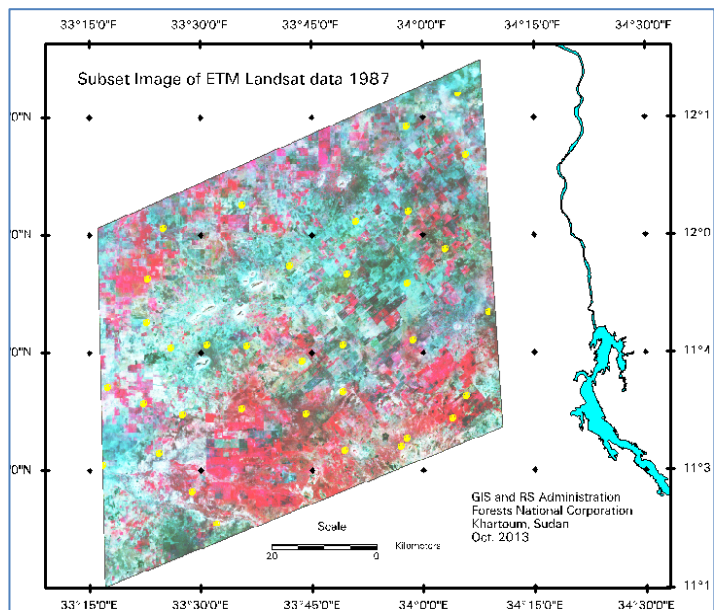
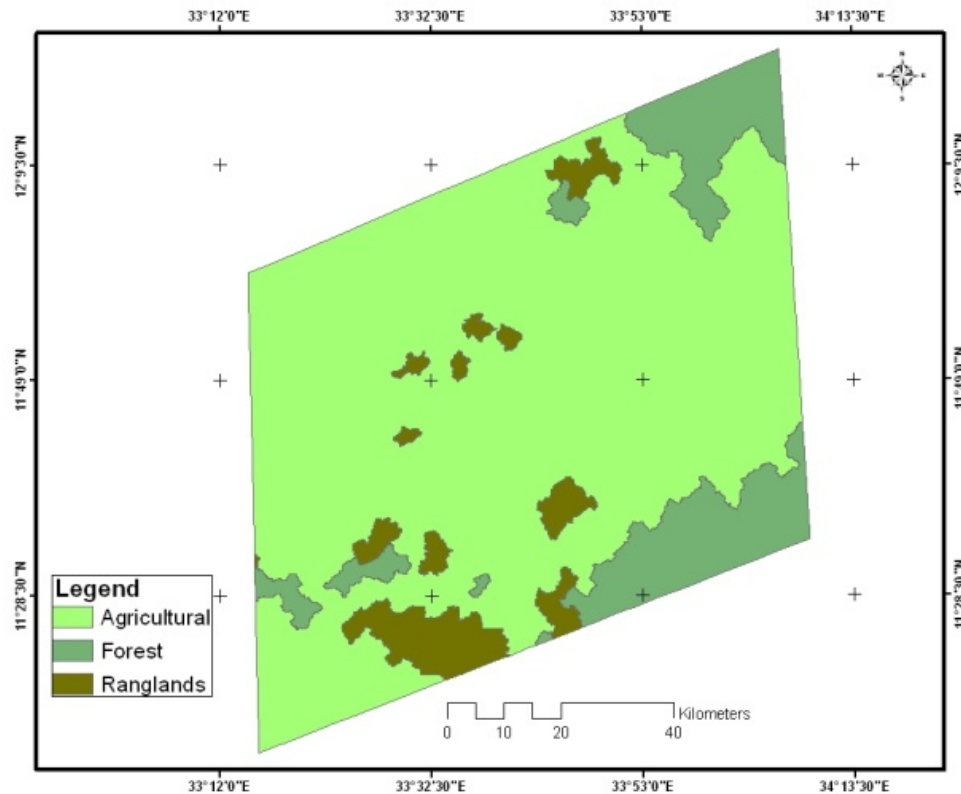


Figure: Subset Image Landsat TM data 1987



**Figure: Supervised classification of the year 1987 of the study area.**

and the history of the changes during the study period.

#### *Image enhancement*

Enhancements were applied to TM, ETM+, and SPOT4 images before classification. These were histogram equalization function which applies a nonlinear contrast stretch that redistributes pixel values so that there is approximately the same number of pixels with each value within the range.

Based on feature extraction and pattern recognition. Digital remote sensed data were stratified and classified using ERDAS Imagine 9.1. GIS software was adopted in order to enhance data quality, and to produce four thematic maps about (Forest, Agricultural, and Rangelands) in the study area through four dates (1987, 1999, 2004, and 2010).

#### *The Africover Project*

In 1997 the Africover project commenced its activities covering 10 Nile Basin countries in addition to East African countries, including the Sudan. It is the only total survey of the country date. The project used Landsat TM coverage of 1997-2000 and the maps produced were visually interpreted. Ground validation in the Sudan was, however, limited to some areas in Western Kordofan, Southern Darfur and Red Sea Provinces and limited scattered samples in Central Sudan. The land cover class is defined by a set of pre-selected independent attributes (classifiers). The numbers of classifiers used determine the detail with which the land has been classified. Eventually the land cover database aggregated into six main land cover types and was interpreted

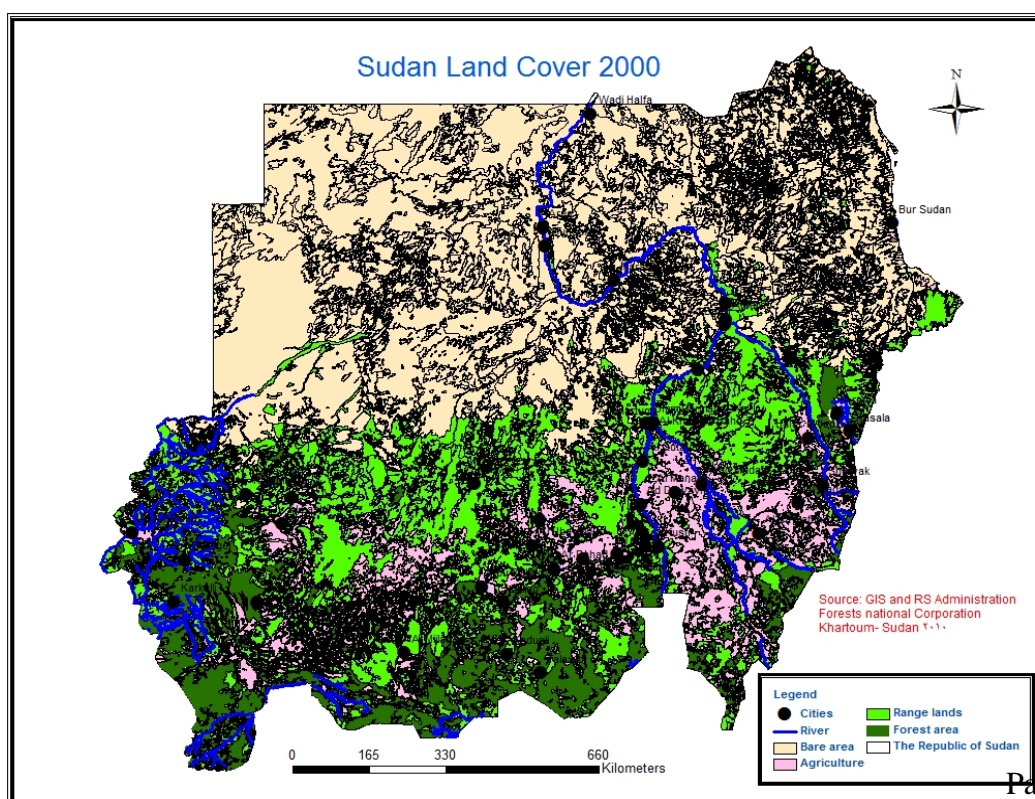
to provide six main land use types. Table Annex III-3 shows the summarized computed areas in the States of the RoS.

**Table Annex III-3: Analysis of Land Use (in ha) of Republic of Sudan (Africover Database, 1997)**

State	Agriculture	Forest area	Rangelands	Urban areas	Bare areas	Water bodies	Total area
Khartoum	17,1885	37,842	1,695,295	58,399	195,248	21,642	2,180,311
Gezira	1,761,940	5,321	667,289	28,971	0	10,877	2,474,356
Blue Nile	2,042,096	1,071,771	1,075,380	4,314	0	24,766	4,219,410
Senmar	1,976,948	626,381	931,460	3,561	24,664	19,155	3,582,144
White Nile	1,459,893	609,781	185,961	8,120	21,419	47,186	4,006,046
Northern State	158,125	20,507	467,278	7,903	35,661,507	127,561	36,442,884
River Nile	162,620	212,508	3,420,955	10,357	7,497,175	52,693	12,937,734
Gadaref	3,221,524	522,087	2,079,853	13,935	9,570	2,026	5,849,007
Kassala	797,522	899,977	2,849,610	41,987	403,684	9,873	5,002,644
Red Sea	100,424	331,434	2,290,225	8,737	18,899,005	233	21,630,048
N. Kordofan	3,025,129	637,074	8,899,417	32,278	6,257,615	1,569	18,853,075
S. Kordofan	1,213,703	4,139,293	2,607,012	6,296	71,110	886	8,038,295
W. Kordofan	3,474,435	3,137,866	4,629,176	20,357	23,542	369	11,285,755
N. Darfur	2,181,131	830,515	7,845,671	17,163	18,676,387	103	29,551,078
S. Darfur	3,441,510	6,009,313	482,193	17,194	40,686	44	13,870,975
W. Darfur	624,112	2,734,491	3,877,549	1,488	638,302	590	7,880,255
<b>Total</b>	<b>25,812,997</b> <b>13.7%</b>	<b>21,826,161</b> <b>11.6%</b>	<b>44,004,324</b> <b>23.4%</b>	<b>281,060</b> <b>0.1%</b>	<b>88,419,914</b> <b>47.1%</b>	<b>319,573</b> <b>0.2%</b>	<b>187,804,017</b> <b>100.0%</b>

Note that the six Africover classes largely correspond to the IPCC land use categories for the LUCF sector in the National Greenhouse Gas Inventories.

Following is the Sudan's land cover map (issued 2000) based on imagery of year 1997.



**Figure Annex III-1: Sudan Land Cover 2000 (Africover)**



The Africover map codes reclassified according to the FRA 2005 provides the following information presented in table Annex III-4 (FAO 2006:FRA 2005).

**Table Annex III-4: Land cover (ha) taken from FRA 2005 (for RoS).**

Region	Forest	Other wood land	Total
Central	2,698,588	4,795,991	7,494,579
Darfur	11,559,867	12,911,635	24,471,502
Eastern	2,494,136	6,537,548	9,031,684
Khartoum	33,365	271,865	305,230
Kordofan	9,920,094	14,241,317	24,161,411
Northern	314,853	876,306	1,191,159
<b>Total</b>	<b>27,020,903</b>	<b>39,634,662</b>	<b>66,655,565</b>

Based on Africover data for the year 2000.

### *Update of the Africover study*

Africover data was updated by the Sudan Institutional Capacity Program: Food Security Information for Action (SIFSIA). This project was implemented with a strong technical support from Natural Resources and Environment, Land and Water division of FAO (FAO-NRL). The update of the land cover module was implemented by the NRL geospatial unit in collaboration with the GLCN group based in Florence (Italy). The Remote Sensing Authority (RSA), the FNC and MAI's Food Security Technical Secretariat (FSTS) were the major implementing partners. Satellite image interpretation of SPOT and Landsat imagery was performed using FAO's tool box for land cover mapping and Google-earth and field verification. The current database, which heavily relies on high resolution images from 2010, updated the existing Africover database (dated 1999-2000). The main related outputs of SIFSIA initiative is the production of a detailed and harmonized national land cover database and map using remote sensing products, tools and software for mapping and automatic segmentation (see Figure III.2 and table Annex III-5). SIFSIA update of the Africover gave results of the six major land cover categories as follows:

**Table Annex III-5: Area and proportions of the major land cover categories according to SIFSIA update.**

Category	Area (Mha)	% of the total country area
Agriculture	25.8	14
Forest	21.8	12
Range	45.7	24
Urban	0.281	0.0014
Bare	90	47
Water bodies	0.319	0.007

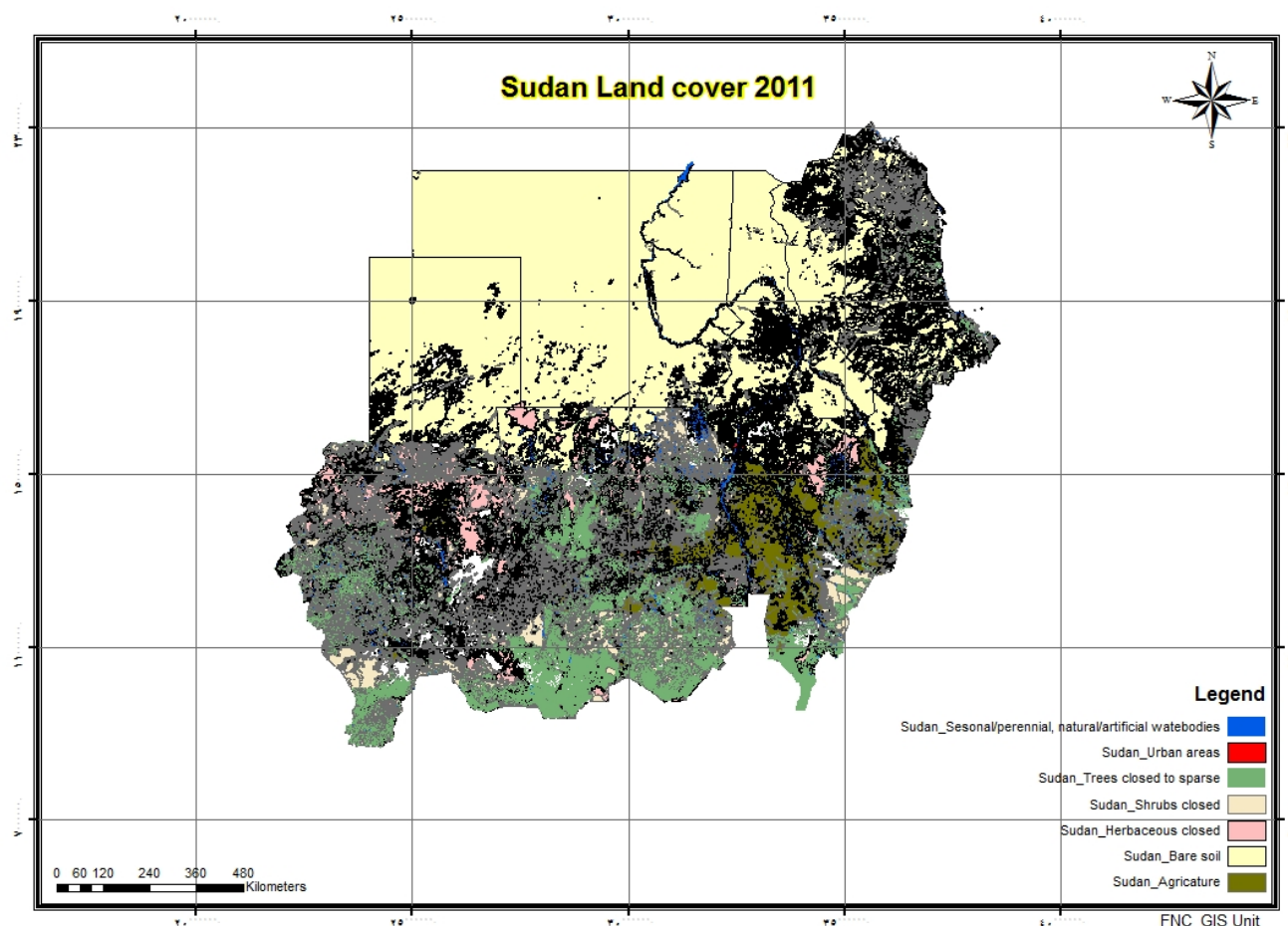


Figure III.2. Sudan Land Cover 2011 (SIFSIA)

### 3.2. Forest Product Consumption Study

In 1994 the FNC, in collaboration with FAO, conducted study on consumption of forest products in the Sudan. The study indicates Sudan's consumption of forest products in quantitative terms. The per capita consumption figures deduced by the study seem realistic, in line with those of neighbouring and other countries of similar ecological and social set-up and it provided a good basis for rationally assessing the contribution of the forestry sub-sector to the GDP in Sudan and considered as a base for forestry strategic planning in the country.

#### *Supply Projection*

Taking 1994 and 1997 as base years, at which wood supply and wood consumption received intensive surveys at the national level, the total wood consumption in Sudan was estimated at 16.0 million cubic meter (FAO/FNC 1994) while the allowable removal (supply) was estimated at 11.0 million cubic meter (NFI 1998). The consumption will be increasing at a rate proportional to the rate of increasing population and development in urbanization. According to the on-going annual deforestation rate, the annual allowable removal is expected to change by the same rate.

However, consumption exceeds the sustainable supply by 45.5%. It is expected that this deficit will increase with the increasing rate of agricultural expansion which results in reduced forest area. Based on the above mentioned information, following are different scenarios for supply projection versus consumption.

**Table Annex III-6: Wood production and consumption (1995) (in m<sup>3</sup>) in Sudan**

Region	Volume of woody vegetation	Annual allowable cut	Wood consumption	Surplus (deficit)
River Nile	672 000	47 040	451 851	(404 811)
Eastern	3 234 000	226 380	2 025 763	(1 799 383)
Central	29 531 000	2 067 170	7 475 000	(5 407 830)
Kordofan	44 218 800	3 095 316	2 551 097	544 219
Darfur	89 096 800	6 236 776	4 018 401	2 218 375
<b>Total</b>	<b>166 752 600</b>	<b>11 672 682</b>	<b>16 522 112</b>	<b>(4 849 430)</b>

*Source: National Forest Inventory 1998*

### *Forecast scenarios of wood consumption*

For future supply projection three scenarios can be thought of based on the following assumptions according to the proposed national forestry strategy:

1. The present situation persists and inputs required for achieving the targets of forest reservation, afforestation and formulation of management plans for sustained production are not made available.
2. Inputs will be made available and the strategy targets achieved.
3. Reduction of wood fuel demand by 25% by using LPG.

**Table Annex III-7: Wood supply and consumption scenarios.**

Scenario	Year	Total Wood Volume	Allowable cut	Wood consumption
<b>1</b>	1998	166 752 600	11 672 682	16 522 112
	2005	173 236 392	12 126 547	19 000 429
	2010	166 362 510	11 645 376	21 850 483
	2015	156 157 403	10 931 108	25 128 055
	2020	141 950 455	9 937 232	28 897 263
	2025	103 115 960	7 218 117	33 231 852
	2030	62 665 991	4 386 619	38 216 629
<b>2</b>	2015	171 157 403	11 981 018	18 846 041
	2020	188 273 143	13 179 120	21 672 947
	2025	207 100 457	14 546 735	24 923 884
	2030	227 810 502	15 946 735	28 662 472
<b>3</b>	2015	156 157 403	10 931 108	18 846 041
	2020	141 950 455	9 937 232	21 672 947
	2025	103 115 960	7 218 117	24 923 884
	2030	62 665 991	4 386 619	28 662 472

*Allowable cut is calculated as 7% of stock at the beginning of the season.*

*Consumption increases by 15% every 5 years*

### *Aggregate consumption of Forest Products*

The main wood products are fuel wood, round wood for construction and sawn timber. Smaller quantities of wood, but of greater economic importance, are used for turnery, handicrafts, tool handles, utensils, beds, saddles and other uses. Sudan consumed a total 16-20 million m<sup>3</sup> round



wood in 1994 including wood fuel, construction, maintenance and furniture wood. Of the various economic sectors, the household sector has the highest share of consumption approximating 80-90% of all wood products consumption. The remaining 10-20% is distributed among the industrial (6.8%), commercial and services sectors (2.5%) and other uses.

The analysis of aggregate consumption by product shows that wood fuel (firewood and charcoal) forms the bulk of the consumption. The wood fuel share of the total is estimated to be 87.5%. Construction, maintenance and furniture wood form 7.2%, 3.8% and 1.5 of the 1994 consumption respectively. Annual wood per capita consumption for all products combined was estimated to be equal to 0.973 m<sup>3</sup> of round wood based on total consumption figures and estimated population. Per-capita estimates however, exhibited wide variations between States and urbanization and income level and education. At the aggregate level the following conclusions can be made regarding per capita estimation.

- The annual household per capita wood consumption constitutes the highest component of the overall national wood use and is estimated to average 0.653 m<sup>3</sup> for urban households and 0.637 m<sup>3</sup> for rural households. Furthermore, per capita estimates also tend to vary with income, ecological zone and education.
- Charcoal, on average, constitutes the highest component of annual household wood consumption, reaching 43% of the total wood consumption. Per capita consumption ranged between 0.493 m<sup>3</sup> for urban households and 0.162 m<sup>3</sup> in rural households. Firewood on average formed 41.8% of the total annual household per capita consumption. The estimated per capita use varied between 0.116 m<sup>3</sup> for urban households and 0.354 m<sup>3</sup> in rural households with national average of 0.273 m<sup>3</sup>.
- Construction, furniture and maintenance wood consumption compound constitute 13.5% of the total annual per capita consumption. The national average is estimated to be 0.051, 0.026 and 0.009 m<sup>3</sup> for construction, maintenance and furniture woods, respectively. Variations are exhibited between rural and urban population.

### **3.3. Forest disturbances**

Little information is available about insects, diseases and other hazards impacting forests and the forest sector in Sudan. One report estimated that 102 874 km<sup>2</sup> of forested areas in four sectors of Darfur, Kordofan, Eastern and Central were affected by insect pests and diseases (FAO, 2007). Fire, fungal and insects' attacks and grazing hinder natural regeneration.

#### *Fires*

Fires area usually sited for land preparation for cultivation but it also destroys the range land. Large animals leave their habitats to remote areas or may be subjected to death. Fire is a serious problem in nearly all forest areas in the Sudan. Only the semi-desert area, where the grass is normally too sparse to burn, and the small areas of closed forest in the South Sudan, where there is no grass, is relatively free from fires. Even in these areas fires sometimes occur, and do considerable damage.

The most difficult fire problems threatening forests occur in Jebel Marra. The steep terrain and valuable forest combine to present a challenge to the local foresters and the villagers. Fortunately, or as a result of the problems, this location has the most active and experienced fire suppression personnel. The results of investigating fire causes in Jebel Marra by Elgamri *et. al.* (2007) is

summarized in Table Annex III-8. Honey collection, cleaning of the agricultural land and tribal conflicts are the common causes of the fire in Jebel Marra.

**Table Annex III-8: Different causes of fire and their percentage of occurrence in Jebel Marra, Sudan.**

Fire Cause	Percent
Honey collection	24%
nomads	22%
Live stock holders	11%
Tribal conflict between farmers and poachers	10%
Cleaning of agricultural land	23%
Smokers	4%
Arson	3%
Others	3%

### *Siltation*

A survey conducted by FNC indicated that siltation is one of the major problems that cause a serious disturbance, leading to *Acacia nilotica* habitat changing, particularly in Sennar State, where all riverine forests were severely affected. The siltation depth amounted to 90 to 220 cm, while, 35% of riverine forests in Blue Nile State are affected. Siltation seems to be a major factor that causes dieback, decline in survival rate of newly planted *A. nilotica*.

### *Diseases*

Following table shows the latest outbreak of insects and disease affecting forests in Sudan.

**Table Annex III-9: Insect damage to forest resources.**

Description / name	Tree species	Year of latest outbreak	Area affected (x1,000 ha)
<i>Sphenoptera chalcichroa arenosa</i>	<i>Acacia nilotica</i>	2009	4.2
<i>Anacredium melanorhodon melanorhodon</i>	<i>Acacia senegal</i>	1994	5000

Source: FRA 2010

## **3.4. Stakeholders and capacity building requirements**

REDD+ readiness activities will be coordinated by the FNC, in collaboration with other partners and all relevant national institutions at both national and state levels. FNC is an organization under the MEFPP established in 1989 as a semi-autonomous parastatal institution responsible for the development of the forest resources in the Sudan. FNC has developed technical capacities and long experiences in working with international and national organizations in multiple areas relating to forest resources development including afforestation and reforestation, forest resources assessment and forest management (See Table II.11). FNC has offices and technical staff at national, State and local levels.

FNC will be the leading agency responsible for the oversight and coordination of the different activities through its offices and staff in the relevant states and in close collaboration with the following stakeholders based on clearly defined roles and responsibilities, in according to their jurisdiction:

- Natural Resources Administration
- Wild Life Administration - Ministry of Interior
- Federal Ministry of Agriculture & Irrigation

- HCENR of MEFPP
- Ministry of Energy
- National Centre for Research
- Forestry Research Centre
- Ministry of Higher Education, through UoKhartoum and Sudan University of Science & Technology
- National Remote Sensing Authority
- Survey National Corporation
- NGOs and CSOs

In addition, close collaboration will be established with Universities and research centers in the activities related to REL/RL methodology development, data and also with other research institutions and departments of relevance to the project.

### *Consultations*

The REDD+ readiness consultations on reference levels shall involve all above-mentioned resource custodians / stakeholders and other related institutions such as RSC, ARC, Energy Research Centre, Miraag (private national company). The consultations will solicit stakeholders' inputs on the proposed methods, data and the stepwise approach to developing Sudan's RELs/RLs. This task shall include an inception workshop, which is expected to contribute to building awareness about Sudan National REDD+ Programme among all stakeholders and to facilitate the implementation of the proposed plan for the development of reference levels.

### *Overview of stakeholders*

Various stakeholder groups with distinct interests in the utilization and management of land, forests and natural resources can be recognized in Sudan. These include government, non-government and community based institutions. Despite the fact that the different components of natural resources are closely related and interdependent, this is not reflected in the counterpart relationship of the various institutions concerned with the use of land and natural resources management.

The following are the institutions and organizations affecting or affected by the development of the RELs/RLs to be included in the consultations. In addition and where needed, some specific roles and responsibilities during the preparation of RELs/RLs will be assigned to individual institution based on their mandate and comparative advantage.

<b>MEFPP</b>	
Mandate	<p>The Ministry is mandated for:</p> <ul style="list-style-type: none"> <li>• The protection of the constituents of the environment and the social and cultural systems in a sustainable development, for the benefit of current &amp; future generations;</li> <li>• Promoting the environment, rational and sustainable use of the natural resources for the purpose of development and conservation thereof;</li> <li>• Linking between the issues of environment and development;</li> <li>• Ascertaining the responsibility of the component authority, for the protection of the environment and the serious striving to achieve such protection.</li> </ul> <p>The most important institutions within the Ministry are:</p> <ul style="list-style-type: none"> <li>• FNC;</li> <li>• HCENR; and</li> <li>• The Wildlife General Administration (WCGA)</li> </ul>

<b>Ministry of Agriculture &amp; Irrigation</b>	
Mandate	<p>The Ministry is mandated for:</p> <ul style="list-style-type: none"> <li>• Adoption and transferring of endorsing techniques by the research authorities,</li> <li>• Develop the agricultural institutions,</li> <li>• Mobilization of the participants and stakeholders on the agriculture process (farmers, finances, scientists, private agricultural input traders, service providers, marketing specialists and all agricultural practitioners).</li> </ul> <p>It comprises the following administrations:</p> <ul style="list-style-type: none"> <li>• Seed Administration</li> <li>• Agricultural Engineering Administration</li> <li>• Agricultural Information Administration</li> <li>• Agricultural Extension Administration</li> <li>• Fertilizers Administration</li> <li>• Agricultural Research Corporation</li> </ul>
<b>Mechanized Farming Corporation (MFC)</b>	
Mandate	<p>The MFC was established in 1969 to operate the state-owned farms and lease large-scale mechanized schemes to investor farmers. An investor contracts the land leased by the MFC office in the State capital where the scheme is located.</p>
<b>Ministry of Livestock, Range &amp; Fisheries</b>	
Mandate	<p>Mandate of the Ministry is to “Promote, Regulate and Facilitate animal and range resources production, value-addition and access to credit, access to regional and international markets for food security, poverty alleviation and socio-economic development”. The Ministry incorporates the following units and advisory councils:</p> <ul style="list-style-type: none"> <li>• Animal Resource Corporation</li> <li>• Veterinary Supplies Corporation</li> <li>• National Council for Camels</li> <li>• National Council for Milk</li> <li>• National Council for Poultry</li> <li>• National Council for Meat</li> <li>• National Council for Fisheries and Aquatic Lives</li> <li>• National Council for Veterinary Services &amp; Animal Live</li> <li>• Range and Pasture Administration (RPA)</li> </ul>
<b>Remote Sensing Authority</b>	
Mandate	<p>RSA was established in 1977, as a National Remote Sensing Center (NRSC) within the National Council for Research, Ministry of Higher Education and Scientific Research. In 1996 the Remote Sensing Center was renamed to the Remote Sensing Authority and affiliated with the National Center for Research, Ministry of Science and Technology.</p> <p>RSA is conducting research in the field of remote sensing, geo-informatics and GPS technology applications for natural resources, environment and disasters. The agency provides value-added services in natural resources management, remote sensing, GIS, GPS and technology transfer. RSA is involved in human capacity development through education, training, and workshops awareness programs for professional as well as public.</p>
<b>High Council on Environment and Natural Resources (HCENR)</b>	
Mandate	<p>The HCENR was established 1991 under the chairmanship and supervision of the Prime Minister, in order to make effective policies, laws, plans and institutions so as solve problems of depletion of natural resources and degradation of the environment in Sudan. Presently the HCENR is affiliated to the MEFPP. The HCENR is primarily established as a coordinating and advisory body.</p> <p>According to HCENR Act (1991) its functions include:</p> <ul style="list-style-type: none"> <li>• Laying down general policies and long term plans for environmental protection and sustainable development of natural resources.</li> <li>• Coordination of efforts directed towards environmental and natural resources</li> </ul>

	<p>management among concerned governmental agencies and between federal and states governments.</p> <ul style="list-style-type: none"> <li>• Periodic review of relevant legislations and recommendations to make them more effective instruments for sustainable development.</li> <li>• Encourage and support research on the environment and natural resources.</li> <li>• Promotion of environmental awareness and education.</li> </ul> <p>According to the resolution 735 (1992) the Board of Directors of HCENR includes MAI, Animal Wealth, Dams &amp; Water Resources, Energy and Mining, Trade and Commerce, Higher Education and Scientific Research and Justice and Attorney General's Chambers. This is in addition to the Secretary General of HCENR and other individuals with knowledge and expertise on environment and natural resources. Many branches for HCENR are being established in the different States under the chairmanship of the State Governors (Wali). The functions of these branches are:</p> <ul style="list-style-type: none"> <li>• To implement the general policies formulated by HCENR;</li> <li>• To monitor implementation of development programmes relating to natural resources;</li> <li>• To collect data and gather information on negative or adverse changes in the environment.</li> </ul>
<b>Research Centers</b>	
Mandate	<p>The mission of the research centers (ARC, FRC) is to plan, develop and implement research designed to produce technologies and systems that are required to ensure high and sustainable productivity, food security and export capacity. Both ARC and FRC are entrusted with applied agricultural and forestry research on food and industrial crops, forestry, livestock and food technology, and with ecological and regional responsibilities to develop sustainable production systems in the Sudan. They have a mandate to:</p> <ul style="list-style-type: none"> <li>• Generate, develop and adapt agricultural and forestry technologies that focus on the needs of the overall agricultural and natural resources development and its beneficiaries,</li> <li>• Manage and conserve the soil and water resources in the country for sustainable and productive land use systems,</li> <li>• Play an active role in dissemination of research results and findings.</li> </ul>
<b>Local Government Institutions</b>	
Mandate	Local government institutions are related to forestry and range development and concerned with pastoralist services.
<b>Community Institutions</b>	
Mandate	They are concerned with ownership and management of forestry and natural resources because of the contribution of these resources to livelihoods.
<b>Trade Unions</b>	
Mandate	Presently, trade unions are established to protect the rights of members, e.g. mechanized farmers and pastoralists. GAPAs encourage its members to increase production and protect the gum trees. It also followed up their grievances with government circles. The Rain fed Farmers Association established a fund through which several tree shelterbelts and woodlots were created in mechanized farming areas in Gadaref and Blue Nile States.
<b>NGOs</b>	
Mandate	<p>NGOs mainly rely on engaging the local communities in project implementation through extension and provision of project components not available locally. This type of voluntary teamwork was readily accepted because the so-called Nafir "Reciprocal Support" is a traditional collective activity, where a group of people work together to harvest a member's crop or construct a member's house. Another tool, which the NGOs benefited from and which is deeply rooted in Sudanese society, is the tribal system, a structured network with distinct interrelations within the tribe and with neighbouring tribes.</p> <p>Their modes of operations are similar and their activities include tree planting using both seeds</p>

	<p>and seedlings, awareness raising, capacity building and environmental education, management of natural forests, assessment and monitoring using advanced technology, conservation of vegetation cover through dissemination of improved stoves and other energy saving devices.</p> <p>The most relevant and active NGOs in the area of natural resources and the environment include the Sudanese Environmental Conservation Society (SECS) and the Sudanese Social Forestry Society (SSFS) in addition to Sudanese CBOs.</p> <p>Other active NGOs involved in forestry related activities include:</p> <ul style="list-style-type: none"> <li>• Sudanese Environmentalists Society</li> <li>• Babiker Badri for Women Studies</li> <li>• Sudanese Forestry Society</li> <li>• Sudanese Society for Combating Desertification</li> <li>• Sudanese Society for Wildlife Conservation</li> <li>• Sudanese Horticultural Society</li> </ul>
<b>Private sector</b>	
Mandate	Private entrepreneurs also contribute to the implementation of forestry programmes, by conducting logging operations, producing firewood and burning charcoal. Some individuals established small tracts of private forests while larger private companies like Gundil and the sugar companies like Kenana, Assalaya, West Sennar, Guneid, and New Halfa, managed to establish considerable areas of irrigated plantations with sizeable socioeconomic and environmental importance.
<b>Traditional Administrations (Leadership)</b>	
Mandate	Native administration has a vital and deeply entrenched role in the settlement of resource conflict and encouraging community participation in the planting and protection of forests and natural resources.

### *Capacity development*

Aiming to improve and increase the overall effectiveness and abilities of the FNC, related ministries & institutions, NGOs, and CBOs, an assessment of capacity needs of all relevant sectors and institutions (forestry, energy, livestock, agriculture, water, education, research, extension, remote sensing centres, etc.) involved in the development of the RELs/RLs is essential. Findings of such assessment will be based on consultation with all relevant stakeholders. This task will be followed by planning and implementation of adequate capacity building programs addressing the needs identified. Based on initial consultation, meetings held, the areas for capacity building include, but are not limited to the following:

- Carbon stock assessment
- Data collection and data analysis
- IPCC guidance and manuals
- Use of technology and equipment (e.g. GPS, measuring devices, etc.)
- Use of Hardware (computers) data analysis software, data management, remote sensing and GIS
- REDD+ issues (carbon and non-carbon, co-benefits)
- SFM
- Dissemination of information