

THE INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

THE GLOBAL ENVIRONMENT FACILITY

INTEGRATED CARBON SEQUESTRATION PROJECT IN SUDAN

PROJECT DOCUMENT

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ACRONYMS

A/R	Afforestation/Reforestation
APR	Annual Project Report
BAU	Business As Usual
BCSP	Butana Carbon Sequestration Project
BDA	Butana Development Agency
BIRD/BIRDP	Butana Integrated Rural Development Project
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNS	Comprehensive National Strategy
CSO	Civil Society Organization
CSPS	Carbon Sequestration Project Sudan
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
FME&PD	Federal Ministry of Environment and Physical Development
FNC	Forest National Corporation
FRMP	Fire Risk Management Plan
GEF	Global Environment Facility
GHG	Green House Gas
GIS	Geographic Information System
HCENR	Higher Council for Environment and Natural Resources
IFAD	International Fund for Agricultural Development
ICB	International Competitive Bidding

INC	Initial National Communication
IPCC	Intergovernmental Panel on Climate Change
ITB	Invitation To Bid
LPG	Liquefied Petroleum Gas
LUCF	Land Use Change and Forestry
LULUCF	Land Use, Land Use Change and Forestry
MDG	Millennium Development Goal
MIS	Management Information System
MFC	Mechanized Farm Corporation
NAP	National Action Plan
NAPA	National Adaptation Programme of Action
NCB	National Competitive Bidding
NGO	Non-Governmental Organisation
NIS	National Implementation Strategy
PIN	Project Identification Note
PIR	Project Implementation Report
PSC	Project Steering Committee
QCBS	Quality and Cost Based Selection
REDD	Reducing Emissions from Deforestation and Forest Degradation
RFP	Request For Proposals
RFQ	Request For Quotes
SECS	Sudanese Environmental Conservation Society
SSFS	Sudanese Social Forestry Society
TOE	Tons of Oil Equivalent
UNDP	United Nations Development Programme

UNCCD United Nations Convention to Combat Desertification
UNFCCC United Nations Framework Convention on Climate Change

SUMMARY

1. At present, after the separation of Southern Sudan, Sudan has an area of 1,881,000 km² and an estimated population of, according to the 2008 census, 33,419,625 people. The arable agricultural land currently is 175 million feddan, whereas cultivated land is 40 million feddan. The livestock population is estimated at 120 million heads. As reported in the Sudan Initial National Communication (INC) to the United Nations Framework Convention on Climate Change (UNFCCC), agriculture and land-use, land-use change and forestry (LULUCF) are the main emitters of greenhouse gases (GHGs) in Sudan.

2. The proposed project would target the Butana region, an area lying between the River Atbara and the Blue Nile, with approximately 1,000,000 inhabitants, which has been prioritized by the Government to receive focused support.

3. The principal objective of the project is to promote a climate-friendly rural development path in Central and Eastern Sudan by increasing the carbon stock and reducing net GHG emissions in the country, while at the same time sustaining rural development in the project area.

4. To achieve this objective, the IFAD/GEF project will be articulated around five components, namely:

- Afforestation/reforestation activities to increase the national carbon sequestration potential
- Forest and carbon stock management and maintenance.
- Promotion of sustainable energy production at the community level.
- Capacity building at the national level for monitoring and reporting on carbon stock and local awareness raising
- Project management.

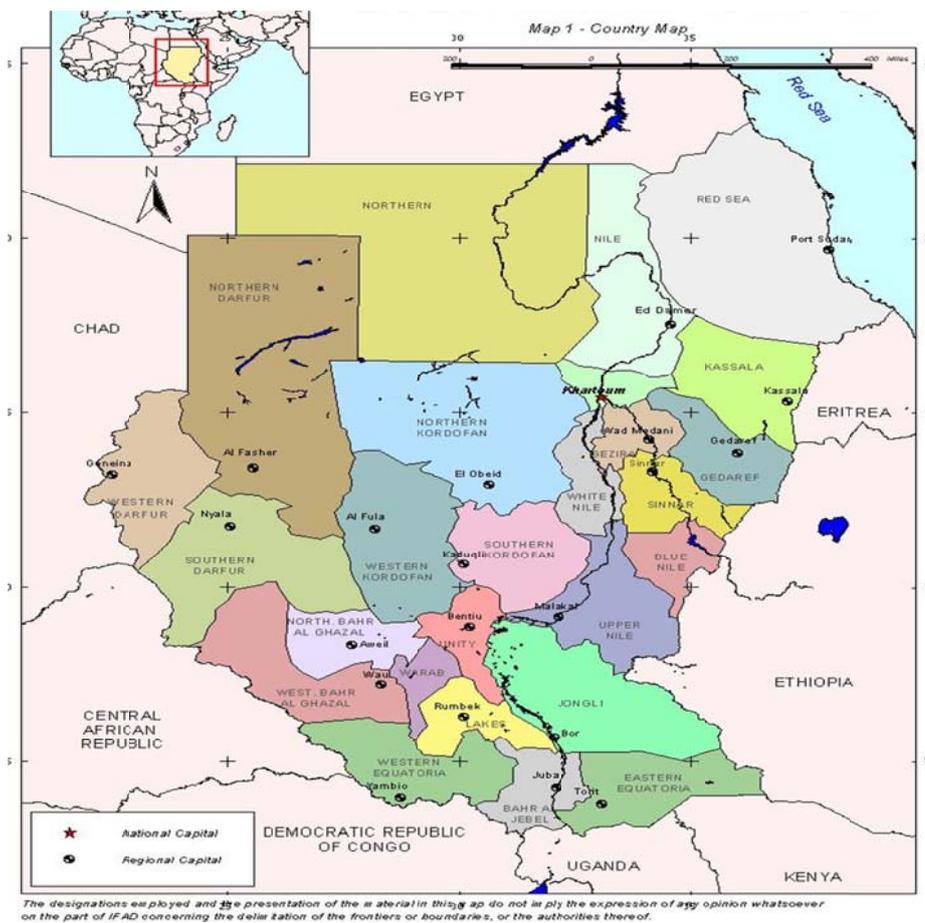
5. Monetary cumulative value of carbon credits generated by the project amounts to between US\$ 4,424,875 and US\$ 4,732,875 over the four years project implementation period (at a conservative estimate of US\$ 7.00 per tonne). This implies revenue between US\$ 19,567,275 and US\$ 22,276,275 over a 20 years period, which is well above the total project cost of US\$ 14,599,908. All the assumptions were based in the voluntary carbon market were the LULUCF projects have more community appeal. However, the voluntary carbon market is smaller compare to the compliance market the LULUCF projects responds for more than 50%of the amount traded in the Voluntary market.(State of the Voluntary Market 2010, Ecosystem Marketplace.

PART I - SITUATION ANALYSIS

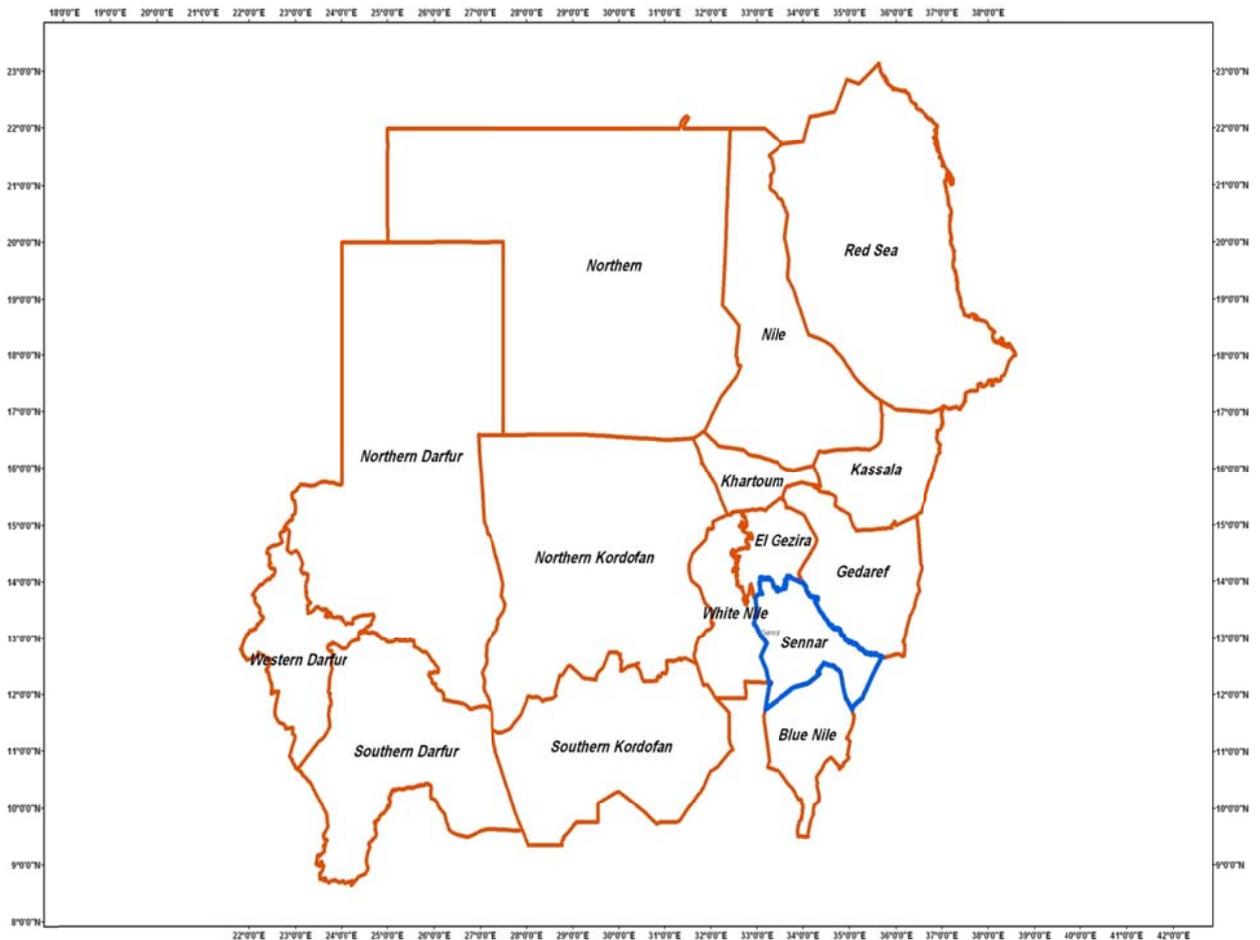
A. General Background

6. Sudan has been known as the largest country in Africa by land area, with rich natural resources and an estimated population of forty two million according to 2008 census. With the declaration of independence of the Republic of South Sudan in July 2011, Sudan's total area was reduced from 2,500,000 square km to 1,881,000 square km, now being the third largest country in Africa, and 17th globally. The Sudan's population, according to 2008 census, amounted to 33,419,625 people while that of the Republic of South Sudan is estimated at 8,260,490. The arable agricultural land is 175 million feddan, which represents 78% of the historical arable land. The cultivated land remains 40 million feddan. The livestock population is estimated at 120 million heads representing 72% of the historical numbers. However, there is huge reduction in the range resources and forests cover amounting to 65% of the total resources before the separation.

MAP 1A: SUDAN BEFORE SEPARATION



MAP 2B: SUDAN WITHOUT THE INDEPENDENT SOUTH:



7. Due to the fact that the secession of the South has been very recent, facts and figures in this document refer to Sudan and South Sudan jointly unless specifically mentioned otherwise.

8. With secession of the South Sudan on July 9, 2011, it is anticipated that the economy will suffer losses from the withdrawal of revenues from the exploitation and export of oil from South Sudan and a significant fiscal adjustment will be required. A large part of the fiscal adjustment is expected to fall on the expenditure side. The Ministry of Finance and National Economy (MOFNE) projects a long-term fiscal adjustment to accommodate a revenue loss as high as 36.5 percent of total revenues. As a result, Sudan faces the challenge of balancing fiscal consolidation against the pressing needs for the development agenda. The fiscal authorities will need to do more with less. The extent of the shock in the short-run remains unclear, with possible transition arrangements to be agreed between the two parties that could smoothen the impact of the loss of oil revenues on the economy of Sudan.

9. The government is carrying out a number of planning exercises to prepare for this fiscal adjustment, but all are yet to be finalized. A revised budget has been approved in August 2011 by the Council of Ministers and the Parliament. The revised plan projected that the real GDP will decrease to 3.0 percent, compared to a projected rate of 5.0 percent in the original budget for 2011; this mainly comes as a result of the lower domestic oil production, Inflation is

expected to reach two-digit levels (18 percent), 6 percentage points higher than levels in the original budget driven by domestic and external factors, including exchange rate pass-through effects. The total revenue is projected to significantly decline by 12 percent compared to the original 2011 budgeted level, driven by the rapid drop in oil revenues. Oil revenues are projected to decline by 43 percent, and account for 26 percent of total revenue¹. Non-oil revenue is projected to increase by 11 percent and account for 69 percent of total revenue, largely driven by an increased VAT rate on communication services from 20 to 30 percent.

10. Overall, Sudan needs to create fiscal space to meet social and development needs, but the challenges of coping with the independence of South Sudan are likely to be the most pressing in the coming year. Rebuilding foreign exchange reserves, mobilising non-oil revenue, and tightening monetary policy to contain inflationary and exchange rate pressures remain an immediate priority. In the medium term, Sudan must continue to strengthen its non-oil revenue collection and export base while developing its financial system to ensure sustainable growth.

B. Performance of the Agricultural Sector

11. Agriculture is the backbone of the Sudanese economy and it is the main source of livelihood for Sudan's rural inhabitants. Agriculture provides 90% of the national food requirements and constitutes 80 % of non-oil exports. The traditional rainfed sector¹ accounted for 26% of total GDP in 2005 and 67% of agricultural GDP. Fluctuations in agricultural growth are caused primarily by vulnerability of production to climatic variability, declining productivity in the rainfed sector and the import restrictions on Sudanese livestock due to disease outbreaks. Forestry in Sudan is closely linked with animal husbandry, rain-fed agriculture and village or urban life and thus assumes a significant supportive function. Woodland areas cover about 74.1 million ha (29.6 % of the country's area)². Trees and shrubs play a crucial role in the Sudanese economy and the lives of its people. Their distribution is such that 65% are in the southern region whereas the remaining 35% are found in the northern region. The forestry sector contributes about 15% to GDP³. In addition, the forestry sector provides 15% of job-opportunities available in the rural areas and 30% of the feed of the national herds. Wood for fuel is the major forest product. The contribution of forestry to the national energy supply is estimated to account for 71% of the total energy consumed in the country. After wood fuel, production of gum arabic is the second largest non-wood forest product in Sudan. Since late 1980s, gum arabic has become the second largest export after cotton, amounting to about 11% of total exports and constituting 80% of world production. Other non-wood forest products include honey, beeswax and other fruits and nuts. The climate of Sudan varies from dry desert in the northern parts to savannah in south. Average annual rainfall is 436 mm, whereas in the northern desert it is near to zero (Elagib and Mansell, 2000). High temperatures (average of 40 degrees Celsius and high radiation produces a large atmospheric demand for moisture. In view of the low rainfall levels and high temperatures and the high evapo-transpiration, most parts of the country are considered arid. Annual potential evapo-transpiration generally exceeds 2,000 mm (Rockström, 1997).

¹ The traditional rainfed sector encompasses here the traditional rainfed agriculture, the animal resources and forestry.

² Source: Sudan Forest National Corporation

³ The figure does not take into account illegally harvested timber used for rural housing, furniture, utensils, arts and crafts, and fuel and fodder.

12. Water used in Sudan is derived almost exclusively from rainwater that falls within Sudan and surface water resources brought by the Nile tributaries descending from the Ethiopian Highlands and Congo watershed area. Groundwater is only used in very limited areas, and then mainly as a domestic water supply.

13. Although Sudan is emerging as an oil producer, it is still a low-income country with a per capita income of US\$320 (average for Sudan and South Sudan).⁴The economy is predominately agricultural including cropping, livestock production, forestry and fishing, which together contribute to about 48 percent of the Gross Domestic Product. Irrigated and traditional rain fed agriculture; forestry and pastoral activities are the most important land use systems and employs nearly 80% of the workforce. Along the Nile and tributaries cultivation depends on irrigation constituting 10% of the agricultural land use (Grove, 1998).

C. Ecosystems and the Forestry Sector

14. The ecosystem classification and the vegetation distribution closely follow the isohyets that runs across the country from west to east. The effect of topographical changes and soil variation on vegetation zones is much less pronounced than that of rainfall levels. According to the classification by Harrison and Jackson (1958), seven ecosystem types may be identified in Sudan:

- Desert;
- Semi-desert;
- Low Rainfall Woodland Savannah on Clay;
- Low Rainfall Woodland Savannah on Sand;
- High Rainfall Woodland Savannah;
- Special Forest Types; and
- Montane Forests

15. The land cover is classified as follows (jointly for Sudan and South Sudan):

- Productive and unproductive forest lands constitute 34.0% of the country area
- Shrubs and desert scrub make up 17.0%.
- Wildlife reserves 5.0%.
- Cropped areas make up 6.0%.
- The flood areas, swamp surface and the montane regions constitute 5.0%
- Other land use types make up the remaining 33.0%.

⁴World Bank Report 2009.

16. The country is rich in natural resources (Hinderson, 2004). Forests represent an important resource for Sudan at both national and local levels by supporting the national economy and livelihoods of communities. Forestry became an important land use at the beginning of the 20th century when they were under formal concern. Forests are managed formally within forest reserves, which are state-owned. Natural forests outside reserves are controlled by royalty collection when wood is extracted for market use. Although licences are required to clear forests for agriculture particularly for mechanized farming, this policy has not been effective in forest conservation and protection against vast expansion of agriculture. Recently, forest ownership has attracted public attention as is reflected in the process of forest reservation under communal, private and investors names. Forests represent the major source of wood for fuel, building material and small-scale saw milling for domestic use and income generation. Non-timber forest products are also of importance for income generation and livelihood support. Forests also play a significant role in soil conservation, protecting agricultural crops from erosion for other uses such as grazing and browsing and for landscape development and environmental protection.

17. However, low levels of investment in forest protection and a lack of effective forest policies and programmes have been responsible for deforestation and forest degradation in Sudan. This has not only impacted on livelihoods as the availability of forest products and other services has declined, but has also resulted in severe environmental degradation and desertification. This situation called for the need for institutional support to Forestry Administration.

18. During the 1980s and 1990s, support for forestry reforms resulted in administrative restructuring. Responsibility for forest management was decentralized, based on the federal system of governance, and the creation of fifteen semi-autonomous states. Since 1986 and following the issuance of forest policy of 1986 and forest legislation (1989), several important changes and developments have occurred in relation to the forestry sector in Sudan that included reorganization of the administrative set-up of the forestry sector through the establishment of a parastatal semi-independent Forests National Corporation (FNC) (1989). The National Constitution (1998) also emphasized the importance of forests in environmental conservation and as a source of goods and services for the country as a whole.

19. These institutional and policy reforms resulted in increased levels of forest conservation, protection and afforestation/reforestation (both state-owned and private. At present, Sudan possesses (13.5) million hectares of government forest reserves, two million hectares of out-growers reserves and (11.0) million hectares of nature reserves. Development and management inside forest reserves is more conducive to sustainable use of forest resources.

Table 1 Forest Reserves in Sudan (incl. the South) (Government and Private)

Parameter [areas in million feddan* (million hectares)]	1901-1985	1986-2000	2001- 2010
Gazetted government forest reserves	2984 -1253	24.9 (10.46)	32.2 (13.5)
Gazetted institutional forests	0.012 (0.005)	0.033 (0.0138)	0.033 (0.0138)
Gazetted community forests	-	0.0099 (0.004)	0.063 (0.026)

Gazetted private forests	-	0.0114 (0.0047)	0.0143 (0.0059)
Gazetted protected areas	28.00 (11.74)	28.00 (11.74)	28.00 (11.74)
Total	30.996 (12.998)	52.9543 (22.2225)	60.3103 (25.2857)

1.0 feddan = 0.42 hectare

20. However, a reserved area (government, community, private or institutional) is defined to include an area or any part declared to be a national forest reserve or state forest reserve or other forest reserve (private, communal or institutional) or enclosure but it is not stated whether the area is covered with trees or not. The boundaries of forest reserves should be well demarcated by boundary posts of stone, concrete iron, and their position should be marked on the maps with co-ordinates. One of the factors impairing the implementation and enforcement of the forestry legislation is the difficulty of ascertaining or identifying forest reserves at present on the ground. While forest reserves are clearly shown on maps, their boundaries are generally not visible on the ground at present, but they should be defined as any area of 0.5 ha or larger with at least 10% tree cover.

21. Sudan developed considerable experience and capacity in forestry resources development and assessment through international support for research to help Sudan assess its forest resources and the nature and extent of forest degradation and deforestation. Recent surveys included the combination of ground measurements with remote sensing, which facilitated efficient mapping. These experiences helped in assessment of the extent of forests cover and evaluation of deforestation and forests degradation.

22. The area of Nature and Forest Reserves (10.1%) in Sudan is far below the target of (25%) defined by the Comprehensive National Strategy. However, increasing the area of forest reserves requires availability of reliable estimates of the forest resources. Forest cover in Sudan (North and South) changed rapidly, declining from 40% in 1901, to 34-36% in 1958 (Harrison and Jackson 1958) to 28.6% (FRA 2005). Forest biomass changed from 2.4 billion m³ in 1965 (Brown and Wolf 1984) to 0.93 billion m³ in 2005 (FRA 2005). The annual rates of deforestation in North Sudan is estimated to be around 2.2% (World Bank 1985, FRA 2005, Daak 2007, Elsiddiget *et al.* 2007).

23. The variation of forest cover, forest types, stocking density, biomass and form of trees and shrubs strongly characterize the vegetation classes in Sudan by zones (FNC/FNI 1998). Short, xerophytes, thorny trees and shrubs constitute the main feature of the desert and semi-desert vegetation (northern part of Butana) where the tree cover is sparse, the stocking density is low and the biomass does not on average exceed 2.0 – 5.0 m³ per hectare (Elsiddig 1980; FNC/FNI 1998). The woodland savannahs forests are characterized by a wide range of crown cover (10 – 30 %) and biomass (10 – 60 m³ per hectare) (Ali, 2007). On the other extreme are the forests of the special modified sites of the riverine and the montane areas and gallery forests characterized by large-stemmed, mostly non-thorny trees forming dense forests with high cover (30 – 60 %) and the biomass may reach up to 300 m³ per hectare on special sites like the galleries and flooded basins.

24. It should be noted that the forest resources, whether natural or plantations, managed or un-managed, exhibit a wide variation in standing wood volume per unit area in different climatic zones and over time. Whereas in the early 1960s, the average volume per hectare of

natural unmanaged forests in the semi-arid zone was estimated at 15 m³/hectare, the average in the savannah was 30 – 50 m³ / ha and was 70 - 150 m³ in the montane and riverine forests.

25. The average standing volume declined during the last five decades to a range of 5.0 – 7.0 m³ /ha in the arid regions and to 12.0 – 15.0 m³/ha in the savannah.

26. Managed plantation exhibits higher volume production per hectare when compared with natural forests in any zone. Plantation establishment is usually planned and developed at regular spacing while the natural forests are spontaneous in regeneration. *Acacia nilotica* plantations on the flood basins produce between 120 - 300 m³ /ha within 20 – 30 years of rotation depending on the site and good management while *Eucalyptus* species under irrigation produce 50 – 60 m³ /ha over a 6 – 7 year rotation.

27. Following the national energy consumption survey in 1994 a national forest inventory was carried out during the period 1995-1997 and published in 1998. The forest survey covered an area of 62.27 million hectares north of latitude 10°N and recorded forests with crown cover ≥10%. The objective of this inventory was partly to assess the available wood supply in relation to demand but also to inform future forest development programmes to supply wood and other forest products while maintaining the ecosystem services provided by forests and a sustainable forest resource. The inventory results showed that forests occupied slightly less than 12% of the area (Appendix 4).

28. The national forest inventory north of latitude 10°N (NFI 1996) concluded that the annual average growth of forests in Sudan was approximately 11.0 million cubic meters which was far below the national annual consumption rate of wood estimated by FAO/FNC (1994) to be about 16.0 million cubic meters. However, the annual volume increment in the savannahs south of the 300-mm/annum isohyets is more than 11.0 million (but needs to be more accurately measured). The deficit between the demand for wood and the annual net rate of forest biomass increase may explain the continuous deforestation and forest degradation in Sudan. In fact the rate of wood clearance and the deforestation is basically a result of agricultural expansion and wood burning for land preparation.

29. Land preparation for agriculture involves on site burning of approximately 50 - 65% of the total wood cleared in Sudan (HCENR 2003). An increase in mechanized farming has resulted in large areas of deforestation and land degradation. It is evident that the rate of deforestation and forest degradation is closely linked to social, economic and environmental changes.

30. Biomass in Sudan constitutes a primary source of energy contributing around 78.5% of Sudan's total energy supply of which 70.5% was contributed by wood biomass and 8% was contributed by non-wood biomass (National Forest Products Study 1995). When converted to tonnes of oil equivalent (TOE), biomass energy (wood and agricultural residues) amounted to 70% of the 6.0 million tons. The major use of wood in Sudan continues to be for energy and the major part of fuel wood is used in the rural areas as firewood and charcoal (Table 2).

Table 2: Per Capita annual wood consumption (in m³ round wood) in the household sector (including the South)

	Firewood	Charcoal	Construction	Maintenance	Furniture	Total
Urban	0.133	0.493	0.028	0.021	0.010	0.658
Rural	0.363	0.162	0.064	0.029	0.009	0.637
%	41.8	43.0	7.8	4.3	1.4	100

Source: FNC 1994

31. At present, the total quantity of wood energy consumption is gradually decreasing as a result of increasing use of energy alternatives such as LPG and kerosene. However, much of the wood energy is wasted as a result of the use of inefficient cooking stoves in households and at some industries like bakeries and traditional cooking oil refineries, as well as through on-site burning for land preparation for agriculture.

32. Table 3 shows biomass consumption by sector, and indicates that the major consumption of biomass energy (88.5%) has been at the household level. Other sectors consume 11.5%. This may indicate that the main approach for biomass energy could be directed towards the household level by introducing energy alternatives and more efficient cooking stoves.

Table 3: Consumption of Biomass in Sudan (incl. South) by sector

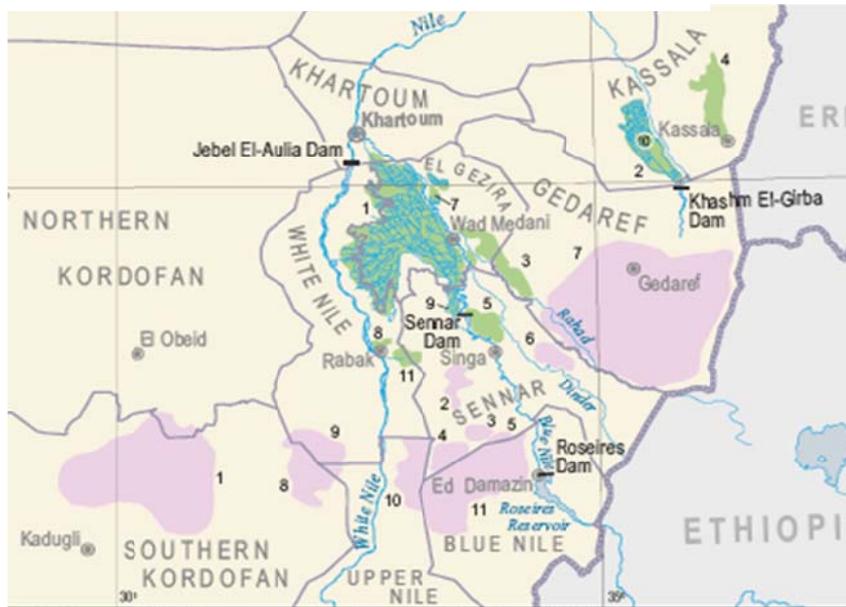
Sector	Fuel wood	Charcoal	Total	%
	M³	m³	M³	
Residential	6,148,380	6,070,207	12,218,587	88.5
Industrial	1,050,174	11,673	1,061,847	7.6
Commercial	31,636	283,899	315,535	2.3
Religious activities	2,09,044	-	209,044	1.6
Total	7,439,234	6,365,779	13,805,013	100

Source: FNC 1994

33. Agriculture is the largest and most important sector in Sudan's economy but it is also responsible for many of the most serious environmental problems as reflected in areas and rates of deforestation and land degradation. Agricultural land use practices include mechanized farming, irrigated farming and rainfed smallholdings. Mechanized farming covers almost 80% of the cultivated lands, the irrigated schemes cover nearly 10% and smallholdings cover the rest. The expansion of mechanized farming is understood to be the most significant driving force behind deforestation and forest degradation (Figure 1).

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34. Prior to oil exploration, agriculture contributed 40.5 per cent of GDP until the year 2000. However, agriculture's GDP contribution declined, the rate of growth of rural incomes has decreased and poverty in rural areas remains high. The average annual growth rate of the agricultural sector between 2000 and 2008 was 3.6 percent, substantially lower than the 10.8 percent during the previous decade. The largest decline in agricultural performance is recorded for the traditional farming sub sector, with a growth rate falling from 24.6 percent in the 1990s to 2.4 percent during 2000-2008. a recent poverty assessment estimates that 75% of the poor in Sudan are rural; and poor mainly derive their livelihoods from agricultural activities .

35. The impact of food prices increases is nuanced in The Sudan. Sorghum and millet recorded a seventy percent and forty percent price increase respectively over the first semester 2008 compared with their 2007 levels. Since sorghum prices stabilised in March but are still higher than their 2006-2010 average. Despite high level and stabilizing trends, the local prices continue to be below the export parity prices, which encourage commercial traders to export (FAO/SIFSIA bulletin 40). The observed increase in livestock prices in the previous years, which improved livestock terms of trade, have now started to stabilise, further stabilizing the terms of trade though still favouring livestock owners. Coupled with relatively high commodity prices, these high livestock prices may exacerbate the food insecurity situation of the poor. There is a high risk that the existing food insecurity could worsen in many traditional food insecure areas as food and livestock prices continue to rise in the coming months. The poor, whose production is always limited by inadequate land, labour and capital reserves, depend on the market to fill a majority of their food needs every year. It is also possible that price increases may erode the value of cash distributions made through Zakat⁵ Chamber or other NGO channels. Between March and May 2011 the staple grains index dropped 22.8 percent below the values of March 2011. This decline was driven by millet and maize while rice and wheat price volatility followed instability in their world prices . Prices for the largely imported rice and

⁵ Islamic religious tax

wheat continued their upward trend and in May reached 33 and 22 percent higher prices, respectively, from one year ago. In effect, recent developments in food prices in Sudan are driven by both domestic and global factors. These are supply-side issues induced by weather-related production shortfalls in Sudan paired with higher and more volatile world grain prices; global food prices have risen by 47 percent since June 2010.

36. The government has undertaken several policy measures to contain inflationary pressures and to mitigate their adverse impact on the vulnerable poor. These included policy measures such as cutting import tariffs for wheat, flour, sugar, and capital goods; and releasing grain stocks of domestic reserves, particularly for sorghum. A number of safety net and social protection programs were officially announced (e.g. cash transfer, school feeding, free health support, and agriculture and industry support funds), but implementation remains unclear.

37. To date, higher food prices have not resulted in higher output, mainly as a result of structural constraints listed in paragraph 6 above, and the fact that the poor are net consumers and negatively affected by the increased food prices, which erode their capacity to invest in agriculture. However, the high prices of staple crops and of cash crops (such as cotton) are also encouraging the Government to seek foreign direct investment in the agriculture sector and to facilitate this through private public partnerships either for export promotion or import substitution.

38. Low productivity and sudden declines in grain yields result in abandonment of large areas of land. The yield of grains from the total irrigated area (10% of cultivated land) has been reported (FAO 2006) to be equal to the yield from the total area of the mechanized farming (the 80%). That may mean that increasing the area and productivity of irrigated cultivation and improving the yield of mechanized agriculture may induce conservation impact on the forest resources by reducing the rate of clearance of forests.

39. After two decades of neglect, agriculture, including livestock, forestry and fisheries is back on the Sudan's growth agenda. The Government formulated the Agriculture Mobilization Plan then the Agriculture Revitalization Plan (ARP) which spanned the period 2007 to 2011. The Government earmarked a budget of SDG 10 billion for this programme to reach the following objectives: (i) higher agricultural exports and decreased reliance on volatile oil exports; (ii) increased productivity; (iii) improved food security and agricultural incomes; (iv) reduced rural poverty; and (v) redressed regional imbalances. Human development, gender mainstreaming and environmental conservation are cross-cutting issues. A recent evaluation of the Agriculture Revitalization Programme concludes that despite the budgetary constraints the government fulfilled, to a large extent, its commitments to the programme funding. The evaluation stressed the physical achievements of the programme and provided no solid judgment on the programme's real impact. Qualitatively, the assessment recorded positive results under the nine objectives of the ARP; however the magnitude of these positive changes were not well articulated. The evaluation recommends the extension of the ARP as the initial duration of four years proved insufficient to bring about the desired change in the sector. The evaluation calls for an increased role of the state government in guiding the planning and in mobilizing the support for the second phase of the ARP.

40. The draft Interim Poverty Reduction Strategy Paper (I- PRSP) identified the agriculture sector and enabling the private sector development as the two key drivers for the growth

strategy in Sudan. I-PRSP also identified key short term priority actions to bring the sector on the right track. These include:

- Assist smallholder farming to become more productive, competitive and sustainable. Actions here could include strengthening land rights, improving access to markets through developing rural infrastructure and providing access to financial services.
- Improve productivity of rain-fed farming with improved seeds, modern irrigation technologies and the provision of fertilizers and other farm inputs.
- Improved access to markets and establishment of efficient value chains by enhancing local infrastructure, improving commodity trading and risk management; link producers to modern supply chains for higher-value urban markets; and adopt product standards for higher-value exports;
- Increase access to water and irrigation as a major determinant of land productivity and the stability of yields. With rising uncertainties in rain-fed agriculture as a result of climate change, investment in water collection and management will be increasingly critical.
- Enhance agricultural research and extension by increasing the allocation of the share of research in the budget and by fostering public-private research partnership. This will enable closer connection between the problems faced by farmers and work done by researchers and an expansion of agricultural extension programs and access to relevant inputs. Commercial farming will receive more emphasis and support. An effective impetus of such investment program will require a land policy that provide most farmers with long term leases and hence a formal security of tenure, either through statutory or customary law..
- Improve livestock marketing through the regulation of stocking rates in Sudan's most vulnerable grazing environments such as North Darfur and North Kordofan with the aim of regenerating the pasture and other forage vegetation; improve the quality of stock routes and improve marketing efficiency.
- Making agricultural systems more environmentally sustainable through the Identification of the main drivers of resource degradation to reverse degradation in less favored areas; improvement in agricultural water management; better management of intensive livestock systems; and maintaining payments for environmental services.

41. Strengthening of forest research, education and training is also important within the forestry institutions framework to provide support to the forestry sector and enhance its development.

D. Climate Change

42. Sudan's contribution to global greenhouse gas emissions is negligible. Net GHG emissions in Sudan did not exceed 15.77 GgC during 1995 to 2009 (see Tables 4 and 5). However, forests contribution in GHGs emissions in Sudan was the highest compared with other sectors, amounting up to 75% resulting in adverse impacts and crisis, reflected in declining agricultural productivity, scarcity of forest products, extinction of palatable range plants and loss in biodiversity.

43. Being an arid country, Sudan is vulnerable to global climate change impacts as a result of increased variability of rainfall fluctuation and a south-easterly shift of the rainfall isohyets.

Projections suggest that there will be a decrease in the number of rainy days for the same amount of annual rainfall (i.e. more intense rainfall events) or increased number of rainy days with long dry periods in between. Expected impacts are increased water scarcity, accelerated desertification and soil erosion processes, decreased productivity with a predicted twenty percent drop in crop yields, damages caused by more extreme climate events such as droughts or floods, increased health-related illnesses, and higher risk of pest and disease outbreaks⁶. These impacts also affect the resource base and the livelihoods activities that depend on these resources.

44. As reported in the Sudan Initial National Communication (INC) to the United Nations Framework Convention on Climate Change (UNFCCC), agriculture and land-use, land-use change and forestry (LULUCF) are the main emitters of greenhouse gases (GHGs) in Sudan. Agriculture contributes to 50,083 Gg of CO₂ equivalent and LULUCF generate net CO₂ emissions of 15,577 Gg (corresponding to more than 75% of total CO₂ emitted). This was a consequence of a steady reduction in the stocked volume of forest resources in Sudan due to: (i) the expansion of agriculture in the absence of proper land-use and forest management planning, (ii) increased urbanization, (iii) fuel wood production (firewood and charcoal, which constitutes more than 70% of total national energy consumption), (iv) and grazing. The INC reports that in 1958 the Sudanese forest area was between 36% and 43% of the total country area; later in 1990, the forest cover had shrunk to 19% of the total country area (FAO). The 1995/1996 national forest inventories estimated the forest area at 12%. This reduction in the forest stock has caused Sudan's forest to become a source of GHG emission rather than GHG sink. Therefore, the INC indicates that forests could play a vital role in carbon sequestration in the country. In more detail, the analysis carried out for the preparation of the INC suggests that afforestation and rehabilitation of rangelands are the most suitable options to achieve GHG emission reduction objectives in the country.

Table 4: The large area of clearance within the savannahs zone

GHGs source and Sink by categories	CO₂ emissions	CO₂ Removals
Total	15,577	0
Change in forest and other woody biomass	0	-9,7
Forest and grassland conversion	28,714	0
Abandonment of managed land	0	-3,438

45. The large area of clearance within the savannahs zone resulted in various adverse consequences including increased poverty and further exacerbating vulnerability to adverse

⁶Source: United Nations Environment Programme (2007). Sudan: Post-conflict environmental assessment. Executive Summary.

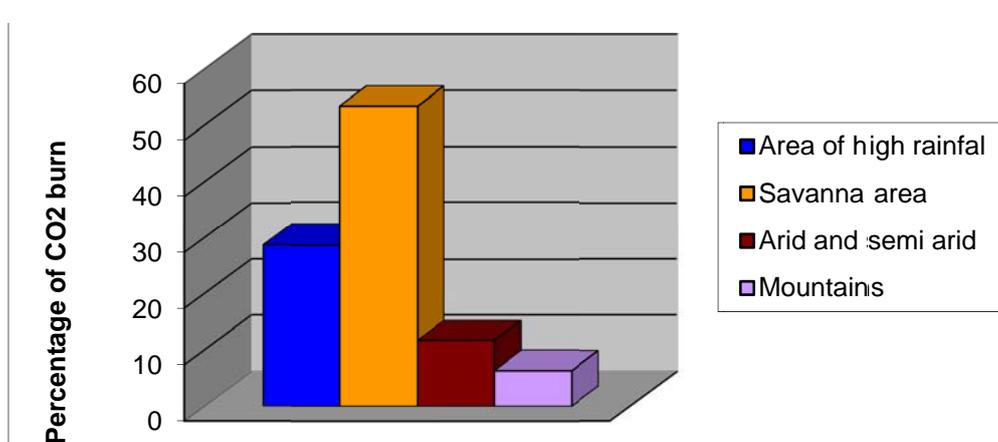
impacts of climate change. The contribution of burning of agricultural biomass residues to total GHGs emissions from agriculture is very small but the major contribution of agriculture biomass is at the household level where it accounts for 5 – 8% of total biomass energy.

Table 5: GHGs emissions from land use (Gg) 20

GHGs source and Sink by categories	CO ₂ Emissions	CO ₂ Removals
Total	8,018	0
Change in forest and other woody biomass	0	-12,125
Forest and grassland conversion	23,924	0
Abandonment of managed land	0	-3,7 81

46. Comparison between emissions related to land use in 1995 and 2009 indicates that total net CO₂ emissions have been reduced from 15.577 GgC to 8.018 GgC. This is largely as a result of a decline in emissions from forests and grassland {from 28.714 GgC (Table 4) to 23.924 GgC (Table 5)} and increased removal by forests and other woody biomass from {from -9.700 GgC (Table 4) to -12.125 GgC (Table 5)}.

47. GHGs emissions also vary between the different geographical zones in Sudan. The savannah is characterized by the highest rates of annual emissions as a result of high rates of deforestation. The savannah is also the most populated and most extensively cultivated zone. Figure 2 illustrates the variations in GHGs emissions across the different zones in Sudan.



48. However, agriculture contributes to GHGs emissions from various sources including crop residues, livestock, agriculture soil and natural fires particularly in the savannah zone. Agriculture constitutes a source of key GHGs including CH₄, N₂O, NO_x and CO.

E. Policy Framework

General

49. Sudan has several policies and strategies at national and sectoral levels to support sustainable development and achieve the Millennium Development Goals. Sustainable use of forest resources has been an important part of these strategic developments. Forest development in the Sudan commenced early in the 20th century. Since then 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). The original Forest Policies of 1932 have undergone continuous changes which are now reflected in the Forest Policy (1986) that encourages forest reservation and conservation and community and private sector participation in forestry development and management.

50. The earliest reference to conservation objectives in development planning in Sudan may be in the Six-year Development Plan (1977-1983), which considered conservation of the country's natural resources as one of the methods for attaining the objectives of the plan, (Tolentino, 1994). Prior to this, the concept of conservation was associated with protected area establishment as an activity rather than planning. Examples 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. 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).

51. A number of strategies, policies and programmes were adopted in the wake of the Salvation and Recovery Development Programme, the most important of which is the Comprehensive National Strategy (CNS) (1992 – 2002). The (CNS) (1992-2002) represents a progress in national planning towards integration of environment and development. While for a long time environmental issues were only dealt with by the Ministries that involved utilization of natural resources (such as Agriculture, Irrigation), the environment was considered within the National Strategy for Comprehensive Development (1992 to 2002) and the Quarter Century National Comprehensive Strategy (2002 to 2027). The Quarter Century Strategic Plan for Development (2002 – 2007) has highlighted fifteen goals as the most important “National Challenges” to be addressed. Three of these are of significance within the realm of the environment:

- Achieving integrated human resources development;
- The conservation of natural resources and the striking of a balance in their exploitation between the present needs and the rights of the coming generations, and preserving the sustainable environmental purity of the natural resources,
- Emphasizing and achieving rural development.

52. The goals of the CNS assume that protection and development of natural resources ensures health, self-sufficiency of population needs and contributes towards the well-being of Sudanese citizens. The CNS gives priority to cost-effective utilization and management of the natural and water resources, and their rehabilitation, paying consideration to the rural sector. The Comprehensive National Strategies (CNS 1992 – 2002 and 2003 - 2027) are both concerned with the importance of forestry in environmental conservation and 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 reserves area is equal to approximately 10.0%. However, the implementation of the CNS was constrained by a lack of coordination and integration between sectoral and national institutions with respect to its formulation. 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).

53. Since 1992, Sudan has put in place several strategies, policies and programmes aimed at sustainable development. These include:

- National Environmental Action Plan Capacity 21 Sudan,
- National Biodiversity Strategy (2001),
- National Action Plan to combat Desertification (2002),
- Climate Change Enabling Project (2002).

54. The National Environmental Action Plan is based on governmental efforts and non-governmental organizations contribution. It is a basic document containing baseline information and identifying major environmental issues.

55. Other policies include Water Policy, Forest Outlook, Document on Sudan's Commitment to Social Development and Population Policy. Sudan is lacking a comprehensive environmental and natural resources policy and legislative framework that deals with land use in an integrated way (Atta Elmoula 1985). Rather, there are a number of individual sectoral policies e.g. agriculture, forestry, wildlife and other resources. Tolentino (1994) refers to the lack of legislation that specifically deals with land use and land management as a principal reason for the absence of environmental and natural resources policies.

56. Absence of land use plans and a lack of laws governing land tenure and use resulted in a situation that led to conflicts between land uses and land users. The conflicting interests of traditional rain fed farmers, mechanized farmers, pastoralists, forest users and the state (as owner of all unregistered land), discouraged proper forms of land management that considered the wider social and environmental impacts. In many cases the rights of the subsistence farmers (traditional agriculture), forest users and pastoralists were not respected and usually encroached upon in favour of the mechanized farmers or state owned and private corporations. Land use under government control, such as mechanized farming practices, generally focuses on resource exploitation, rather than efforts to improve its sustainability. However, land under customary tenure is more sustainable because of the effectiveness of the traditional laws governing ownership, distribution and use. This may be due to the fact that the tribal customs as

implemented by the local leaders try to ensure equity and right of subsistence cultivation for every member of the local community (Sudan Report, 1991).

57. Agricultural expansion policies typically dominate at the expense of forestry and other natural resources development and management including the lack of coordination. This has greatly influenced present day forest and range policies and practices and resulted in vast land degradation (Elsiddig 2004).

58. In 1991, Sudan adopted the federal system as an approach to decentralization, to devolve responsibilities and to re-divide power and revenues among Sudanese people. The federal system resulted in establishment of fifteen States in North Sudan that assumed responsibility for local administration. Policies relating to environmental protection, in general, are joint responsibilities of the federal and state governments yet the lack of comprehensiveness and the absence of effective coordination in the sectoral institutes have had very serious bearing on the environment and the natural resources (Abdel Ati and Awad 1996).

59. 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.

60. Agricultural cultivation in Sudan is composed of three categories: The traditional rain-fed category; the mechanized rain-fed category and the irrigated agriculture.

61. The traditional rain-fed agriculture is basically subsistence farming, providing livelihood to almost 70% of the rural people but 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 gradually shifted in southward direction leaving behind degraded lands because of mismanagement. 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.

Agricultural Policy

62. 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

Forest Policy

63. 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.

64. 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.

65. 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, environmental 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 20% of the area of the country is stated to be owned by the government as forest reserves. The policy stressed the role of forests in environmental protection by creating new obligations on a lessee in mechanized farming or irrigated area in order to maintain or establish green belts. 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.

66. 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.

Government and the Regions

67. The reservation of a certain area as a community forest presupposes that the native leader, the locality, the commissioner and the state minister of agriculture establish rights of the community over the particular area through a procedure involving confirmation. At the end the federal Minister of Agriculture makes the reservation order upon the recommendation of the general manager of the Forest National Corporation (FNC). After that the order should be published in the official gazette of laws of the Sudan. On the other hand, a committee as designated by the community undertakes the responsibility of forest management.

Higher Council for Environment and Natural Resources

68. 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. In 1995 after the creation of the Ministry of Environment and Tourism, HCENR was made part of it. Presently the HCENR is affiliated to the Ministry of Environment and Physical Development. The HCENR is primarily established as a coordinating and advisory body. According to HCENR Act (1991) its functions include:

- Laying down general policies and long term plans for environmental protection and sustainable development of natural resources.
- Coordination of efforts directed towards environmental and natural resources management among concerned governmental agencies and between federal and states governments.
- Periodic review of relevant legislations and recommendations to make them more effective instruments for sustainable development.
- Encourage and support research on the environment and natural resources.
- Promotion of environmental awareness and education.

69. According to the resolution 735 (1992) the Board of Directors of HCENR include ministers of Agriculture, Animal Wealth, Irrigation and 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.

70. 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:

- To implement the general policies formulated by HCENR.
- To monitor implementation of development program relating to natural resources.
- To collect data and gather information on negative or adverse changes in the environment.

71. HCENR and its branches are authorized to constitute specialized technical committees at their respective levels to assist in the performance of their tasks. HCENR represents Sudan as a focal point for most of the global conventions on the environment (UNFCCC, CBD) and responsible for ensuring Sudan's compliance with its obligations under these treaties. Hence, HCENR is implementing a number of capacity building projects to prepare Sudan to respond to the requirements of the conventions. With this function, HCENR has to play an effective role in natural resources sustainable management.

Range Policy

72. 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.

Animal Resources Policy

73. 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

74. 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.

Mechanized Farming

75. 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.

76. 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.

77. 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.

National Water Policy

78. 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.

Environmental Importance

79. 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.

80. 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 (outside protected reserves) 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.

81. 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, fiber, fodder, and useful plants in addition to income generation from the natural resources This will generate sustained mitigation benefits.

82. Many authors agreed to the fact that 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.

83. 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.

84. 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.

F. Land Tenure

85. 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.

86. 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.

87. 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.

88. 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.

G. Legal Framework

General

89. There are three types of laws in the Sudan: The Constitution, the Statutory Law and Customary regulations. The constitution is the source of rules governing personal relationships and transactions, land ownership and land use. The majority of enacted environmental and natural resources laws, such as those relating to forestry, game, fisheries and wildlife fall under statutory law. Customary law encompasses those indigenous rules, which govern the rights and duties of indigenous peoples in their relationships and transactions and in their use of natural resources, especially land and water. Hence, customary laws are as numerous as the tribes.

90. Although customary regulations usually have less sophisticated means of implementation and/or enforcement, they have higher rates of compliance than statutory law provisions (such as regulations, licenses fines, etc). Although statutory laws cover by far the bulk of environmental and natural resources, both the content and the inadequacies in the machinery for enforcement render them the least effectual of the three. In the absence of a comprehensive environmental and natural resources legislation, regulatory measures for environmental management have been contained on sectoral basis and may contradict with agricultural legislation.

91. Sudan Report (1991) stated that since the beginning of the past century (1901) about 150 natural resources laws (Statutory laws) and sectoral regulations dealing with health, water supply, land tenure, game, protected areas, fisheries and marine resources and other sectors of

natural resources, were established in Sudan. However these legislation and regulations remained fragmented, uncoordinated and lacking a unified legislative framework which expresses the general principle governing environmental conservation and natural resources management in Sudan. Instead, they are solely expressing their sectoral interests.

92. However, some of the important weaknesses outlined by many reports on the available environmental legislation state that the legislation:

- Concentrated on duties and responsibilities of the citizens and ignored their rights and education.
- Basically made at the centre and by central bodies and so focused on national interests rather than the interests of the local stakeholders.
- Weakly implemented due to lack of adequate implementation capacity or some time because they were subjected to political interference.
- Some important resources do not have legislations to protect them and control their utilization and management (e.g. rangeland)

93. Tolentino (1994) added that, many of the available Sudanese laws and regulations do not incorporate the modern principles of resource management and conservation. They are mainly use-oriented compared to what is now referred to as environmental laws, which are resource or conservation-oriented. This fact is well discussed in the Sudan Report (1991) where the authors have considered the land tenure and land use rights as the most important challenges to sustainable resource use.

94. An important step was taken towards a better co-ordination with the more recent establishment of an environmental and natural resources law. The Environmental Protection Act (EPA) of June 2001 is a framework law to policies, legislations and executive actions of federal state organs.

Forest Legislation

95. The forest legislation in Sudan is formed by several acts and the main relevant in our field is been described below.

Forest Act 1989

96. The Forest Act 1989 has, since its promulgation, been repeatedly praised as the most important piece of legislation of its kind ever enacted in forestry related issues in Sudan. In addition to the national and regional forest reserves owned by the government, it recognized new types of forest ownership: institutional, private, investment and community forest reserves to be managed by owners, committees and institutions. Investors in agricultural schemes were obliged to raise a forest area not less than 10% of the total area of a rain fed project and a

percentage not less than 5% of the total area of an irrigated project as shelterbelts and windbreaks for the purposes of production and protection.

97. Accordingly the act addressed tree and land tenure. All the forest reserves would be under the technical supervision of the Forests National Corporation (FNC). However, the control over tree cutting outside the reserves was tightened by the requirement of a permit to be issued from the FNC. Investors were also obliged to convert the cleared trees into forest products.

98. The Forests Act of 1989 also states that transportation of forest produce has to be allowed on a permit from the competent authority or will be subject to a deterrent penalty: the confiscation of any property, including the means of transport, used in the commission of the forest offence for the benefit of the corporation.

Forest National Corporation Act 1989

99. The establishment of the Forests National Corporation (FNC) was an important change in the forestry administration. FNC is a parastatal service-oriented and independent body corporate. Such independence marked the transition from a government department to a self-financing entity. It has much more functional freedom and flexible procedure in retaining revenue to meet its recurring expenses.

100. The function and purpose of FNC is to lay down the general policies; make the rules and methods which secure the good utilization and development of forests and achieve full protection of the environment; propose laws which achieve the implementation of the approved policies for the development of forests; supervise technically all forests of the country; disseminate awareness about forests; conduct studies and performs forest planning; mandated to increase the forest reserves areas up to 25% of the area of the country; intensify tree plantation and supply seedlings; develop Gum Arabic and other non-wood forest products; and coordinate with other bodies to implement forest policies.

101. The forest Act (1989) and Forest National Corporation Act (1989) were evident in their environmental conservation as compared with other objectives. The Forest Act (1989) is issued to meet the requirements of the forest policy (1989), which is an update for the earlier forest policy (1932 implemented by supported from the Central and Provincial Forest Ordinances 1932). According to the forest policy 1986 and forest Act 1989, natural forest management should be concentrated inside natural forest reserves to guarantee conservation, regeneration and sustainable management. To reduce felling outside the reserves and discourage people from felling and collection of wood outside the reserves, taxes and Royalty payment on forest products outside reserves are collected.

102. In spite of the support by forest Acts and strong forest policies, natural forest reserves are continuously deteriorated because of the inefficient implementation of the policy and lack of programmes to be linked to the policy. Management activities inside forest reserves have been confined in guarding, policing and prevention of access of local communities to the forests instead of collaboration with them in the management process. For the local people to satisfy their needs, they found themselves compelled to illegally access the forests; a situation that caused forests degradation rather than development.

103. In fact, amendments made on forest policy and forest laws provided opportunities for change of attitudes of forest authorities towards local people involvement in natural forest reserves management. Still this change has resulted in limited collaboration confined to pilot areas of forest reserves and may need more effort to upscale the collaboration experience to other forest resources within the institutional structure as within forest circles or States. Specific clear-cut statements in the forest policy and supported laws incorporating natural resources management on participatory approach in an integrated land use is becoming more urgently needed to replace the generalized statements of the past policies.

104. Among the relevant provisions of the forest Act (1989) is the requirement for farmers obtaining leases from government or parastatal to have shelterbelts or forest cover on 10% of rain fed lands and 5% on irrigated lands. The implementation of this provision on the agricultural land requires co-ordination between the FNC, the agricultural authorities and the farmers. Also according to the Forest Act, individuals, communities or institutions planting trees on their own land will have the freedom to utilize them, as they deem fit.

The 2002 Forests and Renewable Natural Resources Act

105. The Forests and Renewable Natural Resources Act, 2002, provides the framework for the management and protection of forests and renewable natural resources encompassing pasture and range as well as the framework governing the managerial system of the forestry sector.

106. The Act deals with both forests and renewable natural resources; and an independent corporation named the 'National Forests and Renewable Resources Corporation', is to be established by the act. The act is not implemented yet.

107. A principal function of the FNC under the 1989 Act was to lay down the general policies and make the rules and methods, which secure the rational exploitation of the forest domain and its development as well as the protection of the environment. This is articulated as basic function adding range and agricultural land uses to the domain of forests as subjects that FNC could regulate. One of the important institutional prerequisite for the sustainable management of forests and other natural resources is to establish appropriate and reliable forms of land tenure. In a significant departure from the past, both the 2002 and the 1989 acts, recognized new forms of forest ownership: national forest reserves, state forest reserves, private forest reserves and other forest reserves. The latter includes individually owned forest, communally owned forests and the forests of institutions, thus conceptualizing the concept of community forestry.

108. An innovative provision in both acts of the 2002 and the 1989 is that approval is required from the FNC when a land is allocated to any project for any purpose if that requires removal of trees as it is perceived that the natural environment will be negatively affected by removal of trees. This provision should be fully elaborated and articulated to prepare the procedure for environmental impact assessment not only for activities and works demanding major land clearing but also prior to any action for the de-reservation of forests that is likely to have significant adverse impacts on the forest resources.

Wildlife Legislation

109. The Wildlife Conservation and National Parks Act 1986 aim at the conservation of wild animals, game areas and protection of national parks. This also necessitates wise use, development and management of wildlife and parks resources. In this respect, consideration of the country's commitment to CITES (SEE Conventions); and the provision of information on wildlife resources and the promotion of scientific research is recommended.

110. The Act also describes the procedure of establishing natural parks and lists the protected species, specifies closed season for hunting, prohibit some methods of hunting, provide hunting license and permit system. According to Tolentino (1994) the wildlife and National Park Act (1986) is mainly focused on the conservation and protection of wild animals and neglects or excludes the statement on plants and trees, which are also wildlife. It does not provide for zoning of parks and classifications of areas capable of multi-purpose uses which are very important for management purposes and environmental conservation. But, the most important aspect, which ought to be studied for possible inclusion in the law, is participation of people living inside or around national parks. Assigning rights and responsibilities for local communities that depend on national park will enable them to assume informed responsibility over the sustainable use of its resources.

Water Resources Act 1995 and Other Water Related Legislation

111. A number of laws were promulgated such as the National Water Corporation Act, 1995, and the Water Resources Act, 1995. The former repealed the Rural Water Corporation Act and the Urban Water Act. It integrates Nilotic and Non-Nilotic water resources as well as ground water. The flood basin forests along the Blue Nile are under this issue.

H. Environmental Legislation

Environmental Protection Act (EPA)

112. The 2001 Act harmonizes the different sectoral environmental laws, sets environmental standards, and calls for the protection of biodiversity and combating pollution. It states the importance of environmental impact assessment to be carried prior to implementation of any development project. The 2001 Act also calls for raising environmental awareness and popular participation in decision-making process and setting policies.

113. The EPA of 2001 requires under chapter III, number 17 (1) an environmental feasibility study to be carried out for all projects that may have adverse effects on the environment and natural resources. The study must be presented to and signed by a committee constituted by the Higher Council for Environment and Natural Resources (HCENR). Provision number 17 (2) defines what this feasibility study must cover. It includes:

- Expected impact of the proposed Project on the environment;

- Negative impacts that can be avoided upon Project implementation;
- Available alternatives;
- Sufficient explanation that the short term exploitation of the natural resources and the environment will not affect the productivity of those resources in the long term;
- For projects that exploit non-renewable natural resources, the feasibility study should include emphasis on rational exploitation of such resources;
- Precaution measures to mitigate negative effects of the Project.

114. The Act empowers the HCENR to draw natural resources policies, including their assessment, development, and management in an integrated way to achieve sustainability; coordinate the activities of state councils; formulate national long term programs; and to review periodically environment-related legislation.

EIA Legislation

115. In spite of the need for EIA, there is no specific EIA legislation enforced and implemented yet. Preparations are ongoing, and a draft version of an EIA law is currently under development.

Local Government Act 2003

116. With the adoption of the federal system in Sudan some important legislation has been established to define administration units, divide power and to assign responsibilities. The Local Government Act (1989) established the structures and functions of local government within the federal system. The act defines the localities (rural councils) their legal entity, powers and responsibilities. The Locality, according to the act, is an autonomous body with its main function contained in provision of services and development of the locality.

117. To that effect, Legislative Council is to be established. The Locality is entrusted, along with other functions, with agriculture, forestry, natural resources and animal wealth. Its function, in this regard, is to cooperate with others in conserving and protection of the natural resources in order to ensure the sustainable use of the resources; encouraging afforestation and give due care to forests; establishing fire lines, identifying and giving due care to pasture land and water points in close cooperation with concerned institutions and identifying animal routes/corridors for trans-boundary grazing movement in the agricultural land.

118. The Native Administration Act (1989) defines the different native administration levels (the traditional leaders) and the procedure for their election. This Act also lists the powers of native administration, which include the conservation of forests, pastures, maintenance of livestock corridors, fire protection (forests and rangeland) and the environment. In addition, the Judiciary (Rural Courts) Regulations assign judicial powers to native leaders. In this respect, local leaders work in collaboration with local governments.

Investment (Encouragement) Act 1999

119. The Act encourages investment in the fields of agricultural, animal, and industrial activities; energy; mining; transport, communication, tourism, and environment. Investment in the field of agricultural, animal and industrial production is deemed to be strategic investment, capable of enjoying tax-fees exemption and non-attachment, non-confiscation, and non-sequestration of the property of the project.

International and Regional Conventions

120. Since the Rio Summit, a number of conventions in relation to the environment have been ratified and signed by Sudan. These conventions called for inter-sectoral approaches and coordinating mechanisms with all programmes and projects affecting the environment. Accordingly synchronization of efforts and rational utilization of resources are needed to achieve significant progress in environmental protection and sustainable development.

121. Since May 2005, the Sudan is also a contracting party to the Convention on Wetlands of International Importance (Ramsar Convention) where wet sites include the Dinder National Park and the flood basins.

The United Nations Conventions

UNFCCC 1992

122. The United Nations Framework Convention on Climate Change (UNFCCC) is concerned with natural ecosystems and climate change. It acknowledges the role and importance of terrestrial ecosystems as sinks and reservoirs of carbon. It also acknowledges that human activities have been substantially increasing the atmospheric concentrations of greenhouse gases. The ultimate objective is to achieve stabilization of greenhouse gases concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human) interference with the climate systems. This objective is to be achieved within a time frame that allows ecosystems to adapt naturally to climate change, ensures that food production is not threatened, and enables economic development to proceed in a sustainable manner.

123. Sudan is a party to the UNFCCC since 1993 and prepared itself to meet the requirements of the convention through building its capacity by institutional strengthening to facilitate assessment of greenhouse gases in the country in relation to different sources and sinks. Capacity building requires training of personnel in planning, evaluation and development of means and ways of climate change assessment and development of mitigation measures and process monitoring and evaluation systems in a multi-sectoral approach. Sudan signed the convention in 1994 and ratified it in 1995. Sudan also became a party to the Kyoto protocol in 2005.

124. The Convention to Combat Desertification (UNCCD) (1992) became legally binding in December 1996. In compliance with and in pursuit of articles 8, 9 and 10 of the UNCCD, Sudan has prepared its National Action Plan (NAP).

125. Other conventions include the Convention on Biological Diversity 1992 (CBD), Africa Convention on the Conservation of Nature and Natural Resources 1968, revised 2003, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973 and the Convention on Wetlands of International Importance (RAMSAR) 1971. In addition, Sudan is also an active member in the Forest Principles and Agenda 21 (1992).

Institutions and organizations

126. Various stakeholder groups with distinct interests in the utilization and management of land, forests and natural resources could be distinguished 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 but this is not reflected in the counterpart relationship of the various institutions concerned with the use of land and natural resources management because of their different and conflicting affiliations, interests and mandates. Coordination is limited and cooperation is not effective even among closely related institutions like agriculture and forestry. With such lack of coordination particularly with respect to land use, instability may be reflected on the environment.

127. The following are the institutions and organizations affecting or affected by the development of the project, and therefore either potential implementation partners, or beneficiaries.

Ministry of Environment, Forestry and Physical Development

128. The ministry is mandated for:

- The protection of the constituents of the environment and the social and cultural systems in a sustainable development, for the benefit of generations;
- Promoting the environment, rational and sustainable use of the natural resources for the purpose of development and conservation thereof;
- Linking between the issues of environment and development;
- Ascertaining the responsibility of the component authority, for protection of the environment and the serious striving to achieve such protection;
- Achieving the role of the component authority and the organs belonging thereto, and preventing laxity and shortcomings of performance.

129. The major institutions within the ministry are: The Forests National Corporation (FNC); The Higher Council for Environment and Natural Resources (HCENR) and Wildlife Conservation and General Administration (WCGA)

Ministry of Agriculture

130. The Minister of Agriculture is a member in the Board of Directors of HCENR together with ministries of Environment, Animal Wealth, Irrigation and Water Resources, Energy and Mining, Trade and Commerce, Higher Education and Scientific Research and Justice and Attorney General's Chambers. The mechanized farming corporation is belonging to this ministry.

Mechanized Farming Corporation (MFC)

131. 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 Mechanized Farming Corporation office in the State capital where the scheme falls. The minimum 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 MFC.

Local Government Institutions

132. Local government institutions are related to forestry and range development and concerned with pastoralist services.

Other Related Government Institutions

133. Other governmental institutions concerned with natural resources policy making and implementation include:

- The Parliament (National Assembly for legislation)
- Courts (Judiciary)

Community Institutions

134. They are concerned with ownership and management of forestry and natural resources because of the contribution of these resources in livelihood support.

Trade Unions

135. Presently, trade unions are established to protect the rights of members. Mechanized Farmers and Pastoralists are examples.

Non-Governmental Organizations

136. The most relevant and active NGOs in the area of natural resources and environment include the Sudanese Environmental Conservation Society (SECS) and the Sudanese Social Forestry Society (SSFS).

Stakeholder Analysis

137. A selection of as many relevant stakeholders as possible was made, and it was analysed what role each of them should play in the project, according to their specific mandates, capabilities and comparative advantages. The results of this analysis, as well as the definition of the role of each organisation in the project are shown in table 5.

138. This selection process has already started by consultation of stakeholders during the preliminary visits including the local communities and local government during preparation of the present document. It is expected that key stakeholders like the Ministry of Environment and FNC would play significant role while others would have coordination and supporting role.

139. In order to define exact location of project activities to be implemented project staff will hold a survey to identify the most suitable locations, particularly in relation to maximum social benefits.

140. The main stakeholders identified include:

- The Ministry of the Environment, for its mandate as a policy maker and potential to play a coordinating role;
- FNC, for having a large experience in the forestry sector (A/R and biomass energy saving), making it apt to be closely involved in the management of the project;
- MFC, for its great interest in combat of deforestation
- Community organisations (including BIRDP related institutions, such as credit and savings associations/sanduqs, village development committees and community/producer organisations for forest management plan development etc.), for having interest in poverty reduction and improved livelihoods, and having direct access to local communities;
- Local government, for being responsible for local development.

141. These stakeholders will also be the main implementing institutions in the project, the proposed tasks of each of them described in the last column of the stakeholder summary in table6.

Table 6: Preliminary analysis of stakeholders

Estimated project impact (H,M,L)	Estimated priority (1,2,3)	Expectation for the project +ve or -ve	Potential for or increasing support or reducing obstacle	Proposed contributions in project implementation
H	3	+ve, willing to engage and enhance change	Good coordination between different institutions Environment protection	Project management, Coordination, Replicability
H	3	+ve, enhanced A/R work and income from carbon sequestration potential	Capacity building Awareness raising Reduced emission	Project management, fund management, field implementation, co-financing, training, awareness raising and communication, monitoring & evaluation, replicability
H	1	-ve, deforestation should be reduced	Increasing yield	Training, awareness raising and communication, Policy advice, replicability
H	3	+ve, achieving multiple uses +ve, bare land planted + yield level increased	Poverty reduced Livelihood supported Resilience improved	Field implementation, site selection training awareness raising and communication
	2	environment protected	People rights considered	
M	2	ve services provided tax paid	Community standard improved	Training, awareness raising & communication, policy advice

142. Prior to project implementation, a stakeholder survey and analysis should be carried out to facilitate improvement in the project design with respect to the role of stakeholders. This will be based on the developed criteria and evaluation of the extent to which the project affects the stakeholders' interests and the classification made by the stakeholders themselves regarding the extent to which they and other stakeholders are affected. In addition, the stakeholders' expectations should be assessed on the basis of determination of the potential risk involved if their key expectations are not met and assessment of the positive or negative expectations and how measures could be addressed in order to meet the expectations.

PART II - PROJECT STRATEGY

Project rationale, incremental reasoning, consistency with GEF policies and strategies, and GEF added value

A. Project Rationale

143. Forestry is very important for rural development in satisfying the basic needs of societies at all stages of development. Forest products in the form of wood fuel, charcoal, construction poles, timber, gum, leaves, and native and processed medicines are still in high demand at varying levels. The means by which these products are obtained has varying impacts on forest cover and the ecosystem services it delivers.

144. The contribution of forest resources to the Sudanese national economy is at present far underestimated (3.3% of the GDP). Estimates are based solely on the income from timber and fail to consider the contribution to energy (more than 69% of the energy balance at present) and the value of other socio-economic and environmental benefits derived from forest resources. Forests contribute 30-70% of animal feed in rainy and dry seasons respectively and employ around 15% of the labour force in rural areas. Gum Arabic produced by Hashab trees (*Acacia Senegal*) is an export commodity that earns foreign exchange and also supports the livelihoods of more than two million persons in the dry lands of Sudan.

145. The diversity in the soils and climate of the Sudan underlie the different patterns in land use. In the North, land use is characterized by highly mobile pastoral systems, while the central part of Sudan and much of the South is characterized by sedentary Agro-pastoral system (small-scale agriculture together with some animal husbandry). Large-scale agriculture rainfed and irrigated forms occur in the central and eastern regions and in close proximity to the river basins (where the project area is located).

146. The land tenure system in Sudan has greatly influenced the exploitation of natural resources. The 1970 Unregistered Land Act of Sudan states that all unregistered land is state owned, but local people have rights to its benefits. This applies to rangelands and other uncultivated or non-residential lands. Forest laws also include similar provisions to grant people access to resources inside the forest reserves. Although the customary systems of land tenure defined the use of communal lands, conflicts over land-use have occurred in a number of areas, due to scarcity of land-based resources and other environmental factors e.g. drought. However, since 1992 all national development plans called for the rational use of natural resources and environmental protection.

147. As reported in Sudan's Initial National Communication (INC) to the United Nations Framework Convention on Climate Change (UNFCCC), agriculture and land-use, land-use change and forestry (LULUCF) are the main emitters of greenhouse gases (GHGs) in Sudan. LULUCF generate net CO₂ emissions of about 15,577 Gg (corresponding to more than 75% of total CO₂ emitted). This was a consequence of a steady reduction in the stocked volume of forest resources in Sudan due to: (i) the expansion of agriculture in the absence of proper land-use and forest management planning, (ii) increased urbanization, (iii) fuel wood production (firewood and charcoal, which constitutes more than 70% of total national energy consumption), (iv) and grazing. The continuous reduction in the forest stock has caused Sudan's forest to become a source of GHG emissions rather than a net GHG sink.

Table 7: Land area and forest resources in Sudan and South Sudan

Country	Land area in million ha and (%)		Forest resources in million feddan* and (%)	
	Sudan	187.8	73.4	51.96
South Sudan	68.2	26.6	109.62	68%

Source: FNC report Jan 2011*1 feddan equal 0.42 ha

148. The splitting of Sudan will have significant implications for the forestry sector and its current policies and programmes. The table below shows approximately how land and forest resources might be divided between the South (the new state of South Sudan) and the north (Sudan):

149. According to this preliminary assessment report by FNC, the forests in the north are mainly dry subtropical forests with low tree density, between 150-300 trees per fed, and are mostly classified as protected forest. Sudan is expected to lose around two thirds of its forest resources after separation from the South. Accordingly the forest cover will decrease from 67 million hectares to 21.8 million hectares, representing about 11% of the total area of Northern Sudan. This will lead to Sudan's classification as a low forest cover country. Moreover, separation from the South is expected to result in an increase in the deforestation rate from 0.74% (FAO) to 2.2%. This estimation is mainly based on the fact that, the largest share of deforestation presently occurs in north Sudan (about 90%). Furthermore, the average tree density per hectare will be reduced and consequently the annual allowable removal is expected to be reduced from 11 million cubic meters to about 8 million cubic meters. This is significant given that forest biomass consumption in Northern Sudan is approximately 22 million cubic meters (in 2010), which is twice more than the existing annual allowable removal. Such situation will lead to the rapid deterioration of the forest resource unless, significant and

immediate efforts are made to increase the rate of afforestation (ideally, by at least hundred times the present rate) and to increase efforts to protect the remaining forest area in Northern of Sudan.

150. The Forest National Corporation (FNC) is self-financing and relies on the collection of revenues from fees and royalties from non-reserve forests and returns on investment and the proceeds from sales of wood products harvested within forest reserves. FNC accomplishments during the last two decades in the areas of reservation and afforestation deserve redoubling the availability of funds for the promotion of sound management and sustainable development. But unfortunately that was not the case in view of lack of finance from the three resources defined by FAO (26 % from own resources, 33 % from the national budget and 41 % from foreign donors). The contribution of the national budget during the past five years did not exceed 5% and the foreign aids did not exceed 9 %.

151. The ratio of the corporation revenue during the past five years was 86 % of the expenditure. Fifty five percent of the revenue is used to meet the expenditure under Chapter I of the budget and 45 % to meet the costs of operation (forest reservation, afforestation, protection and desertification control). It can be concluded that insufficient financial resources do not allow FNC to respond fully to the forestry needs of the country and in particular needs to implement large-scale afforestation and reforestation programmes.

152. The Initial National Communication (INC) of Sudan indicates that forests could play a vital role in carbon sequestration in the country. The analysis carried out for the preparation of the INC suggests that afforestation and rehabilitation of rangelands are the most suitable options to achieve GHG emission reduction objectives in the country. In addition, the present very high rate of deforestation and forest degradation suggests that the Sudan’s forest sector has the potential to play an important role in the current processes under the UNFCCC aiming at reducing emissions from deforestation and forest degradation in developing country, the so called REDD-plus.

153. Table 8 below shows the potential available areas for afforestation, including areas of 10% and 5% of the rainfed and irrigated agricultural lands respectively.

Table 8: Potential land for afforestation and reforestation in Sudan

Potential sources of land	Potential Area Million (fed)
10% of mechanized rainfed agriculture schemes	3.5
5% of irrigated agriculture schemes	0.2
Waste land between latitudes 10 and 22 ^{o8}	37.4
Total	41.1

⁸ Mostly degraded rangelands

154. The overall objective of Sudan's national implementation strategy for climate change is to promote sustainable development paths that improve Sudan's adaptive capacity and limit its growth in GHG emissions through integration of climate change issues and concerns into national policies, strategies and development plans

155. The contribution of the forest sector to climate change mitigation and its devastating impacts and the associated carbon/development benefits is well recognized in the Sudan's Initial National Communication (INC). Despite that, Sudan is not committed under the UNFCCC to a GHG emission reduction target. However, being one of the most vulnerable countries to the devastating impacts of climate change, it is found imperative for the government to undertake steps to reduce GHG emissions with the overarching aim that these mitigation actions shall not only reduce emissions and enhance sinks but also simultaneously contribute to meeting the overall development priorities of the country. Therefore mitigation actions are also considered as very important drivers to national development through the opportunities they create for accessing investments, funding and technology transfer

156. The mitigation analysis in the INC focused mainly on the energy and the Land Use Change and Forestry (LUCF) sectors as being the dominant areas where GHG emission reductions could be achieved. In the LUCF sector the analysis showed that all options of afforestation and rehabilitation of degraded lands are possible for Sudan to both embark on a sustainability path and to contribute to national development priorities. The energy options also found to be an important possibility for Sudan to reduce its emissions growth particular with regard to biomass energy. At present energy use is still dominated by consumption of firewood and charcoal resources that are proceeding at unsustainable levels.

157. The analysis of these options indicated that all options have a reasonably good potential for carbon uptake. Regarding the cost effectiveness indicators, almost all LUCF options have showed very attractive economics compared to other countries. All have very low initial cost and present value of cost per ton of carbon. Social and environmental aspects have also been weighed in the selection of the options. See the two tables below from Sudan's INC to the UNFCCC.

Table 9 Cost –effectiveness indicators for carbon conservation

Mitigation Option	Land Type	Mitigation Measure	Land Area (000 ha)	Initial Cost		Present Value of Costs	
				US\$/tC	US\$/ha	US\$/tC	US\$/ha
Forestry	Wasteland	Hashab	6,25	0.6	23	1.11	44
		Mixed Acacia (60%. Talih)	6,25	0.7	23	1.26	44
		Mixed Acacia (60%. Hashab)	6,25	0.6	23	1.13	44
		Rangeland: scattered trees & shrubs	6,25	0.2	9	0.68	27
		Range grassland: Ranching	471	0.4	16	0.00	0
		Range grassland: Open range	1,57	0.3	11	1.23	41
		Range grassland: Grazing reserves	1,099	0.3	14	0.73	40
	Rainfed	Talih	3,95	0.7	23	7.43	256
		Hashab	3,95	0.5	23	6.06	256
		Mixed Acacia (60%. Talih)	3,95	0.6	23	7.01	256
		Mixed Acacia (60% Hashab)	3,95	0.6	23	7.01	256
	Irrigated	Eucalyptus spp	296	0.2	50	0.91	259
	Management	Forested	Above 20% Crown cover	3,2	0.1	6	1.19
Application Mgt. System			12	0.4	3	6.10	54
Baga grazing reserve			714	0.4	4	7.37	65

Table 10: Cost of incremental carbon uptake by the different mitigation options

				Incremental Carbon Sequestered		Costs		
Mitigation Option	Land Type	Mitigation Measure	Land Area (000 ha)	(millionC)	(million tCO ₂)	Initial Cost (US\$/tC)	Present Value (US\$/tCO ₂)	Total (million PV\$)
Forestry	Wasteland	Hashab	6,25	247.2	904.7	0.16	904.7	148.3
		Mixed Acacia (60%.Talih)	6,25	217.4	795.5	0.19	795.5	152.2
		Mixed Acacia (60%.Hashab)	6,25	242.7	888.4	0.16	888.4	14.6
		Rangeland: scattered trees & shrubs	6,25	249.6	913.6	0.05	913.6	49.9
		Range grassland: Ranching	471	21.0	76.9	0.11	76.9	8.4
		Range grassland: Open range	1,57	52.6	192.5	0.08	192.5	15.8
		Range grassland:	1,099	59.6	218.0	0.08	218.0	17.9
	Rainfed	Grazing reserves	3,95	136.0	497.8	0.19	497.8	95.2
		Hashab	3,95	166.9	610.7	0.14	610.7	83.4
		Mixed Acacia (60%.Talih)	3,95	144.0	527.0	0.16	527.0	86.4
		Mixed Acacia (60% Hashab)	3,95	155.1	567.5	0.14	567.5	93.0
	Irrigated	Eucalyptus spp	296	83.9	307.0	0.05	307.0	16.8
	Management	Forested	Above 20% Crown cover	3,2	22.5	82.5	0.004	0
Application Mgt. System			12	0.1	0.3	0.363	0.1	0.0
Baga grazing reserve			714	6.3	23.0	0.42	0.11	2.6

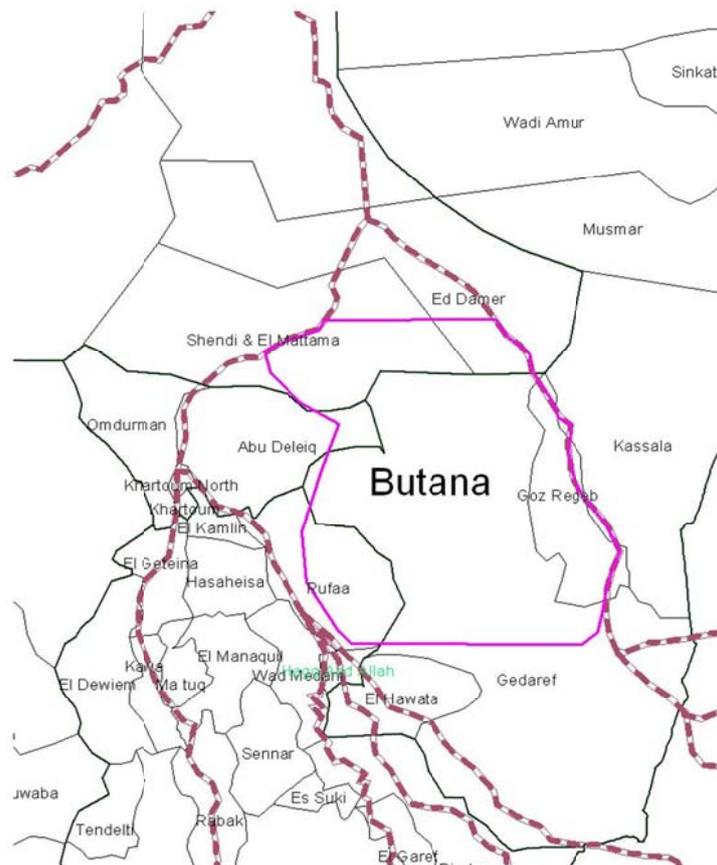
Note 10% Discount Rate used

158. However, it is important to note, the limitations encountered during the analysis of the energy and LUCF mitigation options. Among those limitations, lack of technical and institutional capacity and lack of good quality data indicated as the most important limitations. Good quality activity data and basic national parameters e.g. emissions factors, in addition to technical expertise in estimation and monitoring of forest and biomass carbon stocks are necessary for both improving GHG estimates and for developing good quality mitigation actions and measures. Unfortunately, to date, none of these mitigation options have been implemented due to lack of technical and financial resources.

B. Project Rationale: Butana area

159. The Butana region is an area lying between the River Atbara and the Blue Nile. Butana is one of the areas prioritized by the Government to receive focused support. The area falls under five States (River Nile, Khartoum, Gezira, Gedaref, and Kassala), and 10 localities (Sharg El Nil, Shendi, Shamalshendi, Kaboshiya, Eddamer, Es Soubagh, Um el Gura, Rufa’a, Satit, River Atbara). The Butana area is an extensive, monotonous flat plain. The northern areas are part of the desert/semi-desert zone and rainfall rarely exceeds 100 mm/year. In the central parts of Butana, which is part of the semi-desert, rainfall reaches 250 mm, further south rainfall reaches 400 mm. The greater part of the Butana is, however, drained by numerous khors (watercourses) into inland deltas. Sorghum is main crop cultivated in these deltas.

Table 11: Map 2: Project Boundary



Source: IFPRI: Butana Special Spatial Analysis, March 2006

160. Due to the geological and hydrological conditions prevailing; the provision and supply of water could be achieved through three main supplies, namely groundwater, surface water harvesting and perennial sources. Each of these sources addresses the problem of water supply in varying degree. The available sources of water are tapped through 5 water utilization systems for drinking and irrigation purposes: (i) perennial streams and canals; (ii) open hand – dug wells and hand pumps; (iii) water yards; (iv) water harvesting surface structures (hafirs and dams); (v) traditional water system (natural pool and depressions). These depressions or wadis drain the rainfall into northwest and southwest directions. The surface runoff draining southwest can form major wadis that join the River Nile basin in River Rahad or the Blue Nile. Under normal range of rainfall, most of those wadis end up spreading into deltas. The deltas are terraced and cultivated for the production of sorghum, while the flat land is used for grazing of livestock. The wadis, washing towards river Nile and Blue Nile, form numerous mayas' that hold water for months because of the thick clay layers on the surface of the soils.

161. The region is characterized by a variety of vegetation and plant cover. The northern part is characterized by the growth of dwarf Salam trees (*Acacia ehrenbergiana*) on the impoverished clay and sand soil, and Marakh (*Leptadeniapyrotechnica*) and the perennial grass *Panicumturgidum* on sand dunes. On the clay soil in the semi-desert and savannah to the south, the tree vegetation typical consists of stands of Acacia thorn trees (*Acacia millifera*, *A. raddiana*, *A. nubica*, *A. seyal*, *A. tortilis*). These are presently confined to wadis, where there is sufficient moisture to support their growth. The continuous expansion of sorghum cultivation, whether lawful or otherwise has resulted in the devastation of the vegetation. The ground layer of vegetation, which provides grazing, has also deteriorated through the years because of excessive grazing and the breakdown of the traditional system.

162. It has been estimated that 8 million hectare of the area used for grazing in Butana has suffered substantial or severe erosion and the environment degradation (Ayoub, 1998, Shepherd, 1985). According to Muna 2006, based on the comparison between image classification and image difference results, it could be noticed that the eroded and bare soil increased by about 1 - 3% during the period from 1987 to 1996, and by about 3 - 7% during the period between 1987 and 2000. While the vegetation cover decrease by about 3 - 6% for the same period. Pastoral nomad's in the Butana is undergoing a rapid change in nature, strategy and pattern of mobility due to the expansion in agricultural development schemes in the Butana (Abu Sin, 1970) and changes in the vegetation. Akhtar and Mensching (1993) stated that desertification has become one of the most serious environmental and socio-economic problems in the Butana area.

C. Project Area

163. The project area will be located within Butana region. The afforestation and reforestation activities of the project will mainly be confined to the parts of the Butana that fall within the Gedarif and Gazira because these are the states where large areas, including areas of forest and rangelands, have been negatively affected by mechanized agriculture. Currently the expansion of mechanized agriculture land in Gedarif state is estimated at 8 million feddan, taking into account the provision under the current forest law of allocating 10% of rainfed agricultural area to forestry, the land area available for A/R in Gedarif state can be estimated at 800,000 feddans (more than 360,000 ha). Also because these are the states where forests exploitation for wood consumption is mainly concentrated. More important these States are characterized by the highest potential for biomass growth within Butana because of their location within the area with high rainfall.

164. The concentration of the A/R activities in these two adjacent and closely linked states will minimize the project emissions associated the implementation of the A/R activities and hence maximize the net removal impact of the project. On the other hand the biomass energy conservation activities of the project will cover also other parts of the Butana region to reduce emissions associated with current level of biomass energy consumption. The coverage of energy conservation activities will target the population within the project area in order to reduce their overall demand for biomass energy and hence ensure long-term sustainability of carbon sequestration potential achieved by the project. In this sense this activities will also compensate or minimize negative leakage of carbon emission associated with biomass energy demand.

GedarifState

165. The total area of Gedarif State is 5,849,006.888 hectares. The State is located in eastern Sudan between latitudes $12^{\circ} 39' 36'' - 15^{\circ} 45' 36''$ and longitudes $33^{\circ} 34' 12'' - 36^{\circ} 33' 36''$. Gedarif State and is bordered by Ethiopia on the East. It shares its border with four other states namely Khartoum, Gazira, Sennar and Kassala. The state is characterized by arid and semi-arid climate with summer rainfall which may range from 200-900 per annum. The state has a flat or undulating topography and various vegetation communities ranging from short grass shrub to Acacia woodlands and mixed forests. The total forest cover estimated at 1,545,196.6 ha (18% of the total State area) out of which 612,508.4 hectares are forests reserves. Soils are mainly heavy cracking clays. The major land use types are mechanized large-scale farming, smallholding traditional farming and pastoralism. Forest utilization is important in the State: the per capita consumption of wood-based forest products is equal to 0.71 cubic meters.

166. The dominant tree species in the project area are: *Acacia seyal*, *Balanitesaegyptiaca*, *Acacia mellifera*, *Acacia Senegal*, *Combretumhartmannianum*, *Anogeissusleiocarpus* and *Entadasudanica* occur together with *Boswelliapapyrifera* specifically in hill slopes and soils formed in sites round the hills.

167. Soil deterioration and land degradation are evident in both mechanized and traditional farming areas due to mono cropping of sorghum. Large-scale forest removal is mainly attributed to mechanized agriculture, fuel wood production, charcoal making and overgrazing.

168. Massive tree removal for mechanized rainfed agricultural was started in the mid-forties of last century by only about 500 feddans and currently exceeded nine million feddans. Forests clearance accelerated wind and water erosion, deteriorated soils, increased drought effects and reduced ecosystem productivity. There is an evident need of large-scale forestry programme to rehabilitate the degraded forest reserves, reintroduce forest trees in the vast mechanized agriculture land in forms of woodlots and shelterbelts in order to improve microclimates and reduce soil erosion caused by the mal-practices of continuous land preparation.

169. Being a home for different acacias species Gadaref is famous as a traditional charcoal production area and Rahad riparian forests are also famous for being traditional firewood production areas. The area hence experienced vast tree removal for providing energy to various parts of the country.

170. Moreover refugee influx from adjacent countries into Gedarif area is another cause of severe tree removal and negatively affected the environment through home construction activities and other wood consumption aspects. For the period 1984-1994 it was found that, the total area cleared for settlement of refugees and fuel wood consumption amounted to 813,600 ha.

Gazira State

171. Gazira State lies between latitudes $13^{\circ} 33' 00''$ - $15^{\circ} 28' 12''$ and longitudes $32^{\circ} 24' 36''$ - $34^{\circ} 18' 00''$ with a total area of 2474355.925 hectares. The forest cover constitutes 0.4% of the total State area. The State is the Sudan's major agricultural region with more than 1.1 million hectares. The rainfall range 300-400 mm per annum. The per capita consumption of forest woody products is 0.64 Cubic meters. The total area of the forest reserves is 166419.3 hectares. The dominant tree species includes *Acacia nilotica* along the river banks, *Acacia mellifera*, *Commiphora Africana*, *Bosciasenegalensis*, *Acacia seyal*, *Balanitesaegyptiaca*, *Cadabaglandulosa*, *Cadaba rotunda* and in low areas *Dalbergiamelanoxylon*.

172. Butana is the biggest Administrative Locality within Gazira state with an area of 840000 ha. Butana plains within Gazira State constitute an important grazing land. Cattle, goats and sheep use the grazing lands in the rainy season, and camels throughout the year browsing trees, especially *Acacia* spp. which has high nutritive value. 60 years ago this area was covered with a dense natural stand of a mixture of valuable tree species. The area was subjected to illegal felling of trees and overgrazing, this combined with the effect of frequent droughts resulted in environmental degradation within the Butana locality.

173. Different ecosystems in the Butana locality are subjected to various forms of land degradation and desertification, which has led to sand encroachment, accelerated development of dunes and also there is increased water erosion in the northern part of the area due to removal of vegetation cover. Rangeland and pastures have been deteriorated seriously in both quality and quantity.

D. Target population

174. A recent study revealed that 46.5 percent of the population of Northern Sudan is found to fall below the poverty line, being 26.5 percent of the urban population and 57.6 percent of the rural population (CBS 2010). FAO/SISFIA also reported that one out of three Sudanese suffered from food deprivation in 2009.

175. Poor households are characterized by their physical assets, land and livestock; economic activity that relies on traditional rainfed agriculture; gender of the head of household; and displacement status. Poor households include smallholders, woman headed households and returnee households. Proxy methods are used to assess poverty given the dearth of data on the subject.

176. Livelihoods of poor rural people. Rural livelihoods are subsistence oriented and are based on crop cultivation, herding, and fishing where available. Depending on the predominant production system, poor households own approximately ten to thirty small ruminants, cultivate about one to five feddans⁹ of mainly food crops, cover from three to six months of their food requirements from their own production and the remainder from barter or trade of livestock products/inclusion in the labour force/handicrafts and petty trade. Their main livelihood constraints are (i) unpredictability of rainfall in terms of timing and quantity; (ii) pest and disease outbreaks; (iii) water shortages in the dry season; (iv) barriers on migratory routes, which lead to disputes over rights of passage between pastoral and settled communities or between local communities and commercial interests; and (v) cattle raiding.

177. Poor rural people rely on kinship relations and solidarity among community members as their main coping strategies. They also compensate crop failures or loss of livestock by exploiting their environment, supplementing food or income through wild fruit collection, hunting, fishing, apiculture, weed handicrafts and charcoal making. In larger villages and towns where production systems are more diversified, wage labour constitutes an alternative coping strategy. In the transition area and the northern region, wage labour represents close to fifty

⁹ A feddan is equal to 1.038 acres.

percent of cash incomes. Households also take consumption-limiting decisions such as curbing education and health expenses, cutting water consumption and reducing food intake.

178. The total population of Butana is estimated at 1 million inhabitants, most of whom are farmers and nomads. The local economy is characterized by agro-industrial production driven by the installation of large irrigated and mechanized agricultural schemes and agro-processing industries as well as by increasing urbanization of main settlements on the riverine borders of Butana. Livelihoods, especially of the poorest, are hence a combination of subsistence production and migration in pursuit of wage labour. The project area comprises approximately 10,000 households; expected project beneficiaries are estimated at 100,000, which are usually made up of a large proportion of children and youth, and considerably less adults and few elders. The project target group is composed of farmers, agro-pastoralists and pastoralist households. The target group will be addressed through government agencies as well as local NGOs and schools. Regarding schools, it must be mentioned that school enrolment in Sudan is on average only about 50%, which implies that half the children of school going age cannot be reached by school programmes.

179. The final selection of A/R areas will be decided during the project implementation, there is guidance and criteria provided for the project management (including its steering committee) to make this final selection. This guidance can be elaborate to ensure involvement of maximum number of beneficiary from the local communities. The communities involvement will be in at least in 3 ways:

- a. Farmers and owners of rained agricultural schemes participating in the A/R activities in the rainfed area. Total targeted area is about 4kha, this will be divided in accordance with the provision of the forest Act/policy that call for the allocation of 10% of rainfed area to forestry land use. The project management should consider involving more number of farmers, for example if the landholding per farmer is larger (1kha), the project management may decide to cover only part of the total area that represent the 10% from total farm area, the basis for making the decision should be discussed and agreed with farmer community.
- b. Land less people involved in agroforestry in irrigated area,(this will be carried out in reserved forest through special agreement between FNC and Landless people as it is a case in other areas to ensure that landless will directly benefit from their involvement) total area is about 1kha. This is also depending on how the project management will decide the size of the area of land to be allocated per a farmer. The decision of the management here need to benefit from common and good practice and local economic consideration and consultation of with landless community
- c. Community forests; villagers will be involved in establishment of village woodlots, women forests and other community forests on communal land

180. With regards to gender, the population counts 98.5 males for every hundred women, which implies that the female population of Sudan is slightly larger than the male population. Of

children enrolled in schools, 47% is female, against 53% male, which means, when considering that there are more women than men, women are at a disadvantage. Literacy rate for the age 15 and over stands at 49.9% with men being 50.6% and women being 49.9%. Life expectancy at birth for males is 52.5 years while that of females is 55.5 years. The infant mortality rate for females is 115 while that of males is 134 per thousand live births.

181. The gender related development index (GDI) is 0.492 compared with the human development index (HDI) of 0.516, which indicates that disparity in gender development accounts for 95.3 percent of the HDI. Women are generally the main contributors to the household's income and food production. Their participation in decision making can increasingly be quantified thanks to the introduction of a quota for their representation in state legislatures, parties and community organisations. Nevertheless, this participation is qualitatively weak. Women's empowerment is hindered by (i) a high rate of illiteracy among women, (ii) a customary law that attributes specific gender and age differentiated roles; (iii) marriage practices that push women into early marriages; and (iv) heavy workloads.

182. Typical tasks women are involved in are fetching water and gathering firewood, which take up a large proportion of available time and effort; working of up to 18 hours per day are no exception. They are also involved in handicrafts (mats and basket work) and extraction of non-timber forest products. They also milk small ruminants, if they have any, and process the milk into ghee and yogurt. Women may also be involved in agricultural activities. The ever-growing pressure of mechanized agriculture seriously interferes with these activities. On the other hand, and in some cases, women (as well as men) work as hired labourers on irrigated farms.(IFAD, 2009).

183. Women will benefit most directly from the project activities related to alternative energy sources and fire wood economy, thus lightening the burden of gathering firewood, freeing up time for alternative, income generating activities. Substitution of firewood by LPG may even have positive health impacts through the elimination of smoke from the environment. Better management of the forest will also guarantee access to the forest products women use for handicrafts or selling directly.

184. In many cases it is difficult for male extensionists to assist women, for cultural reasons. For the implementation of this project it is therefore imperative that the implementing agencies count with sufficient female staff to work with women. Currently, extension services count with only about 20% female staff (out of a total of about 380 extensionists). NGOs have undertaken initiatives to improve this situation.

185. The gender mainstreaming approach of the project will be to seek maximum involvement of women, using specialized female staff and local organizations and NGOs, in order to adequately address their needs, also contributing to their empowerment. Activities will include fuel switch (firewood to LPG) as well as activities related to forest management and income generating activities.

E. Project incremental reasoning, consistency with GEF policies and strategies, and GEF added value

186. The proposed project strategy is based on climate change mitigation approaches, including possibility to benefit from the carbon market. This approach requires building upon national mitigation options defined in INC and current policies and programmes of the FNC as well as international experience in dealing with GHG mitigation and the carbon market. The on-going baseline activities carried out by the IFAD-supported Butana Integrated Rural Development (BIRD) project represent the vital development interventions needed to ensure the success of this project in achieving its intended objectives of expanding the carbon sinks and reducing emissions which is the root causes of the climate change, while contributing to sustainable development in the Butana area.

187. The Butana area has been severely affected by lack of adequate investment in the natural resources management and the consequence was severe degradation of the natural vegetation cover (rangelands and forests) and soil erosion.

188. The IFAD-supported Butana Integrated Rural Development (BIRD) project focuses mainly on problems related to overgrazing, by promoting a sustainable livestock system. Environmental sustainability is supported as a crosscutting issue given its fundamental role in improving local livelihoods and increasing local communities' resilience to drought. Specific activities include increasing the productivity of livestock husbandry systems, the introduction of fodder in the farming system, the improvement of carrying capacity of the range, the construction/rehabilitation of water facilities, the development of resource management plans. Also, marketing services will be reinforced and capacity building and institutional support strengthened.

189. Specific activities are tailored to the specificities of the ecosystems and socio-economic settings characterizing the Butana region. The overall goal of the BIRD project is to achieve a sustainable improvement in the livelihoods and drought-resilience of rural poor households. Its specific objectives include (i) establishing a coherent and cost-effective governance framework that ensures regulated access to land and water resources in the region; (ii) improving both women's and men's access to – and bargaining position in – livestock markets; (iii) developing the capacity of community-based organizations to engage in environmentally sound development initiatives that are gender- and socially equitable.

190. While building the basis for a sustainable use of natural resources in Butana, the BIRD does not address other environmental issues that contribute to increasing the sustainability of rural development efforts in the country. While seeking to provide remedial action to improve the livelihoods of rural poor household, the activities supported in the baseline do not take into account the potential of increasing the carbon stock in the project area, while at the same time generating other economic and environmental benefits.

191. Therefore, this project proposal builds on BIRD intervention and aims towards addressing the gaps related to the forest and natural resources development including the high demand for biomass energy in the Butana area. The intended objectives are to contribute to the global incremental benefits of GHG mitigation while at the same time to enhance rural sustainable development in the project area. The key components of the mitigation in this approach are afforestation/reforestation to expanding biomass carbon stock and the promotion of non-biomass and/or efficient biomass energy technology and know-how. The project components also include the promotion of sustainable management and conservation of forests and biomass carbon stock. In addition to awareness raising, capacity building and involvement of stakeholders, which are key to the implementation and sustainability of these mitigation interventions.

192. The project is in line with the Sudan government strategy as it deals with forestry issues in a comprehensive manner from providing genetic resources in nurseries to supporting ecosystem productivity by establishment of plantations, windbreaks and shelterbelts to provision of alternative energy sources and economizing the use of biomass energy. The project aims to promote the mainstreaming of long-term climate mitigation into forest and land use policy and planning frameworks, enhance institutional capacity building, and improving forest carbon stocks management, and monitoring and reporting system. The project will contribute to addressing the concerns arising from the implications on the forest sector caused by the separation of Sudan into two states as a result of the implementation of the Comprehensive Peace Agreement (CPA) signed in 2005. The project will aim towards being in lines with strategic thinking to addressing these implications.

193. The Global Environment Facility (GEF) provided resources in its resources allocation framework (RAF) of GEF4 for Sudan. The fund was intended to address a number of objectives including climate change mitigation. As indicated in the INC of Sudan, the forestry sector represents a high priority for Sudan to contribute to the mitigation of climate change and at the same time to support rural development. This proposal is consistent with the GEF strategy on climate change. In particular, the present proposal is in line with the GEF-4 strategic objectives of (i) reducing GHG emissions from land-use, land-use change and forestry (LULUCF), and (ii) promoting sustainable biomass energy production. The focus of the intervention is on LULUCF activities and sustainable production and use of biomass energy. The activities promoting the production and efficient use of energy from biomass will be carried out without conflicting with other environmental and development objectives.

194. The GEF financing will be used to finance the implementation of on-the-ground, direct carbon sequestration (A/R) and biomass emission reduction measures that will be monitored and evaluated to assess implementation success and potential for replication in other areas of the country. The GEF intervention is required for supporting the development of the potential for carbon sequestration and emission reduction, as well as contributing to enhanced rural development, and building of the required awareness to conserve, and capacity to manage, monitor and report, the carbon stock and changes at both the national and local levels. The GEF funds will serve as a catalyst for supporting revision of the national approach for forest

management and utilization to take into account, in addition to national priorities, global challenges and commitments as well as possible market benefits.

F. Country eligibility; country ownership and drivenness

195. The Government of Sudan ratified the UNFCCC in November 1993 and the Kyoto Protocol in February 2005. Sudan fulfilled its commitment under the UNFCCC by submitting its Initial National Communication (INC) in February 2003 and NAPA in July 2007. The INC process included climate change mitigation studies in two main priority areas: energy and non-energy. The latter includes forestry, agriculture and rangeland. In the non-energy mitigation analysis two main groups of mitigation options were identified for increasing carbon sequestration and storage. The first group represents afforestation and rehabilitation options. These options refer to the afforestation and rehabilitation of wastelands, which estimated at 15.3 million hectare, together with an area of 1.6 million hectares including afforestation of 10% of the rain fed land and 5% of the irrigated agricultural land. These options were consistent with the forest policy and with the provisions of the current forest law of 2000. The second group represents management options involving a natural resource management approach based on the conservation and rehabilitation of degraded forests and rangelands. The NIS also indicated that biomass energy consumption is responsible for over 80 percent of total carbon dioxide emissions. Therefore, investing in energy efficiency is considered as one of the most cost-effective way to reduce carbon dioxide emissions.

196. The Sudan's INC clearly indicated that cooking with biomass fuels is a significant end-use in Sudanese households, both rural and urban. The increased use of LPG can help to reduce pressures on Sudanese biomass stocks that sequester carbon. LPG represents a reliable source of future domestic energy supply in Sudan. Steps toward widespread dissemination of this technology are already underway in Sudan. However, at the present time the distribution capacity is very limited due to both financial and technical barriers that hinder the process. Therefore, INC called for encouraging technology transfer, through incentives and barriers removal. Replacing biomass fuel with higher energy density fuels in sectors of household, bakeries and brick-making industry. Switch from the use of traditional fuels (firewood & charcoal) in the household, industry and commercial sectors to more efficient fuels.

197. The INC included also the National Implementation Strategy (NIS) for Sudan to implement its obligations under the UNFCCC. One of the main objectives of the NIS is to develop a national GHG mitigation programme. Sudan first national communication clearly indicated the need to build technical capacity and a good quality database for national activity data and basic parameters e.g. emissions factors necessary for both improving GHG estimates and for developing mitigation (e.g. CDM) projects. One of the main objectives of Sudan's INC is to raise stakeholder awareness, and to build an enabling environment to integrate climate change issues and concerns into national development (capacity building, institutional infrastructure).

198. There are also a number of strategies, and policies developed by Sudan's government containing measures to address the root causes of decreasing forest/vegetation cover and the associated socio-economic and environmental impacts. In 1986 the Minister of Agriculture and Natural Resources, approved the Statement of Forest Policy. The primary objective of the statement is the establishment, reservation, protection and management of forest resources for the purposes of production and environmental protection. The Forest Policy Statement responded to the new concepts, perceived since the seventies based on the emphasis on environmental protection, popular participation and the multiple uses of forests. The Statement:

- Recognized new forms of forest tenure including private, community, and institutional forests, targeted 20% of the total area of the country as forest reserves;
- Stressed the role of forests in environmental protection by creating new obligations on a lessee in mechanized farming or irrigated area to maintain or establish green belts;
- Emphasized the role of public participation and the international community in afforestation and sustainable management of forests

199. The present Forest Act (2002) calls for the reservation of 25% of total country area for forestry and wildlife, in addition to the allocation of 5% and 10% of the area of the irrigated and rainfed agricultural schemes respectively for woodlots and shelterbelts.

200. The Sudan ratified Kyoto Protocol on 16 February 2005. However, Sudan is a relative latecomer to the CDM scene. Currently, Sudan is developing a number of Project Idea Notes (PIN) for CDM projects with technical support from UNDP. The PINs cover: (1) wind energy (2) energy efficient cook stoves; and (3) A/R on degraded land with Gum Arabic (social forestry). During the preparation phase of this proposal projects from Sudan in the Voluntary Carbon Markets were not identified. Usually the international voluntary market has more preference for communities based projects that reinforce and empower local groups and woman. And another advantage is that the voluntary carbon projects doesn't need the directly approval from the government compare to the compliance market, this means that the relationship between the buyers are directly with the developers and implementing organizations. Thus this situation the voluntary carbon projects will not be under the embargo suffered by the Sudanese government.

201. The government started a number of activities aimed towards the preparation of its National strategy for REDD-plus. In 2010 FNC established a National REDD-Plus unit to develop the framework for REDD+ strategic planning in Sudan; this work is conducted in collaboration with Higher Council for Environment and Natural Resources (HCENR) and support from the United Nation Development Programme (UNDP). This unit is embarked now on a number of activities, including assessment of capacity building needs, consultation with local communities and civil society on readiness and REDD+ strategic planning, preparation of

REDD+ guidelines; development of Sudan REDD+ information system (Website, existing forestry extension system) to ensure transparency and flow of information.

G. Project goal, objectives, outcomes, outputs, activities and indicators

202. The guiding design principle of the project is to promote a carbon sequestration and emission reduction interventions relative to mitigation of global climate change and relative to sustaining livelihood systems and rural development, through increasing biomass carbon stock and reducing GHG emissions in the project area. In a sense, the strategic considerations of the design of this project include a global and national focus, afforestation and reforestation, conservation and sustainable management of forest carbon stocks, promotion of sustainable energy, capacity building and enhancement of sustainable rural livelihoods.

203. The overall goal of the project is to promote a climate-friendly rural development path in Central and Eastern Sudan by increasing the carbon stock and reducing net GHG emissions in the country, while at the same time sustaining rural development in the project area.

H. Project objectives

- To establish at least 10.000 ha of forests in areas with high potential for sustainable biomass growth using multiple A/R forms, mixed species and suitable water harvesting methods.
- To promote sustainable management and maintenance of biomass carbon stock through the implementation of standard forest management practices in selected forest reserves and A/R areas involving local communities
- To promote wide diffusion of highly efficient, biomass energy technologies, as appropriate, in the project area using climate-friendly incentives
- To develop technical and institutional capacities within FNC for GHGs mitigation, REDD+, forest and carbon stock monitoring and reporting, and access preferentially to the voluntary carbon market

204. As a contribution to the achievement of the overall goal and primary objective, five expected outcomes and numerous expected outputs would be achieved within the locations for project activities. This is explained in further detail in the paragraphs that follow and subsequently summarized in table 17 below them.

I. Project outcomes

1. Afforestation and reforestation (A/R) activities successfully implemented and lead to increased national carbon sequestration potential.

2. Forest carbon stock is maintained in the long run, through conservation and improved management including protection from causes of deforestation and fires.
3. Wide diffusion of highly efficient, biomass energy technologies, as appropriate, is promoted in the project area using climate-friendly incentives.
4. Institutional and technical capacities are developed for monitoring and reporting of forest carbon stock and changes at national level and awareness is raised at local level on forest and climate change mitigation.
5. Successful implementation of project achieving agreed objectives (Project Management).

Outcome 1: Afforestation and reforestation (A/R) activities successfully implemented and lead to increased national carbon sequestration potential

205. The A/R will be implemented in suitable areas with favourable conditions for sustainable tree growth to ensure maximum carbon uptake. The area selected for A/R activities will include communal lands as well as private lands (mechanized rainfed farms) and it will involve local groups e.g. farmers and land-less people. Agreements will be signed between farmers communities, FNC, and the project management regarding the A/R activities, in which all the details should be dealt with.

206. For the plantation activities of the project no use of pesticides is foreseen. Should it be deemed necessary due to unforeseen circumstances, it will be tried to use only natural pesticides, such as neem leaf extract or similar.

J. Carbon sequestration potential of the A/R activities of the BCSP in Sudan

207. This is an ex-ante estimation of expected carbon sequestration potential on 10000 ha planned to be planted by the Butana carbon sequestration project over the period 2012, 2013, 2014 and 2015. This land is divided in 9000 ha on rainfed and 1000 on irrigated areas. The values need to be adjusted during project implementation based on actual data derived through stratification and a well-designed project monitoring system. Provisions have been made for an international consultancy to address this issue.

208. The main purpose for the ex-ante estimation of the carbon sequestration potential is to show evidence and have indicative figures of what annual and total carbon credits may be expected from implementing the project A/R activities. However, the data and parameters used are based on the currently available national data and from the IPCC guidelines. Therefore the estimates provided are considered representative to the climatic conditions in the targeted areas

and the selected species. After the project commencement, these calculations will be based on a relevant A/R CDM methodology and actual monitoring data to be generated by the project.

209. Lifetime of direct carbon sequestration is determined by two main factors, the harvest rotation (management plan) of the species planted and the crediting period determined by the project. For carbon market purposes the calculation shall be conducted for a full length of the crediting period and if there is harvest during this period (in case crediting period is longer than harvest rotation) it should be accounted as loss and deducted from the total carbon removals. Harvest should always be accounted as loss and deducted from removals while replanting should be added to the removals.

210. Given the rotation of the mix-acacia spp (17-20 years) selected for this project, (in the estimation we used average value of 17 yrs), it is possible that the project selects a harvesting plan of similar length to the crediting period. In forest management, annual harvest usually shouldn't exceed the mean annual increment, this implies that the carbon stock at least should not decrease as a result of harvest. When the project prepares the management plan for its A/R areas, it should stratify and divide the area into compartments that will be harvested and replanted over the length of the rotation period (that is similar to the selected crediting period). It is also advisable, when the project develops its carbon finance model based on its A/R activities, to consider that FNC is expected (and should be enabled by the project to do so) to continue to implement similar A/R activities in the area after project completes the planting of its targeted areas and the practice is well established.

211. Areas to be planted inside the forest reserved area are bare lands or lands where existing vegetation cover is negligible because the lands are degraded and/or being degraded. The areas to be planted on mechanized farms are lands of which the vegetation cover has been cleared since early 1980s, they lost fertility due to inadequate land preparation practices.

212. Therefore the baseline carbon stock change on the proposed areas can conservatively be assumed to equal zero. Carbon removal expected to occur on these lands as a result of the project implementation could be considered net removal attributable to the project after subtraction of any project emissions specifically related to the implementation of the A/R activities (expected to be minimal).

213. The spread sheet of the Bio C/F of the World Bank is used to estimate the carbon sequestration potential. Mostly default data from the IPCC GPG-LULUCF (2003), data from FNC and input from national experts are used to drive the estimates for the expected carbon removal (see table overleaf). In the selection of the parameters used we considered the need to drive conservative estimates of the expected carbon removal.

Table 12: Parameters used to drive the estimates for the carbon sequestration potential of the selected A/R activities of the BCSP

Parameter	Value or unit	Source
Wood density acacia spp	0.6	t.d.m. m3, from FNC sources
Wood density acacia nilotica	0.7	t.d.m. m3, from FAO: http://www.fao.org/docrep/w4095e/w4095e0c.htm#TopOfPage
Wood density Eucalyptus spp	0.6	t.d.m. m3, Expert judgment
Root/shoot ratio Acacia spp	0.46	http://etd.uofk.edu/uofktdallview.php?id=808 Sudanese study estimated R for A. seyal 0.47, A. Senegal 0.46 (for young trees)
Root/shoot ratio Acacia nilotica	0.42	Dimension less from IPCC GPG-LULUCF
Root/shoot ratio Eucalyptus	0.42	Dimension less from IPCC GPG-LULUCF
BEF acacia spp, acacia nilotica and Eucalyptus spp	1.5	Dimension less from IPCC GPG-LULUCF
Mean Annual increment (MAI) - Mixed acacia spp	4.5	m3/ha/yr, from FNC, from Sudan's initial national communication
MAI For Acacia nilotica	7	m3/ha/yr, FNC, Expert judgment
MAI For Eucalyptus	15	m3/ha/yr, IPCC GPG-LULUCF (the minimum value in the range of the IPCC in table)

214. The pools considered in the estimation of carbon removal include only above and below ground living biomass. Dead organic matter and soil pools have not been estimated due to lack of data. At least soil data could be developed through the project's monitoring plan in order to include it in the estimation of the actual net project removal.

215. The table overleaf shows the results of ex-ante estimation of the carbon removal expected to occur in the proposed project area. As it can be seen, it does contain the values of tCO₂/ha/yr for all the species selected for the project, included under the heading "Annual removal tCO₂/ha/yr". These values are based on the mean annual increment (MAI) values documented in the Table 12 and it seems reasonable in the context of Butana area. For example, the estimate for mixed acacia is based on MAI value of 4.5 m³/ha/year, A. nilotica on 7 m³/ha/yr and 15 m³/ha/yr for Eucalyptus which is harvested at least 3 times during its (stump) rotation period (sources of all data used in the calculations are documented in Table 12).

Table 13: estimates of carbon sequestration potential of selected A/R forms

A/R forms	Area ha	Species	Rotation Yrs	Annual Removal tCO2/ha/yr	Average ⁽¹⁾ Total annual removal tCO2/yr	Total ⁽²⁾ removal in tCO2 By 2016	Total ⁽³⁾ removal tCO2 By 2032
A/R on rainfed areas	9000	Mixed <i>acacia spp</i> (60% talih <i>acacia seyal</i>)	17-20	10.8	90,338	260,172	1,806,760
A/R on irrigated areas (2 options)	1000	<i>Acacia nilotica</i>	30	19.1	17,540	47,836	350,800
		<i>Eucalyptus spp</i>	21	35.1	32,216	87,863	644,320

1. Average values for total areas over the rotation period of the species used, in the case of mixed acacia 17 years was used
2. Values from the calculation done using the Bio C/F spreadsheet
3. Estimates based on multiplying the average total annual removal by 20 year
4. Eucalyptus is assumed to be harvested 3 times, once every 7 years.

216. Average cumulative values for total areas over the rotation period of the species used, in the case of mixed acacia - 17 years was used. Values from the calculation done using the Bio C/Fspread sheet. Estimates based on multiplying the average total annual removal by 20 year. Revenue expected was calculated using an average price of 7US\$ per ton of Carbon for non-regulated market, using Social Carbon that ad an additional of 35% compare to VCS (Voluntary Carbon Standard).

217. Further selection of species may be required during project implementation to guarantee that the most suitable species are used.

218. The plan for A/R activities (described above) includes all the 10kha targeted by the project. This areas expected to be divided in a panting schedule to be implemented over the duration of the project implementation, 4 years. The estimation of the potential carbon sequestration of the project follows the suggested annual planting schedule shown below.

Table 14: Planting schedule of the BCSP

Years	Areas of Mix-acacia (ha)	Areas of <i>A. niloitca</i> or <i>Eucalyptus spp</i> (ha)
2012	500	250

2013	3,500	250
2014	2,500	500
2015	2,500	0
Total areas	9000	1000

219. The estimates provided for the annual removal per hectare of the selected species are based on the best available data. The average value for the annual removal per hectare (tCO₂/ha/yr) included in table (12) represents the actual carbon removal of the project. *This value still need to be adjusted by subtracting any baseline removal, project emissions and leakage, as appropriate, in order to obtain the net carbon removal of the project which is the actual carbon credits of the project that can be sell in the carbon market.* However, we believe the estimates provided reasonably show the potential carbon sequestration that the project may achieve if implemented in accordance with the prescribed activities. This assumption is based on the following:

- The potential A/R areas described in this document indicate that the Baseline removal can be neglected (assumed equal zero) based on current CDM rules (either bare lands or lands with less than 2% tree crown cover)
- Leakage that attributable to the planting of the A/R areas is unlikely to occur, because no displacement of human activities is expected in this project (leakage will be negligible =0)
- Project emissions could be minimized (to a negligible level) by best planning of the A/R activities, e.g. selecting A/R areas within close proximity (as described in this document), best practice in land preparation, etc.

220. After the project implementation commences and the A/R areas is finally defined, a carbon accounting model (for the A/R CDM or/and the voluntary market) will be developed (international expert assistant may be needed). In this carbon model the estimation of project net removal will be based on an approved A/R CDM methodology that takes into consideration the baseline carbon stock change, project implementation emissions, any leakage attributable the project and the actual removals achieved by the project. The current planned activities in this project document imply the development of carbon market model, however, it might need to be explicitly mentioned in the project document, as part of the A/R activities that “ a model for accessing CDM or voluntary market will be developed based on the project planned A/R activities for the purpose of generating revenue that can be used in sustaining the A/R programme after the project termination.

221. Additional measures are needed to ensure deviation from the current baseline (business as usual) and maximize the carbon sequestration potential of the selected A/R areas. These include targeted input by the BIRD project on management and control of grazing in the A/R areas. Also there is a need to ensure that the energy conservation activities of the BCSP fully address the biomass energy needs of communities living in close proximity to the A/R areas and minimize the project emissions (due to fossil fuel consumption) associated with the implementation of the A/R activities. Such measures if adequately implemented will minimize leakage attributable to the project and will improve the sustainability of established forest carbon stocks.

222. After the project implementation commences, a monitoring plan is expected to be established with details of the project area based on planting schedule, topography, etc. the plan should specify the parameters that should be measured/monitored periodically and the sampling protocol. Based on the monitored data to be collected during the implementation phase, the project can make the estimation of the actual net carbon removal achieved by its currently planned A/R activities.

223. After the end of the project implementation period, FNC is expected to adopt and continue the model established by the project in its A/R and forest development activities for the Butana area and other similar areas in Sudan. FNC has the mandate and policies to increase forest cover and manage them on a sustainable basis. Therefore if this model is successfully implemented in a cost effective manner it will certainly encourage FNC to carry it based on the resources generated through carbon credits and other sources to increase the carbon sequestration potential beyond the above-motivated estimates

Output 1.1: 10,000 ha increase of reforested area in sites with less than 40% of canopy cover.

224. At least 10kha of A/R areas will be implemented by the project in selected site within the Gedarif and Gazira states. The implementation will involve farmers, villagers, communities and gum producers in planting of 9000 ha of rainfed plantations and 1000ha of irrigated plantations in addition to villages tree planting. 60% of the A/R will be established in almost bare areas inside forest reserves to ensure long-term protection and maintenance. Local communities, and especially landless farmers will be involved in these A/R activities inside the reserves. This will provide them with the opportunity to cultivate their crops during the project implementation and as long as the tree canopy permits them to cultivate. It is worth mentioning that all successive forest laws provide the right for people to access the reserved forest and to participate in their management. The other 40% of the targeted A/R area will be implemented in the rainfed agricultural lands, especially the mechanized farms where vast areas have been cleared since early 1970s and are bare and subjected to regular land preparation that led to their continuous degradation.

225. These activities will be implemented mainly with farmers based on the provisions in the Forest Law (2002) that allocate 10% of rainfed agricultural land to tree planting. Based on the same provisions, agreements will be made between the farmers and FNC to organize benefits and ensure long-term maintenance of the forest carbon stocks that will be established in their lands.

226. The establishment of A/R will be undertaken using local and indigenous tree species and all suitable forms of forests establishment including through seedlings, seeds, enrichment planting, enhancement of natural regeneration, etc. Almost all targeted A/R areas assessed during the project formulation mission are without or with a negligible woody vegetation cover, this means a zero baseline removal will be the case in almost all the targeted lands, and all the carbon removal expected to occur as a result of the implementation of this project could safely be accounted as a net removal attributable to the project input.

227. For seedling production, community nurseries as part of villages and community tree planting activities will be used. However, sustainability is important. The rehabilitation of some of the FNC nurseries will help making seedlings available (as well as seeds and know-how) for FNC to continue implementing the 10% on rainfed when the project provides a successful model by implementing A/R on rainfed mechanized agriculture lands with farmers. There are many villages that have experience in nursery activities in the area and plantation establishment whether rain fed or irrigated.

228. Based on the climatic and other site conditions and the consultations carried during the visit to the potential A/R areas a consensus has been developed around the use of mixed Acacia species, mainly Talih (acacia seyal) and its associated species in the A/R activities on the rainfed areas and Sunt (Acacia Nilotica) and potentially Eucalyptus spp in the irrigated area. . Gazira state is part of Butana and there is very good potential there to plant A. Nilotica and Eucalyptus. These two species have high potential for carbon sequestration and generate revenue from both carbon credits and other products. The area allocated for these is one tenth of the total planned area. If it is successfully implemented as carbon market activities it will open the opportunities for a large area under irrigated agriculture, almost bare lands and eligible for carbon market (Gazira and Rahad schemes), to be planted and for farmers to access new sources of income. Also the Rahad scheme has potential for provision of irrigation for the plantation of these species, and experience exists. According to the available data mixed acacia species will contribute to net removal of carbon dioxide of approximately 12 CO₂/ha/yr, while Sunt and Eucalyptus species selected for irrigated areas expected to contribute to net removal of about 25 CO₂/ha/yr.

229. Key activities

1.1.1 Define and map areas for A/R based on the following agreed criteria: (4 Kha) in the agriculture land based on the provision in the Forest Act (10% of rainfed agriculture schemes)(6 Kha) in the degraded forest bare land inside forest reserves

- 1.1.2 Carry out stratification of the selected area based on topographical and/or ecological criteria
- 1.1.3 Define and assess the baseline on the selected A/R areas based on the rules and definitions of the Kyoto Protocol
- 1.1.4 Rehabilitation of up to four central nurseries (Showak, Fao, Rufa'a, etc, according to favourable conditions such as availability of water and labour) for production of seedlings of selected species for the different A/R activities
- 1.1.5 Implement suitable, reduced tillage land preparation practices
- 1.1.6 Implement A/R involving local communities, in the selected areas using seedlings, seeds, and enhancement of natural regeneration
- 1.1.7 Establish a forest monitoring system and develop data for ex post estimation of carbon fluxes.

Output 1.2: Agro-forestry initiatives involving landless farmers are implemented.

230. Agro-forestry activities will be implemented in areas with irrigation possibility, mainly inside the forest reserves in collaboration with landless farmers. Such practices already exist and worked very well between FNC and farmers, however, on a limited scale mainly because of lack of resources. The landless farmers are provided with opportunities to cultivate their crops and in the meantime they do the tree planting under specific terms of agreements with FNC. In all these agreements the farmers are given access to lands inside the forest reserve that they can cultivate and take the responsibility for tree planting and maintenance on this land till the trees reach a canopy closure that doesn't permit further cultivation then the farmers are shifted to another piece of land under the same conditions. Local and indigenous tree species (e.g. *Acacia nilotica*, *Eucalyptus*) could be used for A/R in land under irrigation where more potential for biomass carbon stock is expected. The irrigation is normally done by gravity and is practiced for 1-2 years till root system of the trees is well established.

231. Key activities

- 1.2.1 Awareness raising and technical capacity building of the targeted farmers
- 1.2.2 Define suitable models for agroforestry in irrigated area in collaboration with landless farmers, based on successful national and regional experiences and practices
- 1.2.3 Prepare implementation agreements with farmers based on existing experiences and taking into consideration the objective of carbon sequestration and climate change mitigation

Output 1.3: Improved water harvesting systems are defined and implemented to support successful A/R activities

232. To ensure better tree established and more sustainable biomass growth, suitable water harvesting techniques will be identified and implemented. There are number of water harvesting

techniques being implemented in the Butana area as well as in other part of Sudan with similar conditions. However there is limited information on the effectiveness of these techniques and therefore the project will need to undertake some work to screen available relevant examples and select from them the most suitable ones to be implemented in the A/R activities to improve the condition for tree growth. From the examples of the water harvesting techniques in the Butana area visited, there is a need for at least site-specific contour mapping to be undertaken to ensure the effectiveness of the design of the water harvesting technique used.

233. Key activities

1.3.1 Screen, assess and select suitable water harvesting techniques from the experiences available in the Butana area or in other similar areas in other part of Sudan (e.g. Dar Asalam area south Elfashir in north Darfour).

1.3.2 Develop site-specific contour maps for the selected A/R areas

1.3.3 Implement the selected water harvesting systems or techniques in the A/R areas and assess their effectiveness in supporting improved A/R activities

Output 1.4: Define and implement suitable erosion control measures for the A/R areas

234. Although in many cases water harvesting methods may also serve to reduce erosion, particularly hydric erosion, the concentration of water that water harvesting methods often provoke can also be an erosion agent. Therefore it is important that adequate erosion control measures accompany the water harvesting methods. Uphill erosion as well as downhill sedimentation can seriously affect plantations, by taking either the top soil away, or by “burying” seedlings. Splash erosion can also cause serious damages of the soil, hampering plant growth, especially root development, and increase superficial run-off, often leading to more severe erosion, as well as the loss of water. Under dry conditions also wind erosion may impose serious negative impacts. For these reasons erosion control must be considered while implementing water harvesting methods and plantation forests in general.

235. Key activities

1.4.1 Study on erosion control

1.4.2 Implementation of adequate measures

236. Both water harvesting and erosion control may require structures of considerable size. For this reason it is suggested the project purchase a powerful tractor specifically for this purpose.

Outcome 2: Forest carbon stock is maintained in the long run, through conservation and improved management including protection from causes of deforestation and fires.

237. The Sudan has accumulated long experience in forest conservation and protection attained through forest reserves and other legal measures supported by national strategies,

policy statements and legal framework at national and State levels. Approximately 13.5 million hectares constitute the national forest reserves and 100 forest reserves in the project area. However, increasing deforestation rates in the project area (the Butana) upsets most of the conservational efforts directed towards sustainable maintenance of the forest state. Deforestation is perceived to have negative contribution to climate change and carbon storage through its contribution to GHGs emission in addition to its adverse impacts on livelihood supporting systems.

238. Agriculture and land-use, land-use change and forestry (LULUCF) are the main emitters of greenhouse gases (GHGs) in Sudan. Consequently a steady reduction in the stocked volume of forest resources in Sudan is going on. In fact, there are various factors that need to be addressed through adoption of an approach that considers the multiple functions of forests, which necessitate the management of the forests on sustainable basis with involvement of local communities in order to facilitate protection of biomass and ensure the maintenance of the carbon stock in the long run. Many factors contributed to the continuous degradation of the natural forests in the project area including lack of management, illegal felling, over grazing and poor regeneration. However, the Government and the Forest National Corporation are already undertaking several activities to conserve forests in the project area (the Butana).

239. Forests could play a vital role in carbon sequestration in the Sudan and people livelihood. Hence, rehabilitation of degraded lands and conservation of existing forests are perceived to achieve GHG emission reduction objectives and maintain provision of people needs in the country in general and the Butana area in particular. The communities dependant on the selected forest reserves will play a key role in defining the forest management objectives and developing the management plans including prescriptions of the roles and responsibility of their implementation

Output 2.1: Participatory forest management promoted as a way to protect the carbon stock from drivers of deforestation (illegal felling, over grazing, poor management and forest fires)

240. The main causes of deforestation in the project area are contained in agricultural expansion, illegal felling, over grazing and poor management in addition to annual forest fires. The annual rate of deforestation and forest degradation is approximately 2.2% and 5% respectively. Solution to these problems could be attained through sustainable forest management based on participatory approach, which involves local communities in the management and protection of forests and new regeneration against clearance and fire hazards. The approach will result in reducing emissions from deforestation and forest degradation in Butana area and improves forests health and productivity in addition to environmental improvement.

241. Key activities

2.1.1 Define geographical boundary (a discrete unit of land) encompassing one or more adjacent forest reserves and the A/R areas in Gedafir or Gezeera States. The geographical area should also encompass all the local socioeconomic activities that cause deforestation and forest degradation.

2.1.2 Assess the forest biomass carbon stock and, deforestation rate using remote sensing technology and ground survey (contracting a consultant for 9 months per year)

2.1.3 Identify and assess all possible factors causing deforestation and forest degradation

2.1.4 Prepare and implement forest management plans based on participatory approach with objective of reducing deforestation and forest degradation, while addressing local needs and other causes of deforestation.

Output 2.2 Fire management system is improved and post fire management plans are developed and implemented

242. Due to the several droughts fire risk in plantations is considerable. Due to the high fire incidence it is necessary to undertake serious actions to prevent fires, and should they still occur to be prepared for mitigation of the damages caused by them. The establishment of community fire brigades will be part of the strategy.

243. Key activities

2.2.1 Design and execute fire management plans in the A/R areas and as part of the forest management plans that contain fire lines networks.

2.2.2 Prepare and implement post fire management plans using participatory approaches.

Output 2.3 Long-term sustainability of biomass carbon storage potential increased.

244. Sustainable forest development and management approaches require long time to have measureable results. Participatory forest management approach will lead to people participation in forest protection rather than practicing illegal felling because participatory forest management will adopt a system that contributes to provision of people needs with respect to forest products and services. In the long run, the approach will increase the potentialities of the forests for storage of biomass carbon in a sustainable system.

245. Key activities

2.3.1 Revise forest policies and legislation to enhance participatory forest protection and management

2.3.2 Strengthen and raise institutional and community capacities in space technology use for monitoring to minimise fire risks

2.3.3 Set up and maintain a deforestation and forest degradation monitoring system

2.3.4 Monitor deforestation and forest degradation in Butana

Output 2.4: Forest micro-insurance schemes tested on a pilot base in 2 sites

246. A general insurance contract is a legally binding unilateral agreement between an insured and an insurance company to indemnify the buyer of a contract under specified circumstances. In exchange for premium payment(s) the company covers stipulated perils.

247. Elements of an insurance contract include (1) property covered, property excluded; (2) perils covered, perils excluded; (3) location covered, location excluded; (4) time period the policy is in force; (5) persons covered, persons excluded; (6) policy limits; and (7) coinsurance requirements.

248. Both micro-finance and micro-insurance need to be affordable in order to sustain the claim of providing low-cost financial services to low-income groups (Toon Bullens, 2006). If micro-insurance is to succeed on a massive scale, costs have to come down considerably, plain and simple. That paves the way for greater affordability and, hence, social acceptance.

249. In already forested areas and particularly for private forests, micro-insurance schemes will be tested on a pilot base to reduce the risk of loss of the carbon stock. There are two options for crop insurance. One option is input-based or loss cost. Here the actual costs of production, which may or may not include harvest cost, are calculated and insured. If the plant is damaged at any stage during the vegetative growth the incurred costs are indemnified. If the damage is partial and the value of the harvested crop does not cover the production cost then the insured shall be indemnified the difference between the value of the harvested crop and the insured costs spent on production. The other option is yield-based, insuring a certain level of harvest agreed by the insured and insurer. If the insured harvest is not attained wholly or partially the insured is indemnified according to the actual loss. He is to end by revenue equal to the value of the insured crop. The practice in Sudan is to use the first option for all annual crops.

250. In Sudan insurance of forest crops, including gum Arabic, hasn't yet been adopted. The experience of CSPS will be a pioneer one. The insurance amount and premium for each product depend on the hazards to be covered, cost of inputs and value of the crop. For each insurance product a single or multi perils need to be identified. Cost of production inputs per unit area, which vary considerably for the different activities of CSPS, need to be estimated. At least for the first year resort may be made for estimates from comparable experiences, while keeping records of production costs per unit area. While value of annual crops makes no major constraints, appreciation of the value of tree crops needs to be taken into account for insurance in the second and subsequent years of the project.

251. Organization of farmers involved in insurance contracts needs to be given due consideration. It is very difficult for insurance companies to deal with individual farmers. Farmers need to be organized into clusters or committees, geographically, community or activity-based, local and insurance policies issued to representatives. Sheikan Ins. & R.

company has accumulated experiences dealing with agricultural insurance with thousand farmers from Gezira Agricultural Scheme. In a long-term perspective this would make the forest asset more competitive on the carbon market, and the project will contribute and reinforce the development of Sudanese projects based in forestry (REDD, REDD+, afforestation and reforestation). Linkages with financial institutions that already exist in rural areas will be considered to keep the operational costs of the insurance scheme as low and as efficient as possible.

252. Key activities

2.4.1 define properties to be ensured and estimate their values, define perils covered and excluded, time duration, and premium payment

2.4.2 prepare at least two insurance contracts for (1) irrigated forestry, including agroforestry, home gardens and community nursery, and (2) rain fed dry land forestry (part of 2.4.3)

2.4.3 undertake a special study on broader application of micro-insurance (30 days)

Outcome 3: Wide diffusion of highly efficient, biomass energy technologies, as appropriate, is promoted in the project area using climate-friendly incentives.

253. To date, biomass energy is considered the most important source of energy in Sudan with wood fuel accounting to about 70% of the total energy consumption. The average annual per capita consumption is approximately 24.3 kg for rural households. Most of the institutions in the rural and semi-urban areas in Butana region are relying on wood fuel as the main source of energy for cooking.

254. The high dependency of Butana population on biomass-based fuels and inefficient technologies such as traditional stoves has placed greater pressure on forest resource in Butana area. Alredaisy and Zubair (2011) revealed that tree-felling for wood fuel contributed 40%, agricultural expansion around 30%, grazing around 20%, for use as building material 7%, other human uses by 2% and for manufacturing agricultural tools 1%. Clear felling of trees for energy has been enhanced by population growth in Butana. This population consumes 740,000 cubic meters of woody biomass annually. It was estimated that a family of 7 members consumes half a tree per day, 15 trees/month or 180 tree/year. The result of such an unsustainable utilization of forest resources is a continuous depletion of forest area. Increased use of energy efficient stoves and energy alternatives technologies is part of the Sudan Energy strategy of sustainable development and environmental protection.

255. Lack of adequate access to environmentally sound energy technologies and options are still a major challenge in Sudan particularly in rural areas. The main purpose of this outcome is to promote diffusion of climate mitigation technologies for rural energy needs. This is in addition to reducing GHGs emission associated with energy consumption is expected to contribute to releasing pressure on fragile forest resources in Butana area. In this respect this component will also contribute to increasing the economic opportunities for both households and businesses that will improve and provide energy services.

256. The approach to achieving this outcome will involve the facilitation of the provision of basic energy services to targeted rural communities. Through building enabling environment for energy technologies deployment and diffusion, using the project to enable distribution of biomass and other non-biomass stoves to poor households. The project will apply a climate friendly incentives approach (e.g. reward for successful household tree planting practice) based on the practical experience of FNC in the dissemination of improved cook stoves.

257. The Badia biomass improved stove and LPG cooker stoves are main possible options, as they have proven to be many times more efficient than traditional stoves currently used in the area. Local communities will be trained and organized to carry out the proposed activities. Technology services, market linkages and extension will be strengthened to support the development of this activity. The activities supported in this outcome are also expected to have other environmental and socioeconomic co-benefit.

258. For the biomass energy conservation component the project management should relay on the experience of FNC and its well trained and skilled staff (in energy saving and energy alternatives), energy research and the institutions established by BIRDP at the community level (e.g. the credit and saving associations/sanduqs; the village development committees)

K. Emission reduction potential from biomass energy consumption in the Butana area

259. Biomass represents the main energy source for cooking in the households and other small institutions in Butana area as well as in most rural areas of Sudan. Currently the combustion of biomass is done through very inefficient different types of tradition stoves. Almost all the biomass consumed in Butana area is coming from non-renewable sources. Since early seventies vegetation clearance started in Butana for mechanized agriculture and today apart from the few remaining forest reserve, more than 90% of the Butana area is almost bare land without woody vegetation. The few remaining forest are in fact shrinking in area despite efforts by FNC to manage and conserve them. This situation indicates that GHGs emissions associated with biomass energy consumption in Butana are mostly net emissions since biomass is coming from non-sustainable sources.

260. The biomass energy conservation component of this project intended to promote efficient biomass energy combustion technology (Badia improve stove) and non-biomass energy technology (using LPG) to reduce biomass consumption and the associated GHGs emissions. The project will conduct an assessment of the number of households, the biomass energy demands in the targeted communities and conditions suitable for each type of technology. This initial assessment will enable the project to define communities where LPG is most suitable, mainly the communities in close proximity to urban area and services required for LPG technology dissemination, and communities where efficient biomass stove is more suitable, which are communities close to forest reserves expected to be covered by the project component

on forest conservation sustainable management, and communities in remote area where conditions make the only option available is the efficient biomass stoves.

261. Based on the proposed budget and required activities to promote the diffusion of these technologies, the initial number of the households targeted by the project is about 7000 for efficient biomass stoves and 6000 for LPG cooking stoves, which will be provided through two options to finance the LPG technology and efficient Biomass stoves: the first is through a revolving fund created by the BIRDP, the second is to involve the community in the seeds collections, tree planting, seedlings raising and other field activities and the work performed by then will be paid with the LPG or the stoves. Obviously, a refill of the gas bottle has a cost for the population. It is however very likely that the time currently spent on gathering firewood will be used to develop other income generating activities.

262. The estimation of potential emission reduction of this project is prepared based on the small-scale methodology of the CDM, AMS.II.G "Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass - version 2". The table below show the data and parameters used in the assessment of the emission reduction potential associated with the implementation of these activities:

Table 15: Data and parameters used in emissions reduction potential assessment

Data, parameter	Amount/unit	Sources
Per capita biomass consumption	2.1644 kg/person/day	FAO
Efficiency of Badia stove	0.35	Energy research institute
Efficiency of traditional stoves	0.1	Default for 3 stone traditional fire stove widely used in Butana
Net calorific value of the non-renewable woody biomass (NCVbiomass)	0.015 TJ/tonne	IPCC
Number of household and members per household	7000 efficient biomass stoves 6000 LPG cooking sotves	5 members per household
Number of days per year	365 days	
EFprojected_fossilfuel (kerosene)	71.5 tCO2/TJ	IPCC

Estimation is conducted using the following equation: $ER_y = B_y \text{ savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected_fossilfuel}$

Where: ER_y : Emission reductions during the year y in tCO₂e

$B_y, \text{savings}$: Quantity of woody biomass that is saved in tonnes

$f_{NRB,y}$: Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass

$NCV_{biomass}$: Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)

$EF_{projected_fossilfuel}$: Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO₂/TJ

263. The table below shows the result based on the calculation for a CDM project in the same area. In their calculation they used the same methodology, AMS.II.G, also in the case of LPG, which might have underestimated the total emission reduction, because the case of LPG is more of a fuel switch rather than an efficiency issue. This CDM project is still at the PIN stage, awaiting approval.

Table 16: Emission Reduction and Revenue Generated Potential for LPG

Number of stoves/households	Emission reduction per stove/household t CO2/yr	Direct project lifetime emission reduction		Indirect emission reduction	Revenue generated
		Project total annual emission reduction t CO2/yr	Project total emission reduction in t CO2 (by 2016)		
7000	2.7	18,9	75,6	378.000	529.200
6000	2.4	14,4	57,6	288.000	2.016.000
Total		33,3	133, 200	666, 000	2.545.200

264. The price of carbon credit was based in the price of the voluntary market for special projects using Social Carbon Standard. US\$ 7,00.

265. A possibility for the case of LPG may be the CDM methodology AMS IIIB Fuel Switch, which looks more suitable for application in this case, its logic seems relevant, and however it might need to be revised to better suit the case of biomass in this project. Based on a conservative estimate the project could generate a cumulative value of between US\$ 1,879,675 and US\$ 2,187,675 by 2016.

266. Alternatively emission reduction/avoided could be roughly estimated base on the baseline emissions. In the case of this project could be assumed as %90 of the total biomass consumption in the baseline when considering the low efficiency of the currently used stoves (about 0.1), it could further be adjusted for any (if any) amount of biomass coming from renewable source or for efficiency of LPG stove. An estimation of the potential emission reduction could be as follow:

267. Based on the above data/parameters, total biomass consumption could be estimated as: total number of persons* per capita consumption* 265 days of the year* efficiency of traditional stoves/ 1000= 6000*5*2.1644*365*0.9/1000 = 21,330.162 tonne/yr. CO2 emission associated with total consumption could be estimated as: total consumption*wood density*carbon fraction*44/12= 21,330.162*0.6*0.5*= 23,463.1782 t CO2/y

Output 3.1: GHG emissions from biomass energy production at the community level reduced.

268. A target of 7000 energy efficient stoves installed in household and institution, leading to a reduction of wood fuel consumption by 35%:

269. The aim is to widely disseminate biomass energy efficient cooking stoves in households and institutions in the rural and semi-urban areas of Butana region.

270. This output will be implemented using the local institutions developed by BIRD to organize local communities in Butana area. One stove will be distributed per household, which on average contains 5 members. Based on available studies and data, it can be estimated that the distribution and instalment of 7000 of Badia stoves will save 19,750 tonne of wood fuel annually, which is equal to 16110 tCo₂/year. The most common type of stove used in Butana is the traditional inefficient three-stones open fire stove. This type of stove normally consumes very large amount of firewood, leading to more deforestation and environmental degradation in the area. As the biomass used for cooking is mainly obtained from non-renewable sources, its combustion will lead to net CO₂ emission. Using improved cooking stoves can therefore reduce wood consumption and hence reduce GHG emission significantly.

271. Improved cook stoves suitable for both household and institutional uses are available in Sudan and produced locally by a limited number of trained artisans. The improved stoves are 35 % more efficient than the traditional three stone open-fire stoves. The improved Badia stoves proved to be the simplest, efficient, and easy to manufacture by rural artisans using locally available materials (clay, animal dung and locally available metal sheets for lining). However, the lack of financial support, low level of awareness and lack of training prohibit the households and rural institutions in acquiring these energy saving stoves. A cooking set includes a cook stove, and LPG cylinder, a 8.3mm high pressure 2-meter gas hose, a regulator, and a drive clip for the LPG hose. Khartoum market price (Oct. 2011) per unit of cast iron gas cooker, single burner, Model GB-01 (made in China, popular in Sudan) is SDG.30.00 (US\$ 11.00). The price of a 12 –Kg LPG cylinder (filled with LPG) and its parts is SDG 210.00 (US\$ 76.00). The total cost per a cooking set is US\$ 87.00. With assumed costs of internal transport of US\$ 1.00 per cylinder, the total cost per unit of LPG becomes US\$ 88.00 delivered at the Butana area.

272. FOB (China) prices of a gas cooker, single burner (made in China) range between US\$ 3.05 and 4.23 per unit. Project management may go for contracts with producers for annual quotas as planned in the project document.

273. There are at least two LPG repository centers in Butana area (New Halfa and Tambul towns) that belong to two different LPG distribution companies (Aman and Nile). Supply of LPG is secured. The project may sign contracts with these two companies for delivery of LPG to the main centers in the Butana area.

274. Microfinance has for the last few years gained high momentum in Sudan and is directed towards poverty alleviation particularly for poorer community sectors and productive families. Households in Butana area are potentially eligible for Microfinance loans which are made at non-conventional collaterals. BDA will definitely be useful in settlement of related procedures.

275. Key activities

3.1.1 Assess household and total consumption and/or demand for biomass energy of the targeted communities,

3.1.2 Identify barriers and enabling factors of energy technology e.g. suitable applications, know-how and the differences in local circumstances of targeted communities

3.1.3 Address any potential barriers for dissemination and climate friendly incentive system e.g. successful household tree planting (based on successful experiences of FNC and BIRD) to promote wide dissemination.

3.1.4 Build technical capacity of the targeted groups in construction and uses of improved stoves.

3.1.5 Distribute improved stoves to household and install suitable applications in local institutions.

3.1.6 Establish a monitoring system to ensure successful diffusion and use of the energy technologies and for assessment of associated carbon reduction.

Output 3.2: The use of improved and modern climate friendly stoves using alternatives energy sources is promoted to replace inefficient wood stoves

276. A target of 6,000 LPG cylinders and devices distributed to 6,000 families, leading to a saving of 145,800 tonnes of wood fuel

277. A social preference for LPG as an alternative to wood fuel is undeniable; this is due to its known environmental and socioeconomic benefits. It is clean, it saves the time and efforts the women spend in collecting fuel wood and cooking. However, the dissemination of LPG is very limited because of financial, technical (services) and know-how barriers. To promote wide use of LPG cooking facilities there is a need for adequate training and dissemination of knowledge to potential users, especially targeted towards women. Sudan exempted LPG appliances from import duties and introduced direct fuel subsidies on LPG to promote its diffusion.

278. The promotion of LPG cooking facilities diffusion in the Butana area expected to contribute to a direct reduction of GHG emissions not only through energy substitution but also through conservation of forest resources.

279. This output will be implemented using the local institutions developed by BIRD to organized local communities in Butana area. The distribution of LPG will mainly target communities in semi-urban area to ensure access to services such as refilling of cylinders. The

project will define other co-benefit to engaging the local population in an incentive program that linked to their involvement in afforestation and forest conservation activities. Extension services will need to be strengthened to support the development of this activity.

280. Key activities

3.2.1 Identify barriers and enabling factors of energy technology e.g. suitable applications, availability of services, know-how and the differences in local circumstances of targeted communities

3.2.2 Build technical capacity of local people to use LPG cooking facilities and address any potential barriers for dissemination of LPG technology such as refilling and services stations

3.2.3 Prepare and disseminate appropriate standard safety measures to enhance the safe use of LPG in the target areas.

3.2.4 Define and use incentives that encourage tree planting and forest conservation to disseminate LPG cooking facilities.

3.2.5 Based on BIRD experience, develop and implement a system to use the project resources allocated to the dissemination of LPG cooking facilities

Outcome 4 Institutional and technical capacities are developed for monitoring and reporting of forest carbon stock and changes at national level and awareness is raised at local level on forest and climate change mitigation

281. This will be developed at two levels: national and local. At the national level, monitoring and reporting on carbon stock and changes will aim to increase the capacity of both decision makers and technicians on LULUCF mapping techniques (including ground survey and remote-sensing techniques), as well as on measurement of carbon stock and fluxes in the land use systems. Under this component, relevant information and data, including a Geographic Information System (GIS), will be collected, updated and disseminated to improve estimation and accounting of carbon stock change for UNFCCC reporting as well as for possible CDM and REDD activities that could generate income for the country.

Output 4.1 Enhancing national capacity to develop, implement and monitor potential LULUCF projects including CDM, REDD or voluntary mechanisms.

282. The project will design a tailored training programme using multiple methodologies, including: Facilitated Workshops, Demonstrations, Seminars, Role Playing, Case Studies, and Simulations.

283. The training programme will include a series of training activities implemented over the lifetime of the project, covering the following topics:

- Carbon trade and forest management sessions.
- Methodologies for estimating carbon stocks and emissions.

- Elaboration of PDDs, Project Document design for voluntary and regulated markets.
- Forest carbon inventories, feasibility on REDD investments
- Contracts : such as Emission Reduction Purchase Agreements

284. A significant part of the training will be in the shape of “hands-on” or on-the-job training, with the aim of establishing a system for monitoring forest carbon stock and associated GHG fluxes.

285. Key activities

4.1.1. Training sessions for policy makers and technicians;

4.1.2. Analysis and processing of relevant time series data for monitoring land use change and carbon fluxes and stocks.

4.1.3. Test at the local level state of the art GIS for LULUCF monitoring and up scale the outcomes at the national level;

4.1.4. Conduct specific studies to generate local data and parameters for better estimation of carbon stock change and GHG fluxes

4.1.5. Establishment of a baseline and monitoring system for deforestation and forest degradation.

286. Based on the evolving work under the REDD agenda of the UNFCCC, a national carbon stock inventory will be also established. This will be supported by a forest carbon accounting model that generates district-level and national-level estimates of carbon stocks in forest biomass, litter and soil.

287. The establishment of the baseline will be done through contracting of a consultancy. The baseline will consider historical deforestation data using satellite imagery (20, 10 and 5 years ago) as well as the present rate to develop a monitoring tool that will be used for the validation and verification of the carbon credits generated by the project activities, associated with carbon fluxes and stocks.

Output 4.2: Enhancing local capacity to promote forestry awareness among the target group, and to develop, implement and monitor potential LULUCF projects.

288. Targeted capacity building activities will take place at the beginning of the project implementation to ensure that mitigation activities are: (i) undertaken in a cost-effective way and with the full involvement of the local population; (ii) mitigation benefits are monitored, analysed, and reported correctly. These activities will build on capacity building efforts by the IFAD project; their incremental value will be linked to the climate change mitigation aspects. This component will create the appropriate enabling environment to implement the investment activities in the most efficient way. At the local level, promotion of forestry awareness among nomads, farmers, women and school children to motivate their participation in rehabilitation,

conservation and sustainable management of their natural resources, and establishment of community forests, village woodlots, farm forestry and school forestry program. The training programme will include a series of training activities implemented over the lifetime of the project, covering the following topics: 1) Causes and types of climate change impacts 2) Climate change impacts on forestry and natural resources

289. Key activities

- 4.2.1 Deliver awareness raising sessions for Policy makers and technicians;
- 4.2.2 Conduct training sessions for technicians
- 4.2.3 Organise awareness raising campaigns at local community level
- 4.2.4 Training for development of non-wood forest products-based traditional and intermediate technology to process non-wood forest products in cottage industry or use of these products (fruits, seeds, honey) for sale, and establish pilot projects

Outcome 5: Project Management

290. This will support the issues associated with project management. Lessons learned will be disseminated through IFAD's regional knowledge network KARIANET and other relevant knowledge vehicles, thereby ensuring regional coverage. A dedicated project website and a database on climate change related issues and activities could be established. This would contribute top-scaling and replicating successful experience in other regions.

Output 5.1: FNC and BIRDP set-up programmes and financial management systems that ensure effective implementation of the project

291. Key activities

- 5.1.1 Establish Project management structures including techniques, procedures, people, and systems that leads to effective implementation of the project.
- 5.1.2 Disseminate lessons learned thereby assuring regional coverage.
- 5.1.3 Establish a dedicated project website and a database on climate change related issues and activities.
- 5.1.4 Monitoring and Evaluation.

L. Expected global, national and local environmental benefits

292. The proposed project is expected to generate multiple benefits at local, national and global levels:

At the project area:

293. The project expected to contribute significantly to addressing the barriers to sustainable rural development in a complementary manner to the interventions by BIRD and other initiatives in the area. This will be through increasing the woody vegetation cover in the area, in forms of new plantations, on farms shelterbelts and wood lots, village trees and home gardens etc. This in turn will contribute to increasing farm productivity, increase animal fodder specially during dry season, reduce soil erosion, and contribute to reducing the risk of migration from rural to urban areas and consolidate social peace and stability in the area.

294. The project activities are also expected to contribute to combating land degradation, conserve biodiversity and reduce poverty through strengthening the enabling environment and developing institutional capacity, meeting the local needs for fuel wood, tree fodder, timber, fruit and minor forest products. In addition to provisions for employment to the rural population and thereby improving their socio-economic conditions.

295. The irrigated forest plantations are expected to play significant role in the local economy as the small farmers sector represents the dominant group benefiting from these plantations.

296. In terms of climate change adaptation, it is expected that the project will contribute to building the resilience of the targeted communities and help them to cope with the recurring drought and high temperatures that adversely affect the vegetation, rangelands, and their local livelihood supporting systems. It is well documented in Sudan's NAPA that because of frequent droughts in Butana region, the rangeland is severely deteriorated; overgrazing is common, leading to the disappearance of suitable species and increasing conflicts over limited rangeland resources.

At the national level:

297. The project is expected to contribute to increasing the national sink of carbon dioxide and reducing emissions associated with biomass energy consumption and this in turn will contribute to reducing the overall national emissions which is mainly dominated by emissions from the forest and land use sector (more than 70% of CO₂ emissions). The project is also expected to create adequate capacity within the forestry and land use sector to increase, sustainably manage, monitor, and report on forestry and biomass carbon stock. The planned trainings and learning by doing activities will contribute to introducing technical GHGs mitigation knowledge, generating national activity data and emissions factors and other parameters needed for GHGs estimation in addition to improving institutional capacities and data managements.

298. The project will establish new forest areas with the additional management objective of carbon sequestration. The development of a baseline for reducing emissions from deforestation

and forest degradation and standard forest practices in a pilot area will introduce knowledge of managing and monitoring biomass carbon stock. This knowledge will also enable Sudan to develop capacity to access carbon markets and FNC to integrate these new concepts in its national planning and replicate it in other places within Sudan.

At the Global level:

299. **Climate change mitigation benefits:** These are expected to be achieved in terms of reduced net carbon emissions in the country through conservation of existing carbon stock (forest management), expansion of carbon stock (A/R), increase in the use of alternative energy sources (LPG), more efficient use of firewood (efficient cooking stoves) and increase in the soil organic carbon. In addition capacities to access the carbon market will improve and this in turn will provide an incentive to replicate successful experiences elsewhere and integrate mitigation objectives into the development planning of the forest and land use sector. The data, capacities and practical experience gained from this project will also help Sudan to improve A/R practices, forest management and eventually to direct its national planning towards a low carbon sustainable development, which became a requirement for developing countries based on the recently adopted Cancun agreement of the UNFCCC.

300. **Climate change adaptation benefits:** The adaptation benefits will be delivered through economic diversification (agroforestry, social and private forestry, biomass production) and reduced pressure on critical natural resources. The introduction of trees as shelterbelts and woodlots on the agriculture land will improve the microclimate in terms of increased humidity and water conservation, lower temperatures and therefore less evaporation, and will reduce soil erosion, and will therefore improve conditions for crop production and counteract the negative impacts of climate change. It will also provide additional income sources for local people. These activities will reduce the vulnerability and enable the local population to better cope with climatic changes through reducing the negative impacts of climate change on the one hand, and offering alternative sources of income on the other hand. All these benefits are in line with NAPA priorities and represent very useful experiences for other similar areas in Sudan and in many of the African countries especially in the Sahel.

301. **Biodiversity conservation benefits:** The proposed activities will also contribute to maintaining ecological processes and not damaging other ecosystems. Mainly local and indigenous species will be used in the A/R activities. Moreover, it is expected that the project input on conservation and management of forest and woody vegetation will enhance the regeneration and protection of many of the range vegetation that have been severely affected by over grazing and mismanagement. An increase in both forest cover (area) and quality (no longer over exploited and therefore richer in species), will create and/or increase ecological niches for ecologically important species. Since any population needs a minimum size for healthy survival and reproduction. The larger the area the higher chances are that any such area can sustain healthy populations of as many species as possible. In this respect should be mentioned also the importance of connectivity between different areas through ecological corridors, which allows

species to “travel” from one area to the next one, diversifying the gene pool. In a way, through an ecological corridor two separate areas become one and the same. The importance of biodiversity to agriculture must be mentioned. A complex ecosystem (as opposed to e.g. a monoculture) in equilibrium helps to avoid pests (it creates niches for predators), and creates niches for insects necessary for the pollination of crops (e.g. bees).

302. **Desertification control benefits:** Afforestation/reforestation activities and the input on water harvesting will contribute to soil formation, and erosion control, reducing sand dune formation and advancement. The increase in soil organic matter will help to maintain soil humidity and avoids run-off, especially on clayey soils. The crown cover will not only reduce the erosive impacts of rain and wind, it will also shelter the soil from the sun, thus reducing evaporation. Humidity of the air under a tree cover is higher than humidity in the open field. Furthermore the roots of trees and other plants have an important function to fix the soil and therefore prevent erosion. Another important function of forests is that they work like a sponge: they retain water and let it go in an even way, whereas on degraded soils without plant cover the precipitation runs off at once, leaving the area dry almost immediately again. Moreover the latter may cause serious flooding and sedimentation problems downstream.

303. **Improved sustainable forest management:** The FNC /IFAD/GEF intervention will also contribute to strengthening sustainable forest management and increased forest regeneration capacity, vitality and health. Specially the input of forest management will introduce and integrate the objective of carbon sequestration, management, monitoring and reporting of GHGs

M. Consistency of the project with national/regional priorities/plans

304. The proposed project is fully in line with the overall objective of Sudan’s national implementation strategy for climate change, namely to promote sustainable development paths that improve Sudan’s adaptive capacity and limit the growth in GHG emissions through integration of climate change issues and concerns into national policies, strategies and development plans. The present proposal is consistent with the indications contained in the Sudanese Initial National Communication to the UNFCCC, where forests are acknowledged to play a crucial role in mitigating climate change in the country. Afforestation and rehabilitation of rangelands are indicated as the most suitable activities to achieve GHG emission reduction objectives in the country. A major effort has been carried out by the Forest National Corporation to conserve the existing forest in the project area.

305. To date more than 100 natural forests have been demarcated and declared as forest reserves in accordance with the current Forest Law, which gives them protection against irrational use, whilst not impeding access to the local communities. However over the past 25 years there has been a rapid deterioration and reduction in the forest carbon stock of Butana area due to continued deforestation and forest degradation that in turn resulted in the accelerated environmental degradation and desertification in the area. The proposal is also aligned with the

climate change-related activities supported by the Higher Council for Environment and Natural Resources, particularly with regard to the assessment of GHG sources and sinks and GHG mitigation options that are relevant to the preparation of Sudan's National Communication. Also, the proposed activities will contribute to the objectives of other environmental conventions, namely the United Nations Convention to Combat Desertification (UNCCD) to which Sudan became Party in 1992 and the United Nations Convention on Biodiversity (UNCBD) signed by Sudan in 1995.

N. Describe the consistency of the project with GEF strategies and strategic programs

306. The proposal is consistent with the GEF strategy on climate change. In particular, the present proposal is in line with the GEF-4 strategic objectives of (i) reducing GHG emissions from land-use, land-use change and forestry (LULUCF), and (ii) promoting sustainable biomass energy production. The focus of the intervention is on LULUCF activities; energy production from biomass will be supported in the context of an integrated approach that will ensure the sustainable production and use of energy from this source. The activities promoting the production and use of energy from biomass will be carried out without conflicting with other environmental and development objectives.

O. Value-added of GEF involvement in the project demonstrated through incremental reasoning

307. The GEF intervention will be developed in synergy with the IFAD-supported Butana Integrated Rural Development (BIRD) Project.

308. **Baseline.** In Sudan forests experienced severe destruction because of increased population, the needs for fuel wood for grazing and for speculative cultivation also increased; and these are economic necessities that are often vital means of survival. Plantations were established since the start of forestry practice in the Sudan. Plantations include both indigenous and exotic types. The largest plantations (52,227 ha.) are made of *Acacia Senegal* raised to compensate for areas damaged by fire, illicit felling and senility. Forest Policy and Laws encouraged local communities, private individuals and organizations to establish plantations. However, in the business as usual scenario the areas annually planted are by far below the strategic and policy targets. The Butana area has been particularly affected by deterioration of the vegetation cover. Increased droughts, reduced government expenditure for basic services and changes in the land law, made the area a crossroad and allowed influx of livestock into the rich grazing resources of the Butana. Little or no investment in the natural resources management, apart from unplanned water investments, took place in the region for a long time. The consequence of the poor investment in natural resource management in the region was severe degradation of the natural vegetation cover (rangelands and forests), regression of the fauna and erosion of soils. Nowadays, overgrazing represent one of the main causes of degradation of vegetation. Also, woodcutting for energy purposes accelerated deforestation. Even if energy alternatives have been promoted to meet the wood-fuel deficit by encouraging

the use of other biomass alternatives in order to protect forests and preserve the environment, wood is yet the main energy source, although its combustion for energy production is done in an inefficient way. This further increases the release of carbon emissions. Without any intervention, land use changes and inefficient use of wood for energy production will continue to be the main causes of pressure on the vegetation cover.

309. The IFAD-supported Butana Integrated Rural Development project mostly addresses problems related to overgrazing, by promoting a sustainable livestock system. Environmental sustainability is supported as a crosscutting issue given its fundamental role in improving local livelihoods and increasing local communities' resilience to drought. Specific activities include increasing the productivity of livestock husbandry systems through the improvement of productivity of subsistence crops, the introduction of fodder in the farming system, the improvement of carrying capacity of the range, the construction/rehabilitation of water facilities, the development of resource management plans. Also, marketing services will be reinforced and capacity building and institutional support strengthened. Specific activities are tailored to the specificities of the ecosystems and socio-economic settings characterizing the Butana region. The overall goal of the BIRD project is to achieve a sustainable improvement in the livelihoods and drought-resilience of rural poor households. Its specific objectives include (i) establishing a coherent and cost-effective governance framework that ensures regulated access to land and water resources in the region; (ii) improving both women's and men's access to – and bargaining position in – livestock markets; (iii) developing the capacity of community-based organizations to engage in environmentally sound development initiatives that are gender- and socially equitable.

310. While building the basis for a sustainable use of natural resources in Butana, the BIRD does not address other environmental issues that contribute to increasing the sustainability of rural development efforts in the country. While seeking to provide remedial action to improve the livelihoods of rural poor household, the activities supported in the baseline do not take into account the potential of increasing the carbon stock in the project area, while at the same time generating other economic and environmental benefits.

311. **Incremental reasoning.** The GEF intervention will cover the incremental costs associated to the Government efforts to reduce the national GHG emission balance. In more detail, the GEF intervention will cover the following:

- Afforestation/reforestation activities to increase the national carbon sequestration potential. Under a business-as-usual (BAU) scenario, the LULUCF sector will continue to be a main source of carbon emissions in the country. Baseline activities will focus on the development and improvement of rangelands, including by developing in consultation with the Pastoralist Union and the Framers Union community resource management maps and range management plans. The GEF intervention will support afforestation activities that counterbalance possible negative impacts of range development activities. Afforestation activities will be developed in a synergistic manner with the baseline activities developed along the BAU scenario. As a result of

the GEF intervention, vegetation cover will be increased of approximately 10,000 ha in the Butana region, leading to an incremental carbon uptake of 380 KtC¹⁰ (or 1,393.46 KtCO₂e)¹¹. Significant co-benefits will be generated in terms of increased resilience of the ecosystems, with regards to resistance to climatic shocks due to climate change, and improved biodiversity conservation.

- Carbon stock management and maintenance. Without the GEF intervention, the drivers of deforestation and forest degradation will continue. This may hamper the long-term sustainability of the project outcomes in component 1. With the GEF intervention, the forest management system will be improved, including through the development of a cost-effective methodology to measure carbon stocks and fluxes and improved post-fire management systems. Micro-insurance schemes may be tested on a pilot base to reduce the risk of loss of the carbon stock. In a long-term perspective this would make the forest asset more competitive and appealing in the carbon market.
- Capacity building at the national level for monitoring and reporting on carbon stock and changes and awareness raising on biocarbon stock at the local level. Business as usual capacity building activities focus on developing community-based organizations; locality and state staff is trained on planning, budgeting skills, gender analysis and in formation of community and apex organizations. Experts at the national and local level are not trained on methods for GHG emission reporting from the LULUCF sector. Also, data on carbon stock and fluxes are not available and local population use natural resources in an inefficient manner, ignoring the carbon sequestration potential/benefits deriving from LULUCF activities. The GEF alternative will support capacity building at the national level to enable national experts in concerned institutions to monitor and report effectively on carbon sequestration changes and improvements. Also, a national carbon stock inventory will be created and relevant national climate change policies will include effectively information related to changes in carbon emissions from the LULUCF sector. In addition, the GEF alternative will increase the awareness of the local communities on the potential of sustainable resources management for carbon mitigation and the benefits they may get from involving and maintaining these activities.
- Promotion of sustainable energy production at the community level. Under a business as usual scenario, energy production from biomass is undertaken in an unsustainable manner. The GEF intervention will stimulate biomass energy production form a diversified set of sources and through the adoption of modern environmentally-friendly technologies. This will be carried out in an integrated way with the other project activities.

¹⁰ This amount has been estimated using as reference the IPCC Special Report on Land Use, Land-use change and Forestry.

¹¹ The conversion ratio from carbon to carbon dioxide equivalent is 44/12.

312. The table below summarizes the two scenarios (without and with GEF intervention).

Table 17: Outcomes with and without GEF intervention

Outcomes	Without GEF intervention	With GEF intervention
1. Afforestation/reforestation activities to increase the national carbon sequestration potential.	Emissions from LULUCF continue to increase and forestry remains the primary source of carbon emissions in the country. Sudan continues to generate GHG emissions and follows a non-carbon neutral rural development path. Agriculture and range development do not consider climate change mitigation potential of LULUCF activities.	Contribution of forestry sector to carbon emissions reduction increased. Incremental carbon uptake of 380 KtC (over 10,000 ha) generated. Vegetation cover in the Butana area is increased over 10,000 ha, generating relevant co-benefits for the environment (CC adaptation, biodiversity, and desertification).
2. Forest carbon stock is maintained in the long run, through conservation and improved management including protection from causes of deforestation and fires	Deterioration and reduction in the forest carbon stock of Butana region due to continued deforestation and forest degradation, which in turn result in the accelerated environmental degradation and desertification in the area.	Carbon stock is managed and maintained in a sustainable manner. A cost-effective methodology to measure carbon stocks and fluxes is developed and used. The forest management system is improved and post-fire management practices are introduced. Innovative carbon loss risk sharing/transfer mechanisms are tested on a pilot base.
3. Wide diffusion of highly efficient, biomass energy technologies, as appropriate, is promoted in the project area using climate-friendly incentives.	Biomass is the most consumed type of energy in Sudan (approx. 87% of the national energy needs). Direct burning of fuel-wood and crop residues are largely used in the country, but their inefficient use causes economic losses and affects adversely human health. In a business as usual scenario biomass will continue to be use inefficiently and traditional stoves will continue to be used.	Modern and sustainable practices and technologies for biomass energy production, conversion and use are promoted. Use of improved and modern climate-friendly stoves is promoted. Percentage reduction of GHG emissions through the promotion of sustainable energy production from biomass.
4. Institutional and technical capacities for monitoring forest carbon stock and associated GHG fluxes are	Only a limited number of experts are trained on methods for GHG emission reporting from the LULUCF sector. Policy makers and technicians are not	Sudanese government enabled to integrate climate change issues into the LULUCF sectors Policy makers and technicians are

developed at the national level and awareness is raised at local level about the role of forest and biomass carbon stock in climate change mitigation	<p>able to use existing methods and data are not available.</p> <p>Local population uses natural resources in an inefficient manner and is not aware of the carbon sequestration potential/benefits deriving from LULUCF activities.</p> <p>Capacity building activities focus on developing community-based organizations; locality and state staff is trained on planning, budgeting skills, gender analysis and in formation of apex organizations.</p>	<p>trained in the use of relevant LULUCF mapping techniques and measurements.</p> <p>A national carbon stock inventory is created and national CC policies are more receptive of changes in land use/forestry.</p> <p>Local communities are aware of the potential of sustainable resources management for carbon mitigation and participate in the management of the natural resources</p>
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313. For more than 20 years the Sudan has been a priority country for IFAD. Since 1979 the organization has helped rural poor people in the Sudan by funding a total of 15 projects for a loan amount of US\$211.8 million. A further US\$316.5 million has been contributed for the projects by the government, co financiers and project participants.

314. The Government, with support from IFAD, has developed relevant and effective investment models for rural poverty reduction in both drought prone and conflict-affected areas.

315. All of IFAD’s projects in the Sudan feature community-based and community-driven processes, working with local people to ensure food security and income from agriculture within a framework of sustainable natural resource management. Establishing self-reliance is an essential aim of all projects. Community members are encouraged to form organizing groups to manage newly introduced credit services. The projects tend to bring together a broad range of community members representing different socio-economic groups, and they actively involve women in the development process.

316. Projects financed by IFAD have helped increase agricultural production and provide crucial infrastructure while significantly contributed to sustainable natural resources management.

P. Linkages with other related initiatives

317. Coordination will be ensured with national policies and government activities. As a fundamental condition, coordination will be guaranteed with the activities supported by the IFAD-supported “Butana Integrated Rural Development Project”. In particular, the FNC/IFAD/GEF intervention will coordinate activities related to sustainable use of natural resources with those carried out in the baseline. Also, the proposal will be complementary to relevant climate change and non-climate change on-going and past operations in the country. For instance, the proposed intervention will be complementary to and will build on the lessons

learned from the “Community-based rangeland rehabilitation for carbon sequestration and biodiversity” that addresses land degradation as a cause of reduced ecosystem’s ability to sequester carbon and maintain biodiversity. The project aimed to increase carbon sequestration through sustainable management of rangeland and land use. The project will also build on the lessons learned from the UNDP/GEF supported “Conservation and management of habitats and species and sustainable community use of biodiversity in Dinder National Park”. To the extent possible and where relevant, coordination will be also promoted with the UNDP/LDCF NAPA implementation. Concerning the use of biomass energy the project will learn from other experiences in Sudan as well as projects carried out in other countries (e.g. the World Bank/GEF supported activities in these fields in Ethiopia, Senegal, Mali, Burkina Faso and Madagascar).

318. As described above, this project is closely linked to BIRD in a complementary manner that expected to enhance the sustainability of the outputs to be achieved through the implementation of its planned activities. The project is well linked to the national forest programme (NFP) developed and being implemented by FNC. All the outputs of the project, when implemented, are expected to contribute directly to the attainment of the objectives of the NFP. The project is also expected to contribute significantly to the on-going efforts by FNC to build capacities and prepare for participation in climate change mitigation in particular in the area of CDM and REDD+. Currently Sudan has observer status in the UNREDD programme, The CSP will reinforce the knowledge and capacity in relation to this programme, and will also reinforce cooperation and share knowledge with the other African countries already member of the UNREDD Programme. The national carbon estimation will be updated and reinforced by the SCSP.

319. Good coordination between the institutions, through the steering committee is necessary to optimise the use of resources and to avoid overlaps between the activities of each institution.

320. The project is directly linked to the national implementation strategy for climate change in Sudan as described in Sudan’s Initial National Communication and is based on the mitigation options defined under both the energy and LULUCF sector in the INC. This project also linked to the efforts currently undertaken by the designated national authority (DNA) of the CDM in Sudan to promote access to carbon market.

The project is also linked the objectives of Sudan’s NAPA and the its prioritized activities for Gedarif and River Nile states that aim towards building the capacities of the local communities in Butana area to adapt to the recurrent drought and climate variability in the Butana.

Table 18: Q. Risks and assumptions

Risk	Mitigation measures
Bio-physical and Socio-economic risks in A/R activities	Provision of good and timely technical support and implementation of targeted training programmes
Lack of follow up and participation of the local population	Project has been developed adopting a participatory approach that should ensure the full involvement of the local population in the implementation of the proposed activities. In addition, capacity building and sensitization programmes will be carried out to respond effectively to this risk
People/local population will continue to over-use forest resources, including illegal felling, overgrazing and poor management	The association of the loan with the GEF intervention will shift pressure on forests and provide incentives to diversify income generation activities.. The project will promote participatory forest management as a way to protect the carbon stock from drivers of deforestation. The project will form, with involvement of farmer/herders trade unions, and farmers participating in forest plantation establishment in the agriculture land or degraded forest bare land inside forest reserves A/R activities, joint management committees to shoulder the management of these plantations including their locations, establishment, protection and use, conditions and availability for grazing, and coordinate with fire protection committees for better protection. The project will tailor awareness campaigns, particularly among nomads and rangeland grazers, on the importance of modern utilization and protection of rangeland, and lawful rights and privileges on forest and range reserves.
Low survival rates of the trees	Adoption of suitable planting techniques. FNC will provide tractors and Delfino ploughs to adopt the most successful water harvesting technique. This is expected to increase the survival rate up to 85%, according to studies carried out by the FNC for the Butana area
Weak community based social organizations	Careful selection in order to work with the most effective and influential CSOs

Risk	Mitigation measures
At the splitting of Sudan most forest resources will be in Southern Sudan, increasing pressure on forests in the north	Increase sustainable management efforts and fuel wood economy
Climate change (less rainfall)	The natural resources management and water development activities undertaken in the IFAD baseline project should be able to mitigate this risk. Furthermore, as forest management, afforestation and production of energy from alternative sources are expected to contribute to diversify the income of local population, the project should be able to produce co-benefits in terms of climate change adaptation that would lessen the impact of climate change.
Fire risk	Fire risk management plan (FRMP) to reduce fire risk on A/R activities of CSPS in Butana will particularly address forest fires attributed to nomadic grazers caused by sheer negligence of cooking and campfires and the farmers who burn the crop residues to tidy up and to keep the grazers off their farms, in addition to other causes.
Erratic rainfall and drought	The project will build capacities of local institutions and communities on the design and use of water harvesting techniques and adopt most suitable water harvesting techniques to capture rains and runoff water. Furthermore, the project will involve local communities in the process of drought-resistant species and spacing selection for A/R project activities making use of accumulated indigenous knowledge.
High costs of protection and management	Involvement of local communities and participatory natural resource management

Risk	Mitigation measures
Continued demand for wood	To reduce felling of trees for household energy consumption (i) the project will promote the use of improved fire-wood cooking stoves and liquid petroleum gas (LPG) at household level, (ii) the project will build the capacities of local communities, particularly women, to build and use improved firewood cook stoves, e.g. Badia stove. (iii) Because use of LPG has its own risks, similar training to build capacities of women on the use of the LPG and safety requirements will be extended by the project. To sustain the supply of LPG, the project will coordinate with LPG distributing companies to establish centres of refilling of gas cylinders in well-populated areas (v) the project will promote the use of LPG in bakery industry in some selected areas in Butana e.g. Abu Dilaig town in the Butana part of Khartoum State.
Uncertainty in financial markets and credit risk.	The project will develop with insurance companies that extend agricultural insurance a multi-peril micro insurance policies to cover irrigated, private and communal agroforestry plots and home gardens, and rainfed plantations.
Sudan has been subjected to a trade embargo for a number of years, which constrains access to the carbon markets	The project will promote through BDA and other relevant institutions for a better opportunity of carbon marketing
Changes in the perspective of compliance market and voluntary market due to the International financial crises. That could reduce the size of the market and increase competition between projects reducing the carbon price in the market.	Use the best community based standards available (Gold standard or Social Carbon) for the Butana projects increasing credibility and competitiveness among other projects in Africa. Also create a specific brand and Marketing campaign for the Butana projects. Another important measure will be capacitated and trainee the Sudanese in charge for the sales of the carbon credits generated by Butana project.

321. The Fire risk management plan (FRMP) mentioned above includes:

- Human resource development and capacity building that involve (i) creation of fire prevention/protection committees from representatives of nomads, farmers, other local community sectors and project staff, (ii) create /raise stakeholders awareness on risk of forest fires where the project will work closely with fire protection committees, BDA, local institutions and communities to (a) help control the causes of forest fires (b) develop the necessity of providing help in extinguishing fires and (c) communicate the existence of a fire in any A/R area or in its proximity, (iii) selection and appointment, in consultation of local community structures, of fire-fighting teams, provision of proper training and appropriate fire-fighting equipment to facilitate initial attack, at least and (iv) establishment of fire patrol structures including official and community forest guards supplied with appropriate communicate on systems.
- Physical plans that involve (i) locating of annual regeneration areas within each plantation on geographically non-adjacent sites (ii) opening of wider fire line (fire breaks) networks along the boundaries of plantations, preferably at perpendicular direction to prevailing winds during fire hazard periods. The minimum width is generally 10 meters in irrigated plantations and 20 meters for rainfed plantations.

322. Wherever possible, the project will take advantage of existing fuel breaks such as roads (iii) in larger plantations internal access tracks, generally a minimum of 7m wide, will be opened by the project such that each 40 -50 ha of plantation can be circumnavigated (iv) delineation of greater fuel reduction areas to be heavily grazed or slashed immediately after rains stop and removal of brash in fire danger areas to slow the fire rate of spread (v) potential sources of ignition will be considered and noted on the plan, e.g. proximity to roads, use and characteristics of adjacent land, and the degree of preparedness of neighbours, (vi) erection of fire danger notices and warnings (vii) water supply needs to be considered so as to ensure adequate water will be available in the event of a fire. While this is often not a problem on irrigated plantations where stock are generally catered for, ensuring access to it for fire trucks must be addressed (viii) the project will resort to the use of fire-resistant mix of tree species, e.g., *Acacia seyal* plantations and (ix) the project will insure young plantations against loss by fire for a definite period after planting.

R. Sustainability and Replicability

323. The project intends to introduce a new intervention in carbon management in Sudan that would support the enhancement of the quality of the life of farmers and rural communities.

324. The project objective is to promote a climate-friendly rural development path in Central and Eastern Sudan by increasing the carbon stock and reducing net GHG emissions in the country, while at the same time sustaining rural development in the project area.

325. To ensure the up-scaling of the approach of social carbon calculations, the project will develop and implement a series of activities including awareness raising, training, dissemination of results, and developing alternative financial mechanisms to support the adoption of the activities.

326. The project will address issues that affect the long-term sustainability of forest afforestation, reforestation and conservation as well as the welfare of local communities through promoting the project approach that engaged to relevant institutions and the community.

327. Sustainability of the proposed project will be assured by the following:

Policy Support

328. The Legislative supplement to the Republic of Sudan Gazette No. 1690 Dated December 2002 Supplement No. 11: General Legislatives, was signed on 6\11\2002. This Act was cited as the “Forests and Renewable Natural Resources Act, 2002” and shall come into force from the date of promulgation. In Chapter Two, Management of Forests and Renewable Natural Resources, Part One the Corporation Establishment and The Corporation’s Headquarters and Supervision, one of the purposes of the FNC is clearly stated as to:

Encouraging effective popular participation and presenting a good model for sustainable development.

329. This forest Act is one of the main national policies providing support for sustainability of the proposed project.

Linkage to relevant institutions

330. The proposed project will be institutionally linked to the Ministry of Environment (FNC), the Ministry of Finance and National Economy (BDA), the Ministry of International Cooperation and the higher Council of the Environment.

331. The project management structure would promote the integration of activities within existing programs of the (BIRD and FNC), and the mobilization of resources to support the expansion of project activities.

332. The Integrated rural development project (BIRD) and the Forest National Corporation (FNC) demonstrated a serious interest in integrating the project approach into its lending programmes.

333. The project would seek the support of local network and institutions, would provide “training for trainers”, and extension services, thus promoting the sustainable use of natural resources management.

334. The project will seek to build capacity at the level of directorates of environment and forest sector, specialized extension services, lobbying and advocacy agencies, microfinance institutions fostering a partnership approach and building commitment to follow through activities beyond the project funding phase.

Financial Sustainability

335. The Government of Sudan will continue to give sustainable Carbon stock management a high priority and will promote the financial mechanisms and incentives to apply carbon stock management and maintenance through FNC and BDA. The project will make use of the relevant policies related to rural development and forestry and propose the adoption of carbon market such as REDD+ in order to advocate for increased investments and benefits.

336. The project is expected to sustain and further improve the participatory management of forests by up-scaling the project with identified financial mechanisms adopted by the end of the project’s life. This will be achieved through a series of activities, including those to attract external resources and/or generate financial return and to identify and/or design viable financial mechanisms/models to support financial sustainability (e.g. public funds and programs, generation of environmental service taxes, revolving funds schemes, and certifications).

S. Capacity Building and Information-Sharing

337. Capacity building should take place among management lines of forest sectors that addresses the long-term sustainability of forest management, scaling-up to the national level.

338. The lessons learned from the SCSP funded activities will be widely applicable in similar Forestry systems throughout Sudan and the region, through the project publications and products, IFAD Karia net program, training courses and study tours, the project outputs will be widely disseminated.

PART III - INSTITUTIONAL FRAMEWORK AND MANAGEMENT ARRANGEMENTS

A. Project coordination and supervision

339. The project will be implemented, by the Forest National Corporation (FNC) in collaboration with IFAD-Khartoum and all relevant national institutions at both national and state level. FNC is an organization under the Ministry of Environment, Forestry and Physical Development established in 1989 as a semi-autonomous parastatal institution responsible for the development of the forest resources in 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. FNC has offices and technical staff at national, State and local levels.

340. Forests National Corporation established a national REDD+ unit to develop the framework for a REDD+ strategic plan. Such work was done in collaboration with the United Nations Development Programme (UNDP) and Higher Council for Environment and Natural Resources (HCENR). It is therefore most important that the FNC REDD+ unit be closely involved in the project implementation, in order to guarantee maximisation of replication/scaling up opportunities and the interiorisation of the experiences of the project.

341. The implementation of this project will build on the capacities and technical expertise of FNC. 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 IFAD-Khartoum and BIRD, the climate change Unit of HCENR and other relevant institutions. The effective involvement of local communities and relevant stakeholders, and their support and commitment to the implementation of the proposed activities, will ensure the achievement of the overall outcomes of the project.

342. The role of the BIRDP is essential in the project for having developed related activities in the project area for quite some time, and also part of the counterpart funding for the BCSP will be provided by the BIRDP. Representatives of BIRDP (members of the board of directors) will be required to play an active role in the projects steering committee in order to facilitate smooth implementation and coordination between the two initiatives. The Project Management Units of both projects will also need to meet on a regular basis in order to guarantee efficient field level coordination, thus facilitating team building of key staff of implementing partners, avoid overlap between the two projects and guarantee maximum synergy and optimal application of the available funds. It is suggested that the steering committee decide on the proper way for this collaboration between the two project management units to take shape. In

this sense it would be useful for the two management units to be physically located near to each other (if possible). BIRDP should institutionalise a joint planning process that leads to a Joint Annual Work plans and Budgets as instruments for appropriate sequencing of all activities.

343. A committee will be established among the organisations and local communities involved in the project in order to administer the revenues generated by the project (carbon credits). This committee will take care of the distribution of these revenues to the involved communities based on the policy guidance that the project will provide in terms of channelling of the funds. The framework for the management of the available funds will have to be established during the first year of project implementation.

344. FNC will be represented in the BDA board of directors and the project will present the joint annual work plan and budget to the board and the progress report and any other issues related to Carbon sequestration project.

345. FNC will be responsible : for the management of the project; to prepare the joint AWPB with the BDA; Prepare progress reports of the project ; Submit the AWPB and progress report of the project to the BDA Board of Directors ;Provide technical guidance to the SCUs of Gadaref and Gezira in the implementation of the project activities, Also will be in charge to prepare the project implementation manual. Other responsibilities also may include to create a good channel of communication to keep BDA and all the main stakeholders informed of all changes in the implementation plan; Audit the project accounts including the GEF financing, the carbon revenues and the BIRDP contribution, and finally co-manage with the BDA the funds related to the carbon revenues using the strategy joint defined between FNC and BDA.

346. BDA will be responsible : to prepare the AWPB for the project; Integrate the approved work plan and budget of the project in the SCUs AWPB; Provide timely financing to the project; Carry out the regular supervision of the project in a regular basis and report to FNC and the Board of Directors of BDA accordingly and also play an important role in a co-management with the FNC the funds related to the carbon revenues that could be generated.

347. Three models were presented related with the management of the resources generated by the carbon credits from the Butana Project during the preparation Phase: A joint venture between FNC and BDA; A forest Fund managed by FNC, and a Community fund Managed by BDA. FNC and BDA agreed with a joint venture model that will be detailed during the implementation phase and will be in charge to coordinate and manage all the development activities to Bring the carbon credits to the market. Also the potential main resource generated by the carbon credit will be reinvested in the Butana region.

B. Project implementation arrangements and work plan

348. The project will be implemented over a period of four years. The project will establish a management unit (PMU). FNC will host and guide the project management unit, which in turn will work closely with the project steering committee (PSC) and IFAD-Khartoum/BIRD and FNC offices, and relevant stakeholders in each of the relevant states to implement the project. The activities of the Project management unit will focus on coordination of all technical activities. Initially, this will involve the convening of a workshop which will be held at the beginning of the project activities to raise the awareness about the project at both the national and the state levels. The workshop participants will include all relevant stakeholders including representatives of the Civil Society Organizations, and the media. The workshop will discuss the project work plan, priorities and area coverage.

Terms of reference of project staff

349. The PMU will consist of a National Project Manager (NPM), a Deputy Manager (DPM) with monitoring and evaluation responsibilities and 4 Project Field Officers (PFO) and an accountant in Gezeera and Gedarif States that going to be selected in a merit based recruitment from FNC team. PMU will be responsible for carrying out all the activities specified in the project document and provide overall project management and supervision to ensure that the implementation of the project activities are in line with what was agreed/approved and stipulated in the project document. When needed, additional technical support will be provided through access to national and international experts as appropriated. The specific responsibilities of the PMU and project management may include the following:

- Enhance the capacity and role of the FNC in the area of climate change and forestry.
- Prepare in consultation with the PSC a detailed project work-plan as well as annual and quarter plans.
- Prepare the agenda, organize the meetings of and serve as secretary for, the PSC.
- Coordinate the implementation of all project activities.
- Coordinate recruitment of consultants, project procurements and facilitation of technical tasks, Approve the allocation of funds under the direction of the PSC and in accordance with IFAD procedures.
- Prepare and submit technical reports, progress reports, evaluation reports, and other reports as requested.
- Undertake any related activities considered necessary to facilitate the implementation of the project.
- Monitoring and evaluation of the project implementation

A. Project Technical Committee

350. The membership should include Federal Ministry of Environment and Physical Development (FME&PD); the Higher Council for Environment and Natural Resources (HCENR); BDA; Directors of State Ministries of Agriculture in Gezeera and Gedarif, Farmers Trade Union, Pastoralist trade Union, , FNC state directors. The technical committee will be chaired by the General Manager or his representative of FNC and its main responsibilities will include the following:

- Provide advice on technical guidelines to support the project implementation
- Provide consensus-based technical decisions for the project management, when required by the project management, including recommendations on approval of project plans and revisions.
- Ensure effective technical cooperation between all relevant stakeholders
- Review and approve project annual budget, progress report and recommend changes if any to FNC and BDA.
- Review of project technical implementation issues to ensure that the project is focused throughout its life cycle on achieving its objectives and delivering outputs that will contribute to higher-level outcomes.
- It monitors the efficiency, effectiveness and the utilization of project resources.
- To provide guidance regarding the technical feasibility of the project and its potential expansion.

B. National Project Manager (NPM)

351. The NPM will be a full time employment with the main duties:

- Set up and manage the project office, including staff facilities and services, in accordance with the project work plan;
- Prepare and update project work plans, and submit these to the IFAD-Khartoum for clearance and ensure their implementation consistent with the provisions of the project document.
- Ensure that all agreement with designated project implementing agencies are prepared, negotiated and signed.

- Provide overall supervision and/or coordination of the work to ensure the production of the corresponding project outputs.
- Act as a principal representative of the project during review meetings, evaluations and in discussions and, hence, be responsible for preparation of review and evaluation reports for the consideration of the PSC and project partners.
- Identify potential candidates, national and international, for posts under the project
- Prepare the ToR, in consultation with the implementing partners;
- Draw up specifications for the equipment required under the project; procure such equipment according to Government and IFAD rules and procedures governing such procurement.
- Assume direct responsibility for managing the project budget, ensuring that:
 - Project funds are made available when needed, and are disbursed properly;
 - Accounting records and supporting documents are kept;
 - Required financial reports are prepared;
 - Financial operations are transparent and financial procedures/regulations for national execution projects are applied; and
 - The project is ready to stand up to audit at any time.
- Ensure timely preparation and submission of required reports, including technical, financial, and other requested reports;
- Perform others coordinating tasks as appropriate for the successful implementation of the project in accordance with the project document

C. Project/Finance/Admin officer (CFO) (full time)

352. The CFO will be a full time employment with the main duties:

- Prepare all payment requests, financial record-keeping and preparation of financial reports required in line with relevant financial rules and procedures
- Assistance to the recruitment and procurement processes, checking the conformity with IFAD and the Government rules and procedures
- Preparation of internal and external travel arrangements for project personnel
- Maintenance of equipment ledgers and other data base for the project
- Maintain project filing;

- Maintain the project documentation up-to-date and in perfect order;
- Draft minutes of meetings;
- Elaborate rosters of potential consultants and sub-contractors;
- Assist the Project Manager in elaborating the project work plans;
- Assist the Project Manager in elaborating the project reports as per the applicable IFAD procedures;
- Maintain project equipment ledgers and contract logs;
- Support the project fieldwork and assist in the organization of the different project events (workshops, working group meetings, local stakeholder consultations, management/steering committee meetings, etc.);
- Provide support to project audits;
- Draft correspondence and documents; finalize correspondence of administrative nature; edit reports and other documents for correctness of form and content;
- Facilitate project communications (telephone, fax, e-mail, post, etc.);
- Assist the Project Manager and IFAD in all financial matters related to the project, observing the set deadlines;
- Maintain the project financial records in an impeccable way;
- Ensure strict observation of applied financial planning and reporting

PART IV - PROJECT COST AND FINANCING

A. Financial modalities and cost-effectiveness

353. Project objective aims to promote a climate-friendly rural development path in Central and Eastern Sudan by increasing the carbon stock and reducing net GHG emissions in the country, while at the same time sustaining rural development in the project area. The GEF resources will be provided in the form of grant and will be mostly co-funded through an IFAD loan to the Government of Sudan.

354. The GEF financing will be used to finance the implementation of on-the-ground, direct carbon sequestration (A/R) and biomass emission reduction measures that will be monitored and evaluated to assess implementation success and potential for replication in other areas of the country. The GEF intervention is required for supporting the development of the potential for carbon sequestration and emission reduction, as well as contributing to enhancing rural development, and building of the required awareness to conserve, and capacity to manage, monitor and report, the carbon stock and changes at both the national and local levels. The GEF funds will serve as a catalyst for supporting revision of the national approach for forest management and utilization to take into account, in addition to national priorities, global challenges and commitments as well as possible market benefits. Project management and Monitoring and Evaluation costs are maintained at the lowest possible level.

355. The project is designed in such a way to accommodate the highest possible active community participation. Use of already existing community organizations and various ones to be established by the project will more add to cost reduction. The involvement of local communities and the promotion of participatory approaches for natural resource management will reduce costs of protection and management. FNC capacity and experience will ensure the better technical implementation and performance to achieve the project objectives. A more detailed assessment and possible mitigation measures of this type of risk will be done during the project formulation.

356. To further contribute to cost effectiveness the project aims to establish data base of various project activities, their analysis to reach to low-cost implementation of activities and higher cost-effectiveness in achievement of project objectives and sustainability after the project completion.

357. The GEF intervention will be developed in synergy with the IFAD-supported Butana Integrated Rural Development (BIRD) Project. The preceding of this project by BIRD paves the way for smooth implementation of project activities. Use of management structures of existing

BIRD project and that of FNC present at the states where project sites are means to achieve objectives at reduced costs. Use of already accumulated experiences of BIRD as related to community involvement in natural resource management will lead to high cost-effectiveness of project management. A common management structure will contribute at reducing the transaction costs.

358. The silvicultural techniques, including land preparation, to be used by the project are made at a lower carbon emission. Similarly adoption of alternative energies contributes to low carbon emissions. Maintenance costs are low improving project sustainability.

359. The risk of low survival of the trees will be mitigated through the adoption of suitable planting techniques. FNC will provide tractors and Delfino plough to adopt the most successful water harvesting technique. This is expected to increase the survival rate up to 85%, according to studies carried out by the FNC for the Butana area, thereby improving cost-effectiveness of the project.

360. Afforestation/reforestation mitigation options are also cost-effective with prices ranging between \$15–30 per tonne². On the basis of the data contained in the Sudanese Initial National Communication, afforestation and rehabilitation activities are able to generate an average incremental carbon uptake of 12.34 tCO₂/ha/year.

361. The project relies heavily on raising awareness and building of capacities to encourage the prevention act of communities against the drivers of desertification. Prevention is much cheaper than the cost of dealing with the social, economic and environmental consequences of natural resource degradation.

B. Project Budget

362. Detailed project COSTAB is presented in Annex 6.

C. Cost-effectiveness

363. The project has been conceived in a way to promote sustainable development, ensure replicability on a wider scale, and guarantee sustainability in the long-term. In light of this, the project has been designed with cost-effectiveness in mind. The literature on the economic potential of LULUCF activities is still not yet rigorous. However, according to the IPCC, forests and agroforestry offer the highest potential for carbon sequestration in developing countries among different options in the agricultural sector. Over a time-frame of 40 years, the mitigation potential from forest land is 503 MtCyr-1 and from agroforestry 586 MtCyr-1, while other agriculture-related options would offer a carbon sequestration potential ranging between 13-137 MtCyr-1 depending on the option. Afforestation/reforestation mitigation options are also cost-effective with prices ranging between \$15–30 per tonne¹². On the basis of the data contained in the Sudanese Initial National Communication, afforestation and rehabilitation activities are able to generate an average incremental carbon uptake of 12.3tC02/ha/year.

364. Based on the revenues generated by the project for the first four years each dollar provided by GEF generates US\$ 1.21, whereas for the whole 20 year period the ratio is 1 to 5.36. These estimates are on the conservative side, using values at the lower end of the scale. It must be noted that revenues during the first couple of years are relatively low, due to the fact that not all plantations will have been planted yet. The revenues will be used to considerably increase the reforestation areas and if they will be able to reinvest the resources to increase the beneficiaries and to implement a larger area 5 times bigger than SCSP.

365. Agroforestry and arboriculture are considered particularly cost-effective because they are able to generate synergies with climate change adaptation by reducing the vulnerability of small-scale farmers to climatic variability. Also, assessments of different energy technologies demonstrate that biomass and biogas systems generate the lower amount of emissions per TJ of energy produced, at an average generation cost of 24\$/GJ.

366. Baseline activities will contribute at minimizing the costs (institutional set up, monitoring and evaluation, capacity building, etc.) while maximizing the outcomes. Considering the expected multi-direct/indirect-results of the proposed approach, the value of the global project benefit can overwhelm the implementation costs. In addition, a common management structure will contribute at reducing the transaction costs.

¹² Bosello, F., Giupponi, A. and Povellato, A. (2007) A Review of Recent Studies on Cost Effectiveness of GHG Mitigation Measures in the European Agro-Forestry Sector, Working Papers 2007.14. Fondazione Eni Enrico Mattei.

D. Financing and incremental cost

367. The GEF intervention will cover the costs associated with Government efforts to reduce GHG emissions through a series of project activities that complement those of the BIRD project, and which add value by addressing the causes of deforestation and forest degradation through:

368. Afforestation/reforestation activities leading to an increase in carbon sequestration potential and a number of co-benefits including enhanced forest ecosystem services and biodiversity conservation.

369. Capacity building amongst key institutions to monitor and report on carbon stocks from the LULUCF sector to inform policy and awareness raising amongst stakeholders on the range of benefits from sustainable forest resource management carbon stock management and maintenance with a view to future participation in established carbon markets.

370. Promotion of sustainable and more efficient energy production at community level to reduce pressure on forest resources and ultimately, GHG emission.

E. Disbursement and Procurement

371. Procurement of goods and services financed by the Grant will be done in accordance with IFAD's Project Procurement Guidelines¹³. The procurement rules and procedures are documented for the purposes of existing IFAD-financed projects in Sudan and shall form the basis for this Project.

372. Guiding principles include:

- Ensuring the impartiality, independence and integrity of suppliers and contractors
- Making clear to suppliers and contractors their accountability
- Ensuring full, fair and legitimate competition among eligible suppliers and contractors through competitive bidding processes and transparent tender evaluation procedures
- Ensuring that the procurement costs are proportional to the size of the project activity
- Ensuring value-for-money for all project procurement activities

¹³ <http://www.ifad.org/pub/basic/procure/e/proceng.pdf>

373. Prior to procurement and annually thereafter, the Government of Sudan will submit a Procurement Plan for IFAD for approval. The Procurement Plan will specify, *inter alia*, the method of procurement to be used for each contract and any thresholds that may apply. Typical methods for procurement of goods and services are shown in Table below.

Table 19: Procurement methods for goods and services

Goods	Services
International Competitive Bidding	Quality and Cost-Based Selection
National Competitive Bidding	Quality Based Selection
International or National Shopping	Selection under a fixed budget
Direct Contracting	Selection based on consultants' qualifications
Procurement from commodity markets	Least Cost Selection
Work by force account	Single-Source Selection
Procurement from UN Agencies	Selection of individual consultants
Inspection agents	Commercial Practices
Procurement by financial intermediaries	
Procurement with community participation	

Table 20: Procurement Thresholds

Procurement category and thresholds (in thousands of USD)	Procurement modality	Selection basis	IFAD review requirements
Goods			
< 8.3	National shopping ¹⁴	RFQ (3 quotes)	Post review
= 8.3 - < 20	National shopping	RFQ (5 quotes)	Post review
= 20 - < 200	NCB	ITB	Prior review if = \$ 30,000
200	ICB	ITB	Prior review
Farm inputs	Community Procurement	Quotations / Direct Contracting	Post review
Works / Technical Services			
< 8.3	National shopping	RFQ (3 quotes)	Post review
= 8.3 - < 50	National shopping	RFQ (5 quotes)	Post review
= 50 - < 300	NCB	ITB	Prior review
300	ICB	ITB	Prior review
Consulting Services			
< 8.3	Shortlist	CV comparison (individuals) or RFQ (firms)	Post review
= 8.3	Shortlist	RFP (QCBS)	Prior review if = \$ 20,000
National institutions, MA departments, UN agencies	Sole-Source selection	Direct Contracting	Prior review

¹⁴ National shopping is a procurement method that entails comparing price quotations from several suppliers or contractors (usually at least three) to ensure competitive prices. It is an appropriate method for procuring readily available, off-the-shelf goods or standard specification commodities that are small in value, or simple civil works of small value

374. Any arrangement for subcontracting should be included in the original submission and financial proposal for works and services. The scope of work of the sub-contractor should be disclosed with the conditions provided meeting the same requirements as the main contractor. The sub-contracting arrangements will be part of the bid evaluation. No sub-contracting will be allowed after contract award.

375. The Project will be under direct supervision by IFAD. The project will be supervised as a GEF Component linked to BIRDP. A separate project account will be established for the Project Funds and IFAD will establish a separate Financial Agreement with the Government for this grant. The flow of funds will follow IFAD modalities.

F. Auditing

376. The Government of Sudan (through the FNC) shall ensure that all bidding documents and contracts for the procurement of goods, works and services financed by the GEF shall include a provision requiring bidders, suppliers, contractors, sub-contractors and consultants to permit IFAD to inspect their accounts, records and other documents relating to the bid submission and contract performance and to have them audited by IFAD-appointed auditors and investigators. This provision will require bidders, suppliers, contractors, sub-contractors and consultants to: (i) maintain all documents and records related to the Project for three (3) years after completion of the work contemplated in the relevant contract, and (ii) require the delivery of any document necessary for the investigation of allegations of fraud or corruption and the availability of employees or agents of the bidders, suppliers, contractors, sub-contractors or consultants with knowledge of the Project to respond to questions from the personnel of IFAD or any properly designated auditor, investigator, agent or consultant relating to review or audit of the document. If the bidder, supplier, contractor, sub-contractor or consultant fails to comply with IFAD's request, or otherwise obstructs IFAD's review of the matter, IFAD, in its sole discretion, may take appropriate action against the bidder, supplier, sub-contractor or consultant.

PART V - MONITORING AND EVALUATION

A. M& E System

377. Project monitoring and evaluation will be conducted in accordance with established IFAD and GEF procedures and will be provided by the project team with support from IFAD-GEF. The Strategic Results Framework provides indicators for project implementation along with their corresponding means of verification. These will form the basis on which the project's Monitoring and Evaluation system will be built.

378. The following sections outline the principle components of the Monitoring and Evaluation system to be implemented.

B. The Management Information System (MIS)

379. The MIS will be designed to generate quantitative verifiable information on the Project's performance. It will be in a form that is assisting the CSP, State Circle Coordination and Community Organizations to plan and finance their activities, compare physical progress against the planned targets and allow timely remedial action to be taken to correct problem areas in project implementation. The data produced through the MIS will be aimed at improving decision making and facilitating the work of the CSP and the State Circles by providing the means of focusing on implementation problems and ensuring effective communication and co-ordination between the implementing agencies and participating parties.

C. M& E Arrangement and Organization

380. The organization of M&E will be designed with the view of linking the M&E function with management of project activities. There will be 3 levels of M&E corresponding to the BIRD: CSP, FNC Circles and the Community Organizations.

381. The M&E at CSP level will be undertaken by an M&E Officer and an assistant M&E officer. The M&E Officer will also cumulate with her\his function the responsibility of deputy director. The M&E at CSP level will be mainly responsible for: the aggregation of the physical and financial data from the FNC Circle; verification of this data; analysing and reporting on trends in performance, gaps and successful results; negotiating corrective or enhancing measures with the Director of the CSP for endorsement; formulating the annual work plans and budgets of the project accordingly; organizing the baseline and impact studies.

382. The M&E at the State Circle level will be carried out by the State circle Coordinator. S/He will be responsible for: the aggregation of the community monitoring reports and the reports of the development teams by locality; the analysis of the rate of achievement of the work plan and degree of community satisfaction with the project activities; the summary of lessons learned and recommendations for improving project implementation and results at community level.

383. The M&E at community level will be undertaken by the community organizations. The community organizations will designate up to 2 persons to prepare reports on the rate of implementation of the community work plan agreed with the extension teams; number of beneficiaries and their socio-economic and gender group; success and failure stories; overall assessment of project performance and recommendations for improvement.

384. Financial monitoring and reporting at all management levels will be the responsibility of the Financial Controller who will work closely with the M&E Officer and accountants in the CSP.

D. Lines of reporting

385. Both the M&E Officer and Financial Controller will be directly responsible, and report, to the CSP Director. The State locality will report to the M&E Officer with copy to the Financial Controller. The reports will also be copied with the Executive Officer and Extension Teams of the localities and discussed with them. The Community Organizations will submit their reports to the Extension Teams who in turn will submit it to the State Coordinator.

E. Discussion and decision-making

386. The Community Organizations will discuss their progress reports with the Project Extension Teams and agree on amendments to the work plans accordingly after endorsement of these by the State Circle Coordinator. The State locality Coordinators will discuss the progress reports with CSP Director and General Directors in the FNC States and agree on management decisions accordingly. The progress report and management decisions will then be submitted to the BIRD Director and then to Board of Directors of the BDA. The Board will be required to provide feedback with regards to strategic decision related to coordination matters between the states.

F. Participatory Approach to M& E

387. Participatory monitoring and evaluation is an important element of the Project and will be a valuable mechanism to gauge impacts. It will provide timely progress and impact reporting from the beneficiaries to Project management, thus enhancing bottom-up communication.

388. The participation of beneficiaries will be facilitated through mandatory annual work planning and budgeting requirements, annual implementation and planning workshops, and annual evaluation and beneficiary impact assessments. With the preparation of the AWPBs, it will be a requirement that the progress reported. This will include the following information collected and collated:

- Physical progress made in achieving the targets set by the sub-groups.
- Financial progress including balance sheet of sub-groups revenues and debts;
- Number of beneficiaries disaggregated by gender and socio-economic group;
- Beneficiary assessment of the project activities;
- Stories of success and failure; and
- Constraints and problems from previous year, and ways to resolve them.

389. The Extension Teams will assist the Community Organizations with the monitoring of the work plan and planning the new community development plan for the following year. Communities will be involved in the project self-evaluation process.

G. Key M&E Activities and roles of stakeholders

390. Inception workshop, annual work plans and budgets (AWPBs), where the establishment of performance benchmarks relies on AWPB targets and reports (six-monthly physical progress reporting, against output targets, six-monthly financial reporting against expenditure forecasts and regular financial statements.) and Reports.

391. A Project Inception Workshop will be conducted with the full project team, BIRD team and relevant government counterparts, co-financing partners, IFAD and representation from the GEF as appropriate.

392. A fundamental objective of this Inception Workshop will be to assist the project team to understand and take ownership of the project's goals and objectives, as well as finalize preparation of the project's first annual work plan on the basis of the project's strategic results framework (SRF). This will include reviewing the SRF (indicators, means of verification...),

imparting additional detail as needed, and on the basis of this exercise, finalize the Annual Work Plan (AWP) with precise and measurable performance indicators, and in a manner consistent with the expected outcomes for the project.

393. Additionally, the purpose and objective of the Inception Workshop (IW) will be to:

- Introduce project staff with the FNC, BIRD and the IFAD-GEF expanded team which will support the project during its implementation;
- Detail the roles, support services and complementary responsibilities of vis à vis the project team;
- provide a detailed overview of IFAD-GEF reporting and monitoring and evaluation (M&E) requirements, with particular emphasis on the Project Implementation Reviews (PIRs) and related documentation, the Annual Project Report (APR), as well as mid-term and final evaluations.
- provide an opportunity to inform the project team on IFAD project related budgetary planning, budget reviews, and mandatory budget rephrasing.

394. The IW will also provide an opportunity for all parties to understand their roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms.

395. The Terms of Reference for project staff and decision-making structures will be discussed again, as needed, in order to clarify for all, each party's responsibilities during the project's implementation phase.

396. A detailed schedule of project evaluations will be developed by the project management, in consultation with project implementation partners and stakeholder representatives and incorporated in the Project Inception Report. Such a schedule will include: (i) tentative time frames for evaluations, Steering Committee Meetings, (or relevant advisory and/or coordination mechanisms) and (ii) project related Monitoring and Evaluation activities.

H. Training of staff and community in M& E

397. Training on M&E and facilitating M&E design and implementation processes with implementing partners and primary stakeholders. Undertaking and facilitating others to implement the M&E plan, regularly revising and updating performance questions, indicators, methods, formats and analytical processes. As well as training of the project personnel in

monitoring of social carbon calculations. This can be implemented by the Sahel Centre for information and forestry training (SACIFT) of the FNC.

I. Annual Project Report

398. The Annual Project Report (APR) is an IFAD requirement and part of central oversight, monitoring, and project management. It is a self-assessment report by project management and provides input to IFAD, as well as forming a key input to the Tripartite Project Review. An APR will be prepared on an annual basis prior to the Tripartite Project Review, to reflect progress achieved in meeting the project's Annual Work Plan and assess performance of the project in contributing to intended outcomes through outputs and partnership work. The format of the APR but should include the following:

- An analysis of project performance over the reporting period, including outputs produced, where possible, information on the status of the outcome.
- The constraints experienced in the progress towards results and the reasons for these.
- The three (at most) major constraints to achievement of results, AWP and other expenditure reports.

J. Lessons learned

399. Clear recommendations for future orientation in addressing key problems in lack of progress.

K. Project Implementation Report

400. The PIR is an annual monitoring process mandated by the GEF. It has become an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from on-going projects. Once the project has been under implementation for a year, a Project Implementation Report must be completed by IFAD together with the project.

401. The individual PIRs are collected, reviewed and analyzed by the CO prior to sending them to the focal point at IFAD headquarters.

402. The PIRs are then discussed in the GEF Interagency Focal Area Task Forces in or around November each year and consolidated reports by focal area are collated by the GEF Independent M&E Unit based on the Task Force findings.

403. As and when called for by IFAD, the project team will prepare Specific Thematic Reports, focusing on specific issues or areas of activity.

404. The request for a Thematic Report will be provided to the project team in written form by IFAD and will clearly state the issue or activities that need to be reported on.

405. These reports can be used as a form of lessons learned exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered.

406. IFAD is requested to minimize its requests for special Thematic

407. Reports (given that there are some of these already included in the work plan), and when such are necessary, will allow reasonable timeframes for their preparation by the project team.

L. Information and knowledge sharing

408. Identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects as well as identifying and analyzing lessons learned is an on-going process responsibility of the project coordinator and M& E officer.

409. Results from the project will be disseminated within and beyond the project intervention zone through a number of existing information sharing networks and forums. In addition:

410. The project will participate, as relevant and appropriate, in IFAD-GEF sponsored networks, organized for senior personnel working on projects that share common characteristics.

411. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation through lessons learned.

412. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.

413. Identifying and analyzing lessons learned is an on-going process, and the need to communicate such is a central theme in the project. The counterparts and IFAD shall provide a format and assist the project team in categorizing, documenting and reporting on lessons learned. To this end a percentage of project resources will need to be allocated for these activities.

414. Results from the program will be disseminated throughout Sudan within and beyond the program intervention zone and at the regional level through a number of existing information sharing networks, e.g. Karianet program including replication and scaling up.

M. Mid-term evaluation, recurrent supervision missions, and final evaluation

415. The project team is responsible for guiding and supervising organizations that are sub-contacted to implement special surveys or studies required for evaluating project effects and impacts and for viewing existing social and economic data for the project area to assess if it can provide good baseline data for impact evaluation, identifying gaps to be filled.

416. Outsider's evaluation responsibility is to view project performance against objectives achievements and goals.

N. Requirements and Budget Allocation for M&E

417. The budget allocation for M&E to be incorporated within the Project budget under the Project Management Component, The budget allocation covers: (i) the salary and allowances of the M&E staff of the CSP and of the State Circle Coordinator and extension Teams; (ii) the necessary mobility in terms of vehicles; (iii) the computer and GIS equipment; (iv) the provisions for studies (baseline, mid-term review and annual assessments, satellite studies and monitoring); (v) the training of the personnel of the project (basic staff, state Coordination Circle and Community Organizations) in monitoring and evaluation as well as monitoring of social carbon calculations.

PART VI - ADDITIONAL INFORMATION AND ANNEXES

- Annex 1: Letter of endorsement from GEF OFP
- Annex 2: Letters of commitment from co-financiers (FNC)
- Annex 3: Monitoring and evaluation plan and budget.
- Annex 4: Social carbon methodology
- Annex 5: Logical framework (or results framework)
- Annex 6: Project cost tables
- Annex 7: Identification and assessment of a cost effective risk management plan: Fire, overgrazing, deforestation and micro insurance.

ANNEX 1
LETTER OF ENDORSEMENT FROM GEF OFP



REPUBLIC OF SUDAN

جمهورية السودان

بإذن الله

وزارة البيئة والتنمية العمرانية

MINISTRY OF ENVIRONMENT & PHYSICAL DEVELOPMENT

مكتب الوكيل

UNDER SECRETARY'S OFFICE

Date 10th.02.2009
No. MEPD/GEF

التاريخ
الرقم

To: Dr.Rodne Cooke
Global Environment and Climate Change Unit
Programme management Department
International Fund for Agricultural Development(IFAD)

Subject: Endorsement for the Integrated Carbon Sequestration Project in Sudan

In my capacity as GEF Operational Focal Point for the Sudan, I confirm that the above project proposal (a) is in accordance with the government's national priorities and the commitments made by the Sudan under the relevant global environmental conventions and (b) has been discussed with relevant stakeholders, including the global environmental convention focal points, in accordance with GEF's policy on public involvement.

Accordingly, I am pleased to endorse the preparation of the above project proposal with the support of IFAD. If approved, the proposal will be prepared and jointly implemented by the Forests National Corporation and the Ministry of Environment and Physical Development. . Further, I request IFAD.to provide a copy of the project document for information of this office before it is submitted to the GEF Secretariat for CEO endorsement.

I understand that the total GEF financing being requested for this project is \$4,180,000 inclusive of project preparation grant (PPG), if any, and Agency fee (10%) to IFAD for project cycle management services associated with this project.

المقر : مباني رئاسة مجلس الوزراء سابقاً - شارع الملك نمر - تلفون: ٧٧٣٩٧٠-٧٧٤١٣٩ فاكس: ٧٧٤٠٥٨
Head Office : Mek Nimir Avenue , Khartoum , Sudan Tel.:774139 - 773970 Fax.: 774058

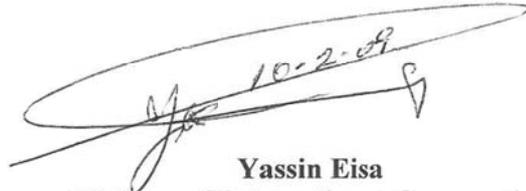
E-mail: (menviroment.sdn@hotmail.com)

I consent to the utilization of the following indicative allocations available to Sudan in GEF-4 under the GEF Resource Allocation Framework to cover the GEF project preparation and implementation as well as the associated Agency fees for this project..

Sincerely,



Dr Elfadil Ali Adam
Under Secretary Ministry of
Environment and Physical Development
GEF Operational Focal Point
Focal Point-Sudan



Yassin Eisa
Ministry of International Corporation
GEF Political

Copy to :Focal Point IFCCC



ANNEX 2
LETTERS OF COMMITMENT FROM CO-FINANCIERS (FNC)



Date/.....12/12/2011

...../التاريخ

NO/..... Forests/74/A/20

...../النمرة

Dear Ms Barbut,

**Subject: Proposed Climate Change Mitigation GEF grant
with the support of IFAD and FNC**

We have the pleasure to inform you that the Forests National Corporation (FNC) of the Sudan who will be acting as an implementing agency will co-finance the above mentioned project in the amount of USD 840,000. This GEF initiative fits very well within the work and expertise of FNC, which will support the implementation of this project.

This GEF initiative in Sudan is very important as it is part of the response to climate change and rural development in the Butana area, in terms of reducing net carbon emissions in the country through conservation of existing carbon stock, expanding the carbon stock, increasing the use of alternative energy sources, and increasing the soil organic carbon and the plant storage capacity.

We look forward to the implementation of this project - a first of its nature in the country - which will promote a climate-friendly rural development path in Sudan.



Dr. Abdelazim Mirghani Ibrahim
General Manager
Forests National Corporation

Ms Monique Barbut
Chief Executive Officer and
Chairman of the Global Environment Facility
Washington, D.C.

ANNEX 3: MONITORING AND EVALUATION PLAN

M& E Activity	Responsibility	Budget	TimeFrame
Inception Workshop (IW) and report	Project Coordinator/ IFAD	-	Within first two months of project start up
Training of project personnel and community in M& E	Relevant institutes Sahel Centre (SACIFT)	-	After the first two months of the project start up
Data collection and analysis	Project team at different levels and Communities	-	Following project IW and & E-training and subsequently all over the year
Information management and knowledge transfer	Project coordinator, M&E officer \ IFAD	-	Annually
APR and PIR	Project Team IFAD	-	Annually
Mid-Term Evaluation	Project team IFAD External Consultants (i.e. evaluation team)	US\$ 25,000	At the mid-point of project implementation
Studies and researches	Consultants	-	At start point and mid-point of project implementation phase
Final external evaluation	Project team, IFAD External Consultants (i.e. evaluation team)	US\$ 25,000	At the end of the project Implementation
Terminal report	Project team, IFAD External Consultants	-	At least one month before the end of the project

ANNEX 4

SOCIAL CARBON METHODOLOGY

1 Methodological concept

Social Carbon Methodology, as a tool, emerged to monitor qualitative and quantitative benefits of the Ilha do Bananal Carbon Sequestration Project in Brazil. It had to be capable of evaluating and integrating both tangible and intangible benefits according to a basic set of guidelines; effectively a tool that could offer strategic direction by focusing on the improvement of resources needed to achieve sustainable livelihoods. The underlying conceptual structure had to be capable of integrating projects/activities within local realities, with a focus on sustainable development.

The parameters of sustainable development, within the Social Carbon Methodology, use the definition of “sustainable livelihoods” originally developed by Chambers and Conway (1992) and later modified by Scoones (1998). The latter defines livelihood as access to capability, to assets (including material and social assets) and to the activities required for survival of the individual (Sen, 1990). A livelihood is sustainable when able to cope with and recover from stress and shock, whilst at the same time maintaining or enhancing individual capabilities and assets, both in the present and in the future, without depleting basic environment resources (Carney, 1998). Accordingly, the Social Carbon Methodology is composed of the following:

1. Basic guidelines that provide direction for community actions and initiatives. The basic guidelines are: community-centred, values people’s potential and resources, participatory, holistic, dynamic and flexible, focused on local and global issues, geared towards the analysis of biodiversity and ecosystems, geared towards problem solving and the search for sustainability, strives for social inclusion and recognizes gender issues and other issues of social inclusion, takes into account power relations and their political context.
2. A conceptual structure providing a panoramic view of the situation and that contributes several elements: perspectives, resources, strategies, threats and opportunities, political organizations and social relationships.

1.2 Basic Methodological Guidelines

The Social Carbon Methodology is based on the community’s point of view, respecting people’s opinions and aims to support the community in its search for means to meet their objectives and aspirations from a communal perspective. It values people’s potential and their

resources, not simply focusing on what is lacking but rescuing and valuing what they have and what they know, as well as their capabilities and releasing every individual's potential. It is a methodology that is participatory, holistic, dynamic and flexible, using a variety of means to stimulate participation, ensuring that people have influence at every step of the project or program, promoting and stimulating communities to take ownership of project assets and activities, and contributing via holistic analysis and focused intervention. It identifies impacts of global changes at the local level, stimulating everyone involved to analyse the bigger picture by considering the influence of institutions and policies in a way that builds perception of the political and social base, which can be strengthened or broken through partnership. It identifies ecosystems and the potential of biodiversity, locating areas of possible ecological tension and stimulating the use of traditional knowledge. It also values and promotes the long term and regular monitoring of fauna and flora. In addition, it is geared towards problem solving and sustainability by avoiding short term pressures and acting to prevent one person's sustainability becoming another's vulnerability. It also promotes social inclusion and recognizes gender issues by seeking equity in gender relations. It promotes improvement in the quality of life of the underprivileged through the reduction of social inequalities (gender, race, ethnicity, age, sexual orientation, religion, geographical position, etc.). Finally, it recognizes power relations and their political context, identifying existing power relations, seeking equity in those relationships, and finally promoting an exercise in citizenship and human rights by inserting political context into the discussion process.

1.2.1 Conceptual Structure of the Methodology

The methodology is composed of the following elements:

Perspectives, resources, strategies, threats and opportunities, political organizations and social relationships.

The perspective elements probe community wishes, their dreams and objectives, with the aim of creating a view of the past, present and future. Chambers and Conway (1992) define sustainable livelihood as a concept that integrates equity, capability and sustainability. Equity can be defined as the incorporation of relative income distribution, with greater equality and less discrimination in the distribution of assets, particularly in the cases of women and the less educated. Capability, as defined by Sen (1984), refers to a person's ability to attain certain basic qualities, including what they are capable of doing, how they cope with difficult situations or shocks, and how they use survival opportunities (Chambers and Conway, 1992). The authors define shock as impacts which are typically sudden, unpredictable and traumatic, such as fires, floods and/or epidemics. Stresses are defined as typically predictable, continuous and cumulative pressures such as seasonal food shortages. Capability can include access to food, income and assets with the last two divisible into tangible and intangible assets. Tangible assets can be identified as financial resources and stocks, while intangible assets are considered the

ability to claim and effectively access other sources. There have been several attempts to define sustainability since the classic formulation by Lester Brown in the 1980's (Santos, 2000) that defined it as the quality of actions that satisfy the needs and expectations of the present generation without diminishing the prospects of future generations.

It was Scoones (1998) who established a working system to investigate the degree of sustainability of a livelihood that could be applied at a range of different scales – from individual, to household, to community, to village, region or even nation, with sustainable livelihood outcomes assessed at different levels. By arguing that the ability to pursue different livelihood strategies is dependent on the basic material and social assets that people have, the author then identified four Resource types: natural, economic or financial, human and social capitals. The concept of Social Carbon includes the four Resource types defined by Scoones (1998) and incorporates two further resources: Biodiversity and Carbon.

Biodiversity Resource represents all the species, ecosystems and genes which make up the biological diversity of a given region. The relevant aspects of this component are the integrity of natural communities, human interaction and use of biodiversity, the degree of conservation, pressures and threats placed on native species and the existence of high priority conservation areas.

Natural Resource can be defined as the natural resource stock (soil, water, air, genetic resources) and environmental services (soil protection, preservation of the hydrological cycle, absorption of pollution, pest control, pollination, etc.) from where resources are extracted to generate a particular livelihood.

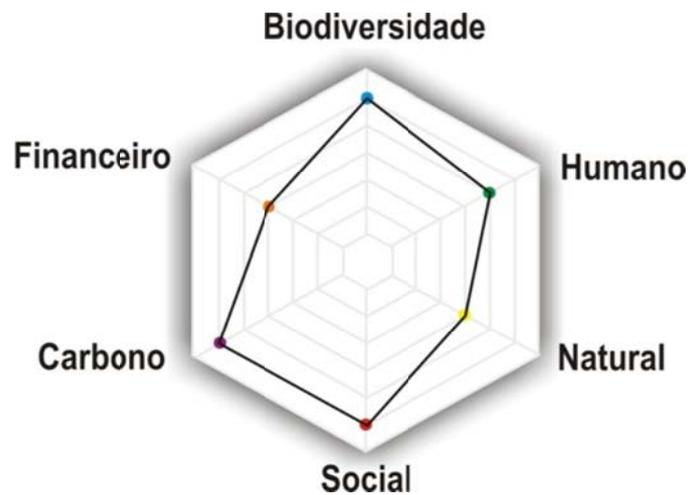
Financial Resource is defined by basic capital (money, credit, debit, savings and other economic assets) available to people and providing them with differing livelihood options, while Human Resource is, besides good health, the ability, knowledge and capacity for work. Altogether, these items are key to guaranteeing alternative livelihood strategies.

Social Resources (employment network, social claims, social relationships, personal relationships, association with social organizations) are the resources people seek when searching for an alternative livelihood and Carbon Resource refers to the carbon management strategy developed that could be carbon sequestration, substitution or conservation.

To conceptualise the Social Carbon Methodology (SCM) a visual representation has been created in the form of a hexagon that contains information on the assets that people have. The guarantee of a sustainable livelihood can be measured, for example, by increased quality of life, increased monthly income, reduction in risk and vulnerability, improvement in food safety and sustainable and better use of natural resources. However, these potential results can suffer interferences, such as people's desire to amass large amounts of financial resources denying others even the minimum and subsequently leading to unsustainable use of natural resources.

Interactions with biodiversity and the form of carbon management used can hugely influence the conceptual dynamic.

Figure 5: Social Carbon hexagon showing six different Resources and



As can be seen in Figure 1, the centre of the hexagon represents zero access to resources, while the external edge represents maximum access to resources. The diagram displays levels of resource access on a 0 to 6 scale. It is important, however, to take into consideration the relative levels of access that individuals have to different resources, as it is easy to hide problems such as gender and social issues, due to the difficulty in measuring intangible assets. Figure 1 shows that the shape of the hexagon changes according to changes in access to a resource.

The analysis of a single resource is insufficient. Social Carbon Methodology requires a holistic approach. In any community intervention project it is important to evaluate whether it can actually improve people's chances of developing skills and flexibility to allow a change in survival strategy over time. A survival strategy can be defined as the combination of activities and choices that people make to achieve a particular livelihood.

A hexagon with six resources can be useful in identifying the status of the community. However, there is a fragile interaction between assets/capitals and the ideal format of the hexagon. As a result, it is difficult to define the ideal combination of resource levels. In spite of this, the Social Carbon Methodology can improve the analysis of community access to different resources. A clear understanding of this can help in finding solutions to the lack of connection between public policies and the real requirements of communities, ensuring more harmonious and real sustainable development.

1.2.2 Social Carbon Resources

The Resources of Social Carbon are necessary to achieve sustainable livelihoods in the medium and long term, and are the means of assessing and monitoring the sustainability of a project and/or community. The six resource types that make up the Social Carbon Methodology are described below:

- Carbon Resource: activities undertaken that relate to social management of carbon, reforestation, systems of agro-forestry, conservation, etc., whether eligible under the CDM or not. To date reforestation projects are the only projects eligible, as carbon conservation projects are not eligible under the Kyoto Protocol (Krug, 2004).
- Biodiversity Resource: the project is in an area of extreme biodiversity or in an area important for conservation and/or biodiversity, an area with high numbers of endangered species, an area that has ecosystems of economic importance with high levels of anthropogenic activity.
- Natural Resource: reduction in rates of deforestation, maintenance of fishery stocks, improvement or maintenance of wildlife stocks and improvements in soil quality.
- Financial Resource: improvement in the ability to access credit and a high level of family savings.
- Human Resource: improvements in adult literacy levels, improvements in family professional capabilities, in particular improvement in technological knowledge and, in the case of farmers, improvement in agricultural knowledge and family health.
- Social Resource: increased participation in social organizations, increased numbers of community decision-makers, reduction in dependency on community representation institutions and local governments.

It is important to note that, when carrying out an analysis using the Social Carbon Methodology, resources registered in the community are not an end in themselves.

These indicators must be described and reported in conjunction with the benefits and impacts from the CDM/Voluntary Market projects and/or other climate change mechanisms. It is fundamental to understand local aspirations, the level of interference from policies, institutions and processes, to check community survival strategies, to define results to be attained and to place into context vulnerabilities to which the community is subject in order to identify specific contributions of the CDM project to those communities, whether positive or negative.

ANNEX 5
LOGICAL FRAMEWORK (OR RESULTS FRAMEWORK)

Narrative	Indicators	Means of Verification	Assumptions
GOALS	(Goal) % of increase in tons of carbon stock in the project area	-BIRD baseline	Continued political and economic stability
The project objective is to promote a climate-friendly rural development path in Central and Eastern Sudan by increasing the carbon stock and reducing net GHG emissions in the country, while at the same time sustaining rural development in the area	(Goal) % of decrease of net GHG emissions in the project area	Periodic reports	stable carbon trade market at the international level
	(Goal) # of persons receiving the project services by gender	Periodic reports	political support of climate change issues at the national level
	(Goal) # of stakeholders being aware on bio-carbon stock at the local and national level	Stakeholder survey	Communities in target area are willing to take an active role.
	(Goal)% of Increase in household asset base by type of household		
OUTCOMES			

Narrative	Indicators	Means of Verification	Assumptions
1-Afforestation and reforestation (A/R) activities successfully implemented and led to increased national carbon sequestration potential	1.a) # of ha of afforestation in sites with less than 40% canopy cover	Progress reports	forestry sector improved in the national economy
	1.b) # of communities/households participating in increasing national carbon sequestration potential through A/R	household survey	No extreme climatic events
	1.c) Baseline on A/R assessed	Progress reports	
			high level of community participation and political embargo
2-Forest carbon stock is maintained in the long run, through conservation and improved management including protection from causes of deforestation and fires	2.a) carbon stock\ tons\ha	Monitoring reports	Institutional stability
	2.b) # stakeholders involved in maintaining forest carbon stock in the long run.	Survey	Economic alternatives available

Narrative	Indicators	Means of Verification	Assumptions
3- Wide diffusion of highly efficient, biomass energy technologies as appropriate, is promoted in the project area using climate friendly incentives.			
	3a). use of LPG in 6,000 households	Progress reports	Cost sufficiently low
	3.b) use of improved wood stoves in 7,000 households	Progress reports	Cost acceptable to communities
4- Institutional and technical capacities for monitoring forest carbon stock and associated GHG fluxes are developed at the national level and awareness is raised at the local level about the role of forest and biomass carbon stock in climate change mitigation			

Narrative	Indicators	Means of Verification	Assumptions
	4.a) Monitoring system for measurement of carbon stock and associated carbon fluxes in place and fully operational, including baseline.	progress reports	Institutional stability
5- Project management	5.a) Project implementation on schedule (% of implementation)	PIR reports	harmony and mutual understanding of the main project implementers
		review reports	
		staff and community records	
OUTPUTS			
1.1- 10,000 ha increase of reforested area in sites with less than 40% of canopy cover	1.1.a) # of ha. Invested in afforestation in sites with less than 40% of canopy cover	-project progress reports	Good access to land for A/R
	1.1.b) Volume of increment carbon uptake	-household survey	Community stability
	1.1.c) Nurseries established	-staff records	
	1.1.d) Monitoring system in place	-state progress reports	
		-community organization reports	
1.2 Agro-forestry initiatives involving land less farmers are implemented	1.2a) # of land less communities involved in agro-forestry activities	Progress reports	Communities are interested in trying out alternative activities

Narrative	Indicators	Means of Verification	Assumptions
	1.2.b) Area under agroforestry	Monitoring reports	Enabling conditions for the communities exist
		Community surveys	
1.3-Improved water harvesting systems are defined and implemented to support successful A/R activities	1.3a) Area with water harvesting systems (ha)	progress reports	Enabling conditions exist
	1.3b) # of hafirs(reservoirs) and wells dug		Cost for communities is reasonable
	1.3c) # of water harvesting micro-catchments constructed		
1.4 Define suitable erosion control measures to be implemented in the A/R areas	1.4a) Study on erosion control measures completed	Document	
	1.4b) # and area of control measures implemented	Progress reports	Cost for communities is reasonable
2.1 Participatory forest management promoted as a way to protect the carbon stock from drivers of deforestation (illegal felling, over grazing, poor management, etc)	2.1a) # of community forests registered and managed by local communities in a participatory manner	-registration of the community forests at the FNC records	People have access to the responsible authorities

Narrative	Indicators	Means of Verification	Assumptions
	2.1b) # of community and home nurseries established	-community organization records	No land disputes, and land tenure security for community forest registration
	2.1c) # of seedlings produced		
2.2 Fire management system is improved and post-fire management plans are developed and implemented	2.2a) Fire Risk Management Plan elaborated	FRMP	Raised awareness of the need for controlling fire caused by farmers and nomads
	2.2b) # of fire lines opened	Progress reports	
	2.2c) # of fire brigades		
2.3-Long-term sustainability of biomass carbon storage potential increased	2.3a) increase in carbon stock by X tons per year	Monitoring reports	Growing conditions are reasonable
	2.3.b) Area of forest reserves increased by X%		FNC is able to establish reserve in a harmonious way
2.4 Forest micro-insurance schemes tested on a pilot base in 2 sites	2.4a) # of communities enrolled in forest micro-insurance.	-micro-insurance companies records	insurance companies accepted forests micro-insurance
	2.4b) # of micro ensured forests.	-household survey	
3.1- GHG emissions from biomass energy production at the community level reduced	3.1a) level of reduction of biomass energy use	-studies results	Alternatives proposed are viable and economical
3.2-The use of improved and modern	3.2a) # of improved and modern	-project progress reports	Supply issues can be resolved

Narrative	Indicators	Means of Verification	Assumptions
climate friendly stoves using alternatives energy sources is promoted to replace inefficient wood stoves	climate friendly stoves used in the project area (6,000 LPG).		
	3.2.b) # of households using improved wood stoves (7,000)	-staff records	
		-state progress reports	
4.1 - Enhancing national capacity to develop implement and monitor potential LULUCF projects including CDM, REDD or voluntary mechanisms	4.1a) # of baseline surveys and data collected on deforestation and forest degradation	Progress reports	
	4.1b) # of analysed and processed relevant time series data for monitoring land use change and carbon fluxes and stocks;	Monitoring reports	Technical capacity is sufficient
	4.1c) # of technicians trained in GIS		
	4.1.d) # of training and awareness raising events		
	4.1e) # of studies to generate data for better estimation of carbon stock changes and fluxes		

Narrative	Indicators	Means of Verification	Assumptions
	4.1f) # of MRV models established for carbon stock change and fluxes		
	4.1g) GIS tested for LULUCF monitoring		
4.2 - Enhancing local capacity to promote forestry awareness among the target group, and to develop, implement and monitor potential LULUCF projects			
	4.2a) #. of training sessions in awareness raising campaigns for communities and policy makers	Progress reports	
	4.2b) # of participants in training and awareness events	Project documents	participants are truly motivated
	4.2c) # of pilot projects on non-wood forest products		
5.1 FNC and BIRDP implements programmes and financial management systems that meet IFAD requirements	5.1.a) Project implementation on schedule	-staff records	harmony and mutual understanding of the main project implementers
	5.1.b) Website accessible	-state progress reports	

Narrative	Indicators	Means of Verification	Assumptions
		-community organization reports	
		5.1.1- midterm review report	
		5.1.2- supervision report	

ANNEX 6
PROJECT COST TABLES

Sudan
Carbon Sequestration Project
Table 1. Afforestation and reforestation activities
Detailed Costs

Unit	Quantities					Unit Cost (US\$)	Base Cost (US\$ '000)					Parameters (in %)			Summary Divisions		Other Accounts		
	2012	2013	2014	2015	Total		2012	2013	2014	2015	Total	Phy. Cont. Rate	For. Exch.	Gross Tax Rate	Component	Expenditure Account	Disb. Acct.	Fin. Rule	
I. Investment Costs																			
A. 10000 ha increase of reforested area /a																			
Define and map areas for A/R	day	15	-	-	-	15	250	3.8	-	-	-	3.8	0.0	0.0	0.0	ARA	CONS	CONS_DA	FNC (100%)
Carry out stratification of selected areas	day	20	-	-	-	20	250	5.0	-	-	-	5.0	0.0	0.0	0.0	ARA	CONS	CONS_DA	FNC (100%)
Define and assess the baseline	day	30	-	-	-	30	250	7.5	-	-	-	7.5	0.0	0.0	0.0	ARA	CONS	CONS_DA	GEF (100%)
Rehabilitation of up to four central /b	day	4	-	-	-	4	28.000	112.0	-	-	-	112.0	0.0	0.0	0.0	ARA	INV	INV_DA	FNC (100%)
Implement suitable, reduced tillage land preparation practices	lumpsum							40.0	90.0	75.0	55.0	260.0	0.0	0.0	0.0	ARA	INV	INV_DA	GEF (100%)
4000 ha of acacia	ha	-	2 000	1 000	1 000	4 000	140	-	280.0	140.0	140.0	560.0	0.0	0.0	0.0	ARA	INV	INV_DA	GEF (100%)
5000 ha of A. seyal mix /c	ha	500	1 500	1 500	1 500	5 000	110	55.0	165.0	165.0	165.0	550.0	0.0	0.0	0.0	ARA	INV	INV_DA	GEF (100%)
1000 ha of irrigated plantation /d	ha	250	250	500	-	1 000	205	51.3	51.3	102.5	-	205.0	0.0	0.0	0.0	ARA	INV	INV_DA	FNC (100%)
Establish a forest monitoring system	lumpsum							9.0	16.5	9.0	9.0	43.5	0.0	0.0	0.0	ARA	CONS	CONS_DA	FNC (100%)
Equipment for maintenance	lumpsum							-	-	-	13.3	13.3	0.0	0.0	0.0	ARA	EQ	EQ_DA	GOVT
Subtotal								283.5	602.8	491.5	382.3	1 760.1							
B. Agro-forestry initiatives																			
Awareness raising and technical capacity building	day	2	2	2	2	8	6.873	13.7	13.7	13.7	13.7	55.0	5.0	50.0	0.0	ARA	TRNG	TRNG_DA	BIRDP (100%)
Define suitable models for agroforestry	day	10	-	-	-	10	250	2.5	-	-	-	2.5	0.0	0.0	0.0	ARA	CONS	CONS_DA	FNC (100%)
Prepare implementation agreements	day	10	-	-	-	10	250	2.5	-	-	-	2.5	0.0	0.0	0.0	ARA	CONS	CONS_DA	FNC (100%)
Subtotal								18.7	13.7	13.7	13.7	60.0							
C. Improved water harvesting systems																			
Screen, assess and select suitable water harvesting techniques	day	10	-	-	-	10	250	2.5	-	-	-	2.5	0.0	0.0	0.0	ARA	CONS	CONS_DA	BIRDP (100%)
Develop site-specific contour maps	ha	1 875	1 875	1 875	1 875	7 500	14,15	26.5	26.5	26.5	26.5	106.1	0.0	0.0	0.0	ARA	INV	INV_DA	GEF (100%)
Investment in community water and livelihoods	lumpsum							2 250.0	2 313.8	-	-	4 563.8	0.0	0.0	0.0	ARA	CONS	CONS_DA	BIRDP (100%)
Subtotal								2 279.0	2 340.3	26.5	26.5	4 672.4							
D. Define suitable erosion control measure																			
Study erosion control	day	10	-	-	-	10	250	2.5	-	-	-	2.5	0.0	0.0	0.0	ARA	CONS	CONS_DA	GEF (100%)
Implementation of measures	ha	500	3 750	2 750	3 000	10 000	38	19.0	142.5	104.5	114.0	380.0	0.0	0.0	0.0	ARA	INV	INV_DA	GEF (100%)
Implement the selected water harvesting system	ha	500	3 500	2 500	2 500	9 000	80	40.0	280.0	200.0	200.0	720.0	0.0	0.0	0.0	ARA	INV	INV_DA	BIRDP (100%)
Community contribution to water harvesting systems at community level	lumpsum							44.8	313.0	238.0	238.0	833.8	0.0	0.0	0.0	ARA	CONS	CONS_DA	BIRDP (100%)
Subtotal								106.3	735.5	542.5	552.0	1 936.3							
Total Investment Costs								2 687.6	3 692.3	1 074.3	974.6	8 428.8							
II. Recurrent Costs																			
A. Project staff																			
Forest guards	pers_month	6	6	6	6	24	3,145.83	18.9	18.9	18.9	18.9	75.5	0.0	0.0	0.0	ARA	STF	PERS_DA	GEF (60%); FNC (40%)
B. Travel and per_diem	lumpsum							20.0	20.0	20.0	20.0	80.0	5.0	0.0	0.0	ARA	TPD	RPD_DA	GEF (100%)
Total Recurrent Costs								38.9	38.9	38.9	38.9	155.5							
Total								2 726.5	3 731.2	1 113.2	1 013.5	8 584.3							

^a in sites with less than 405 of canopy cover

^b communal nurseries

^c in the degraded forest bare land with community participation

^d in the degraded forest bare land inside forest reserves

Sudan
Carbon Sequestration Project
Table 2. Forest carbon stock /a
Detailed Costs

Unit	Quantities					Unit Cost (US\$)	Base Cost (US\$ '000)					Parameters (in %)			Summary Divisions		Other Accounts		
	2012	2013	2014	2015	Total		2012	2013	2014	2015	Total	Phy. Cont. Rate	For. Exch.	Gross Tax Rate	Component	Expenditure Account	Disb. Acct.	Fin. Rule	
I. Investment Costs																			
A. Participatory forest management																			
Define geographical boundary	day	20	-	-	-	20	250	5.0	-	-	-	5.0	0.0	0.0	0.0	FCS	NATTA	TA	BIRDP (100%)
Assess the forest biomass carbon stock	pers_month	9	9	9	9	36	5,625	50.6	50.6	50.6	50.6	202.5	0.0	100.0	0.0	FCS	INTTA	TA	GEF (100%)
Identify and assess all factors causing deforestation	day	30	-	-	-	30	250	7.5	-	-	-	7.5	0.0	0.0	0.0	FCS	CONS	CONS_DA	FNC (100%)
Prepare and implement forest management plans	day	-	343	343	-	686	250	-	85.8	85.8	-	171.5	0.0	0.0	0.0	FCS	NATTA	TA	BIRDP (100%)
Subtotal								63.1	136.4	136.4	50.6	386.5							
B. Long-term sustainability of biomass carbon																			
Revise forest policies and legislation	days	50	50	-	-	100	250	12.5	12.5	-	-	25.0	0.0	0.0	0.0	FCS	CONS	CONS_DA	FNC (100%)
Strengthen and raise institutional and community capacity	lumpsum							35.0	35.0	70.0	65.0	205.0	0.0	0.0	0.0	FCS	NATTA	TA	GEF (100%)
Monitor and prevent deforestation	lumpsum							-	23.7	23.7	23.7	71.1	0.0	0.0	0.0	FCS	NATTA	TA	FNC (100%)
Subtotal								47.5	71.2	93.7	88.7	301.1							
C. Forest micro-insurance chemes																			
Define property to be ensured	property	4	6	7	-	17	1,000	4.0	6.0	7.0	-	17.0	0.0	0.0	0.0	FCS	CONS	CONS_DA	GEF (100%)
Rainfed dry land forest	contract	2	2	2	2	8	3,000	6.0	6.0	6.0	6.0	24.0	0.0	0.0	0.0	FCS	NATTA	TA	GEF (100%)
Irrigated forestry	contract	2	2	2	2	8	3,000	6.0	6.0	6.0	6.0	24.0	0.0	0.0	0.0	FCS	CONS	CONS_DA	GEF (100%)
Special study on micro-insurance	day	30	-	-	-	30	273	8.2	-	-	-	8.2	0.0	0.0	0.0	FCS	CONS	CONS_DA	GEF (100%)
Subtotal								24.2	18.0	19.0	12.0	73.2							
Total Investment Costs								134.8	225.6	249.1	151.3	760.8							
II. Recurrent Costs																			
A. Prepare and implement post-fire management plans	brigade	5	10	15	20	50	200	1.0	2.0	3.0	4.0	10.0	0.0	0.0	0.0	FCS	STF	PERS_DA	BIRDP (100%)
Total Recurrent Costs								1.0	2.0	3.0	4.0	10.0							
Total								135.8	227.6	252.1	155.3	770.8							

/a is maintained in the long run through conservation and improved management

Sudan
Carbon Sequestration Project
Table 3. Diffusion of highly efficient energy technologies /a
Detailed Costs

Unit	Quantities					Unit Cost (US\$)	Base Cost (US\$ '000)					Parameters (in %)			Summary Divisions		Other Accounts		
	2012	2013	2014	2015	Total		2012	2013	2014	2015	Total	Phy. Cont.	For. Exch.	Gross Tax Rate	Component	Expenditure Account	Disb. Acct.	Fin. Rule	
I. Investment Costs																			
A. GHG emission from biomass energy production																			
Assess household and total consumption	day	60	-	-	-	60	250	15.0	-	-	-	15.0	0.0	0.0	0.0	PWDHE	NATTA	TA	BIRDP (100%)
Identify barriers and enabling factors for technology energy	day	120	-	-	-	120	250	30.0	-	-	-	30.0	0.0	0.0	0.0	PWDHE	CONS	CONS_DA	BIRDP (100%)
Address any potential barriers for dissemination	lumpsum							35.0	35.0	35.0	35.0	140.0	0.0	0.0	0.0	PWDHE	CONS	CONS_DA	BIRDP (100%)
Build technical capacity of the target groups	unit	-	40	20	20	80	2,500	-	100.0	50.0	50.0	200.0	5.0	50.0	0.0	PWDHE	TRNG	TRNG_DA	BIRDP (100%)
Distribute improved stoves	unit	1 000	2 000	2 000	2 000	7 000	30	30.0	60.0	60.0	60.0	210.0	5.0	50.0	0.0	PWDHE	TRNG	TRNG_DA	BIRDP (100%)
Establish monitoring system	lumpsum							50.0	25.0	-	-	75.0	5.0	50.0	0.0	PWDHE	TRNG	TRNG_DA	BIRDP (100%)
Subtotal								160.0	220.0	145.0	145.0	670.0							
B. The use of improved and modern stoves																			
Identify barriers and enabling factors for LPG tech.	lumpsum							15.0	-	-	-	15.0	0.0	0.0	0.0	PWDHE	NATTA	TA	BIRDP (100%)
Build technical capacity of local people	unit	5	5	5	5	20	15,000	75.0	75.0	75.0	75.0	300.0	5.0	50.0	0.0	PWDHE	TRNG	TRNG_DA	BIRDP (100%)
Prepare and disseminate appropriate measures	lumpsum							50.0	-	-	-	50.0	0.0	0.0	0.0	PWDHE	PUB	PU_DA	BIRDP (100%)
Define and use incentives /b	lumpsum							47.7	47.7	47.7	47.7	190.6	0.0	0.0	0.0	PWDHE	NATTA	TA	BIRDP (100%)
Develop and implement a system /c	unit	1 500	1 500	1 500	1 500	6 000	60	90.0	90.0	90.0	90.0	360.0	0.0	0.0	0.0	PWDHE	NATTA	TA	BIRDP (100%)
Subtotal								277.7	212.7	212.7	212.7	915.6							
Total								437.7	432.7	357.7	357.7	1 585.6							

^a is promoted in the project area using climate friendly incentives

^b to encourage tree planting and forest conservation

^c to use the project resources based on BIRD experience

Sudan
Carbon Sequestration Project
Table 4. Institutional and technical capacity for monitoring forest
Detailed Costs

Unit	Quantities					Unit Cost (US\$)	Base Cost (US\$ '000)					Parameters (in %)			Summary Divisions		Other Accounts		
	2012	2013	2014	2015	Total		2012	2013	2014	2015	Total	Phy. Cont.	For. Exch.	Gross Tax Rate	Component	Expenditure Account	Disb. Acct.	Fin. Rule	
I. Investment Costs																			
A. Enhancing national capacity /a																			
Training session for policy makers and technicians	day	1	1	1	1	4	6.873	6.9	6.9	6.9	6.9	27.5	0.0	100.0	0.0	ITC	INTTA	TA	GEF (100%)
Analysis and processing of relevant time series data	lumpsum							20.0	-	-	20.0	40.0	0.0	100.0	0.0	ITC	INTTA	TA	GEF (100%)
Test at the local level state of the art	lumpsum							10.0	10.0	10.0	10.0	40.0	0.0	0.0	0.0	ITC	CONS	CONS_DA	GEF (100%)
Establishment of a baseline and monitoring system	lumpsum							80.0	20.0	10.0	10.0	120.0	0.0	0.0	0.0	ITC	NATTA	TA	GEF (100%)
Subtotal								116.9	36.9	26.9	46.9	227.5							
B. Enhancing local capacity to promote forestry awareness																			
Plan and execute six awareness raising sessions /b	unit	2	2	1	1	6	10.000	20.0	20.0	10.0	10.0	60.0	5.0	50.0	0.0	ITC	TRNG	TRNG_DA	BIRDP (100%)
Plan and execute 20 training sessions for 120 technicians	unit	5	5	5	5	20	15.000	75.0	75.0	75.0	75.0	300.0	5.0	50.0	0.0	ITC	TRNG	TRNG_DA	BIRDP (100%)
Organize awareness-raiseng campaign at local community /c	lumpsum							20.0	20.0	20.0	20.0	80.0	0.0	0.0	0.0	ITC	COM	COM_DA	BIRDP (100%)
Training for development /d	lumpsum							20.0	35.0	20.0	20.0	95.0	5.0	50.0	0.0	ITC	TRNG	TRNG_DA	BIRDP (100%)
Subtotal								135.0	150.0	125.0	125.0	535.0							
Total								251.9	186.9	151.9	171.9	762.5							

\a to develop implement and monitoring potential LULUCF
\b RISK OF DOUBLE COUNTING
\c RISK OF DOUBLE COUNTING
\d of non wood forest products

Sudan
Carbon Sequestration Project
Table 5. Project Management
Detailed Costs

Unit	Quantities					Unit Cost (US\$)	Base Cost (US\$ '000)					Parameters (in %)			Summary Divisions		Other Accounts		
	2012	2013	2014	2015	Total		2012	2013	2014	2015	Total	Phy. Cont. Rate	For. Exch.	Gross Tax Rate	Component	Expenditure Account	Disb. Acct.	Fin. Rule	
I. Investment Costs																			
A. FNC and BIRDP implements programmes																			
Knowledge management	year	-	-	1	1	2	22.000	-	-	22.0	22.0	44.0	0.0	0.0	0.0	PM	NATTA	TA	BIRDP (100%)
Establish a dedicated project website /a	lumpsum							33.4	0.4	0.4	0.4	34.5	0.0	100.0	0.0	PM	INTTA	TA	BIRDP (100%)
Mid_term evaluation	lumpsum							-	25.0	-	-	25.0	0.0	100.0	0.0	PM	INTTA	TA	BIRDP (100%)
Final evaluation	lumpsum							-	-	-	25.0	25.0	0.0	100.0	0.0	PM	INTTA	TA	BIRDP (100%)
Project monitoring and evaluation	lumpsum							9.0	9.0	9.0	9.0	36.0	0.0	0.0	0.0	PM	NATTA	TA	FNC (100%)
Short-term consultant	lumpsum							11.1	10.0	10.0	10.0	41.1	0.0	0.0	0.0	PM	CONS	CONS_DA	GEF (100%)
Subtotal								53.5	44.4	41.4	66.4	205.6							
B. Equipment																			
Office equipment /b	lumpsum							8.0	1.0	1.0	1.0	11.0	5.0	80.0	10.0	PM	EQ	EQ_DA	BIRDP (70%); GEF (30%)
Software	lumpsum							15.0	-	-	-	15.0	5.0	80.0	10.0	PM	EQ	EQ_DA	BIRDP (25%); FNC (75%)
4 Wheel Vehicle	unit	1	-	-	-	1	55.000	55.0	-	-	-	55.0	5.0	80.0	10.0	PM	EQ	EQ_DA	BIRDP (50%); GEF (50%)
Pick Up Vehicles	unit	2	-	-	-	2	40.000	80.0	-	-	-	80.0	5.0	80.0	10.0	PM	EQ	EQ_DA	BIRDP (61%); GEF (39%)
Office space	lumpsum							20.4	20.4	20.4	20.4	81.6	5.0	80.0	10.0	PM	EQ	EQ_DA	BIRDP (25%); FNC (75%)
Communication devices	unit	9	-	-	-	9	200	1.8	-	-	-	1.8	5.0	80.0	10.0	PM	EQ	EQ_DA	BIRDP (25%); FNC (75%)
Farm tractors /c	unit	3	-	-	-	3	35.000	105.0	-	-	-	105.0	5.0	80.0	10.0	PM	EQ	EQ_DA	BIRDP (67%); FNC (33%)
Tractor accessories	unit	3	-	0.5	0.5	4	13.000	39.0	-	6.5	6.5	52.0	5.0	80.0	10.0	PM	EQ	EQ_DA	BIRDP (75%); FNC (5%); GEF (20%)
Subtotal								324.2	21.4	27.9	27.9	401.4							
Total Investment Costs								377.7	65.8	69.3	94.3	607.0							
II. Recurrent Costs																			
A. Project staff																			
National project manager	pers_month	1	1	1	1	4	13.482,14	13.5	13.5	13.5	13.5	53.9	0.0	0.0	0.0	PM	STF	PERS_DA	GEF (60%); FNC (40%)
Monitoring and evaluation officer	pers_month	1	1	1	1	4	11.235,11	11.2	11.2	11.2	11.2	44.9	0.0	0.0	0.0	PM	STF	PERS_DA	GEF (60%); FNC (40%)
Project State Co-ordinator	pers_month	2	2	2	2	8	6.741,07	13.5	13.5	13.5	13.5	53.9	0.0	0.0	0.0	PM	STF	PERS_DA	GEF (60%); FNC (40%)
Finance and adm officer	pers_month	1	1	1	1	4	11.235,11	11.2	11.2	11.2	11.2	44.9	0.0	0.0	0.0	PM	STF	PERS_DA	GEF (60%); FNC (40%)
Subtotal								49.4	49.4	49.4	49.4	197.7							
B. Annual operating costs	lumpsum							30.0	22.0	22.0	22.0	96.0	5.0	50.0	10.0	PM	OM	OM_DA	GEF (100%)
Total Recurrent Costs								79.4	71.4	71.4	71.4	293.7							
Total								457.1	137.2	140.7	165.7	900.7							

^a and a database on climate change

^b Computers, laptops and printers

^c These tractors refer to those already owned by BDA and FNC

Sudan
Carbon Sequestration Project
Disbursement Accounts by Financiers
(US\$ '000)

	The Government		GEF		BIRDP		FNC		Total		For. Exch.	Local (Excl. Taxes)	Duties & Taxes
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%			
1. Consultancy	-	-	167.0	2.5	6 283.2	95.9	102.4	1.6	6 552.5	44.5	-	6 552.5	-
2. Investment	-	-	2 309.5	64.7	899.0	25.2	360.8	10.1	3 569.3	24.3	-	3 569.3	-
3. Training	0.0	-	-	-	1 534.0	100.0	-	-	1 534.0	10.4	707.3	826.7	-
4. Technical assistance	-	-	701.0	36.9	1 061.6	56.0	134.5	7.1	1 897.1	12.9	368.4	1 528.6	-
5. Publication	-	-	-	-	52.5	100.0	-	-	52.5	0.4	-	52.5	-
6. Equipment	56.5	12.7	69.6	15.6	210.7	47.2	109.2	24.5	446.0	3.0	343.3	59.5	43.2
7. Communication	-	-	-	-	97.5	100.0	-	-	97.5	0.7	-	97.5	-
8. Personnel	0.0	-	199.7	57.8	12.8	3.7	133.2	38.5	345.6	2.3	-	345.6	-
9. Annual O&M costs	11.2	10.0	100.9	90.0	-	-	-	-	112.1	0.8	52.3	48.6	11.2
10. Travel and per-diem	-	-	102.3	100.0	-	-	-	-	102.3	0.7	-	102.3	-
Total PROJECT COSTS	67.7	0.5	3 650.0	24.8	10 151.2	69.0	840.0	5.7	14 709.0	100.0	1 471.4	13 183.2	54.4

Sudan
Carbon Sequestration Project
Components by Financiers
(US\$ '000)

	The Government		GEF		BIRDP		FNC		Total		For. Exch.	Local (Excl. Taxes)	Duties & Taxes
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%			
1. Afforestation and reforestation activities /a	13.3	0.1	2 477.5	24.8	7 045.3	70.4	464.6	4.6	10 000.7	68.0	30.0	9 970.7	-
2. Forest carbon stock is maintained in the long run /b	-	-	554.8	61.2	226.0	24.9	126.0	13.9	906.8	6.2	210.7	696.1	-
3. To promote wide diffusion of highly efficient /c	0.0	-	-	-	1 888.0	100.0	-	-	1 888.0	12.8	429.0	1 459.1	-
4. Institutional and technical capacity /d	0.0	-	252.8	28.5	635.1	71.5	-	-	887.8	6.0	318.5	569.3	-
5. Project Management /e	54.4	5.3	364.9	35.6	356.8	34.8	249.4	24.3	1 025.5	7.0	483.1	488.0	54.4
Total PROJECT COSTS	67.7	0.5	3 650.0	24.8	10 151.2	69.0	840.0	5.7	14 709.0	100.0	1 471.4	13 183.2	54.4

\a successfully implemented and led to increased national carbon sequestration potential

\b Through conservation and improved management including protection from causes of deforestation and fires

\c biomass energy technologies as appropriate

\d for monitoring forest carbon stock

\e achieving agreed objectives

Sudan
Carbon Sequestration Project
Expenditure Accounts by Financiers
(US\$ '000)

	The Government		GEF		BIRDP		FNC		Total		For. Exch.	Local (Excl. Taxes)	Duties & Taxes
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%			
I. Investment Costs													
A. Consultancy	-	-	167.0	2.5	6 283.2	95.9	102.4	1.6	6 552.5	44.5	-	6 552.5	-
B. Investment	-	-	2 309.5	64.7	899.0	25.2	360.8	10.1	3 569.3	24.3	-	3 569.3	-
C. Training	0.0	-	-	-	1 534.0	100.0	-	-	1 534.0	10.4	707.3	826.7	-
D. Technical Assistance													
International TA	-	-	281.0	76.3	87.4	23.7	-	-	368.4	2.5	368.4	-	-
National TA	-	-	420.0	27.5	974.2	63.7	134.5	8.8	1 528.6	10.4	-	1 528.6	-
Subtotal	-	-	701.0	36.9	1 061.6	56.0	134.5	7.1	1 897.1	12.9	368.4	1 528.6	-
E. Publication	-	-	-	-	52.5	100.0	-	-	52.5	0.4	-	52.5	-
F. Equipment	56.5	12.7	69.6	15.6	210.7	47.2	109.2	24.5	446.0	3.0	343.3	59.5	43.2
G. Communication	-	-	-	-	97.5	100.0	-	-	97.5	0.7	-	97.5	-
Total Investment Costs	56.5	0.4	3 247.1	22.9	10 138.5	71.7	706.9	5.0	14 148.9	96.2	1 419.1	12 686.6	43.2
II. Recurrent Costs													
A. Personnel	0.0	-	199.7	57.8	12.8	3.7	133.2	38.5	345.6	2.3	-	345.6	-
B. Annual O&M costs	11.2	10.0	100.9	90.0	-	-	-	-	112.1	0.8	52.3	48.6	11.2
C. Travel and per-diem	-	-	102.3	100.0	-	-	-	-	102.3	0.7	-	102.3	-
Total Recurrent Costs	11.2	2.0	402.9	71.9	12.8	2.3	133.2	23.8	560.1	3.8	52.3	496.5	11.2
Total PROJECT COSTS	67.7	0.5	3 650.0	24.8	10 151.2	69.0	840.0	5.7	14 709.0	100.0	1 471.4	13 183.2	54.4

Sudan
Carbon Sequestration Project
Components Project Cost Summary

	(Sd '000)			(US\$ '000)			%	% Total
	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange	Base Costs
1. Afforestation and reforestation activities /a	22 848.3	73.4	22 921.7	8 556.8	27.5	8 584.3	-	68
2. Forest carbon stock is maintained in the long run /b	1 517.4	540.7	2 058.2	568.3	202.5	770.8	26	6
3. To promote wide diffusion of highly efficient /c	3 185.8	1 048.1	4 233.9	1 193.1	392.5	1 585.6	25	13
4. Institutional and technical capacity /d	1 248.3	787.7	2 036.0	467.5	295.0	762.5	39	6
5. Project Management /e	1 193.9	1 211.3	2 405.1	447.1	453.6	900.7	50	7
Total BASELINE COSTS	29 993.8	3 661.1	33 654.9	11 232.8	1 371.1	12 603.9	11	100
Physical Contingencies	114.3	135.7	250.0	42.8	50.8	93.6	54	1
Price Contingencies	5 239.0	132.0	5 371.0	1 962.0	49.4	2 011.5	2	16
Total PROJECT COSTS	35 347.0	3 928.9	39 275.9	13 237.6	1 471.4	14 709.0	10	117

-
- \a successfully implemented and led to increased national carbon sequestration potential
 - \b Through conservation and improved management including protection from causes of deforestation and fires
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Sudan
Carbon Sequestration Project
Project Components by Year -- Base Costs
(US\$ '000)

	Base Cost				
	2012	2013	2014	2015	Total
1. Afforestation and reforestation activities /a	2 726.5	3 731.2	1 113.2	1 013.5	8 584.3
2. Forest carbon stock is maintained in the long run /b	135.8	227.6	252.1	155.3	770.8
3. To promote wide diffusion of highly efficient /c	437.7	432.7	357.7	357.7	1 585.6
4. Institutional and technical capacity /d	251.9	186.9	151.9	171.9	762.5
5. Project Management /e	457.1	137.2	140.7	165.7	900.7
Total BASELINE COSTS	4 008.9	4 715.5	2 015.5	1 864.0	12 603.9
Physical Contingencies	32.9	23.4	18.7	18.7	93.6
Price Contingencies					
Inflation					
Local	173.4	683.8	481.1	623.7	1 962.0
Foreign	5.5	9.8	12.8	21.4	49.4
Subtotal Inflation	178.9	693.6	493.9	645.0	2 011.5
Devaluation	-	-	-	-	-
Subtotal Price Contingencies	178.9	693.6	493.9	645.0	2 011.5
Total PROJECT COSTS	4 220.7	5 432.5	2 528.1	2 527.7	14 709.0
Taxes	37.7	4.8	5.8	6.0	54.4
Foreign Exchange	553.4	334.2	265.1	318.7	1 471.4

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Project Components by Year -- Totals Including Contingencies

(US\$ '000)

	Totals Including Contingencies				
	2012	2013	2014	2015	Total
1. Afforestation and reforestation activities /a	2 864.3	4 310.6	1 414.8	1 411.1	10 000.7
2. Forest carbon stock is maintained in the long run /b	140.6	256.5	309.1	200.6	906.8
3. To promote wide diffusion of highly efficient /c	464.4	497.7	444.8	481.1	1 888.0
4. Institutional and technical capacity /d	267.0	214.0	186.0	220.8	887.8
5. Project Management /e	484.4	153.7	173.3	214.1	1 025.5
Total PROJECT COSTS	4 220.7	5 432.5	2 528.1	2 527.7	14 709.0

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Sudan
Carbon Sequestration Project
Expenditure Accounts by Years -- Base Costs
(US\$ '000)

	Base Cost				Foreign Exchange		
	2012	2013	2014	2015	Total	%	Amount
I. Investment Costs							
A. Consultancy	2 454.3	2 722.8	315.0	308.0	5 800.1	-	-
B. Investment	343.8	1 035.3	813.5	700.5	2 893.1	-	-
C. Training	283.7	403.7	303.7	303.7	1 295.0	50.0	647.5
D. Technical Assistance							
International TA	110.9	82.9	57.9	102.9	354.5	100.0	354.5
National TA	302.7	317.1	364.1	273.4	1 257.2	-	-
Subtotal	<u>413.5</u>	<u>400.0</u>	<u>422.0</u>	<u>376.2</u>	<u>1 611.7</u>	<u>22.0</u>	<u>354.5</u>
E. Publication	50.0	-	-	-	50.0	-	-
F. Equipment	324.2	21.4	27.9	41.2	414.7	77.4	321.1
G. Communication	20.0	20.0	20.0	20.0	80.0	-	-
Total Investment Costs	<u>3 889.6</u>	<u>4 603.2</u>	<u>1 902.1</u>	<u>1 749.7</u>	<u>12 144.6</u>	<u>10.9</u>	<u>1 323.1</u>
II. Recurrent Costs							
A. Personnel	69.3	70.3	71.3	72.3	283.2	-	-
B. Annual O&M costs	30.0	22.0	22.0	22.0	96.0	50.0	48.0
C. Travel and per-diem	20.0	20.0	20.0	20.0	80.0	-	-
Total Recurrent Costs	<u>119.3</u>	<u>112.3</u>	<u>113.3</u>	<u>114.3</u>	<u>459.2</u>	<u>10.5</u>	<u>48.0</u>
Total BASELINE COSTS	<u>4 008.9</u>	<u>4 715.5</u>	<u>2 015.5</u>	<u>1 864.0</u>	<u>12 603.9</u>	<u>10.9</u>	<u>1 371.1</u>
Physical Contingencies	32.9	23.4	18.7	18.7	93.6	54.3	50.8
Price Contingencies							
Inflation							
Local	173.4	683.8	481.1	623.7	1 962.0	-	-
Foreign	5.5	9.8	12.8	21.4	49.4	100.0	49.4
Subtotal Inflation	<u>178.9</u>	<u>693.6</u>	<u>493.9</u>	<u>645.0</u>	<u>2 011.5</u>	<u>2.5</u>	<u>49.4</u>
Devaluation	-	-	-	-	-	-	-
Subtotal Price Contingencies	<u>178.9</u>	<u>693.6</u>	<u>493.9</u>	<u>645.0</u>	<u>2 011.5</u>	<u>2.5</u>	<u>49.4</u>
Total PROJECT COSTS	<u>4 220.7</u>	<u>5 432.5</u>	<u>2 528.1</u>	<u>2 527.7</u>	<u>14 709.0</u>	<u>10.0</u>	<u>1 471.4</u>
Taxes	37.7	4.8	5.8	6.0	54.4	-	-
Foreign Exchange	553.4	334.2	265.1	318.7	1 471.4	-	-

Sudan
Carbon Sequestration Project
Expenditure Accounts by Years -- Totals Including Contingencies
(US\$ '000)

	Totals Including Contingencies				
	2012	2013	2014	2015	Total
I. Investment Costs					
A. Consultancy	2 577.1	3 144.8	400.2	430.4	6 552.5
B. Investment	361.0	1 195.7	1 033.6	979.0	3 569.3
C. Training	306.9	463.2	370.2	393.8	1 534.0
D. Technical Assistance					
International TA	112.0	85.4	60.8	110.3	368.4
National TA	317.8	366.3	462.6	382.0	1 528.6
Subtotal	<u>429.8</u>	<u>451.6</u>	<u>523.4</u>	<u>492.3</u>	<u>1 897.1</u>
E. Publication	52.5	-	-	-	52.5
F. Equipment	345.3	23.5	31.5	45.7	446.0
G. Communication	21.0	23.1	25.4	28.0	97.5
Total Investment Costs	<u>4 093.5</u>	<u>5 302.0</u>	<u>2 384.3</u>	<u>2 369.2</u>	<u>14 148.9</u>
II. Recurrent Costs					
A. Personnel	72.8	81.2	90.6	101.1	345.6
B. Annual O&M costs	32.4	25.1	26.5	28.1	112.1
C. Travel and per-diem	22.1	24.3	26.7	29.3	102.3
Total Recurrent Costs	<u>127.2</u>	<u>130.5</u>	<u>143.8</u>	<u>158.5</u>	<u>560.1</u>
Total PROJECT COSTS	<u>4 220.7</u>	<u>5 432.5</u>	<u>2 528.1</u>	<u>2 527.7</u>	<u>14 709.0</u>

ANNEX 7

IDENTIFICATION AND ASSESSMENT OF A COST EFFECTIVE RISK MANAGEMENT PLAN : FIRE, OVERGRAZING, DEFORESTATION AND MICROINSURANCE.

Butana area of the Sudan lies between longitudes 330 to 360 East and latitudes 130 50 to 170 North with an average altitude of around 500 m above sea level. Butana is an extensive plain covering a total area of approximately 70 000 km². Geographically, the Atbara River and the Blue Nile represent the northern and eastern limits, and the Main Nile and Wad Madani Gedaref highway represent the western and southern borders of the Butana region. Administratively it includes parts of five states i.e. NahirElneil, Kassala, Gedaref, Gezira and Khartoum. The Butana is in the eastern region of the Sudan. It is inhabited by the Shukriya tribe. These groups follow a patrilineal segmentary system, which divides the tribe into six sections. These sections are further divided into expanded families with rights and obligations in pasture, water, and agricultural land. Grazing is communal for all members of the tribe, but wells are considered private and are generally controlled by the extended families. The Shukriya keep cattle, camel, sheep and goats (Ahmed et al. , 2004).

The population, in the Butana is estimated at 1 million. The average population density is 15 inhabitants per km², with the main concentration of people in the peripheral big settlements close to the irrigated areas, while the rest of the rural population is scattered in smaller clusters. Butana people are basically rural comprising over 80% of the population and depend on farming and pastoralism to secure their living. It is a diverse community with groups of nomadic herders, agro-pastoralists to sedentary farmers. The large influx of nomadic people from the neighboring states as well as the movements of the local inhabitants usually occurs during the rainy season for livestock grazing and watering. The household size is estimated at 7 persons.

Main potential risks associated with A/R activities in Butana region. Ranking of risks to A/R in Butana Area according to the likeliness of occurrence is (i) fires, (ii) overgrazing, (iii) deforestation and (iv) socio-political and community-based factors as related to natural resource management.

i. FOREST FIRES

In Ethiopia and South Sudan, fires destroy millions of hectares of land each year. Between 2000 and 2008, over 200,000 fires were reported in Sudan. It further stressed on fire prevention as one of the most effective counter measures, and on efficient fire monitoring which can help in early warning, intervention decision-making and measuring impacts (<http://www.mirayafm.org/>).

Types: Forest fires can be divided into three main classes: ground, surface and crown fires. In surface fires the ground vegetation is burnt and most woodland fires start in this way (James, 1966).

Causes. Forest fires are attributable to various causes. Badi (1999) indicated that forest and grassland fires originate from either natural and physical cause, or man. Fires may also be caused accidentally and by natural phenomena (Zaroug, 2006). Stauber (1995) states that natural fires seldom occur in the Sudan. Lightning usually is accompanied by rain and rarely starts fire. People cause essentially all of the fires in Sudan

The natural causes are very few and those are lightning, for which only one case was reported in the Sudan, bottoms of broken glass bottles or chips of same and silica crystals on the edges of grass blades. Lightning was reported to start a fire in a fuel depot in a forest reserve. Fires are believed to be started by glass chips or silica crystals concentrating the heat rays of the noon sun on the inflammable dry grass. Empty bottles are known to start fires in the conical roofed grass huts of the farming communities living along the banks of the Blue Nile (Badi, 1999).

Several human niches are responsible for starting fire in the Sudan. Classification of the fire incidents reported according to the niche of the culprit is shown in table (1).

1. Cover Letter
2. Request for CEO Endorsement Clean
3. Request for CEO Endorsement Tracked.Changed

Niche	Percent of the fire incidents
Farmers	36
Nomadic grazers	45
Deliberate criminal act	3
Travelers	13
Picnickers	3

Source: Badi (1999).

Other two important causes of forest fires in Sudan are poachers and honey collectors. Poachers are known to set the bush or grassland on fire to drive game into present traps or to hinder the advance of game scouts, while honey collectors kindle a small fire to generate smoke to drive the bees away from the hive.

Causes of forest and range fires in Sudan haven't been recorded historically. Table (2) shows list of the order of number of fires reported by cause (Stauber, 1995).

Uncontrolled burning is a serious threat to rangelands resulting in the consumption of 10-30% of the standing dry forage in different parts of the country. Destruction and removal of

vegetation resources by burning or cutting, beside their adverse effects in reducing available natural forage are major factors behind land degradation and desertification (Zaroug, 2006).

Fire hazard period. The dry season starts two to three weeks after the rains end in northern Sudan, i.e. November to April/May. Tall and short grasses are increasingly desiccated during the dry season. Increased wildfire hazard is associated with low humidity, high fuel loads and the presence of moving grazers. Annual wildfires are common and spread rapidly due to northeast winds and flat terrain. This is the case in central, western and southern Sudan. Repeated fires occur if the hot dry weather continues, i.e. late rains (Bayoumi, 1991). Repeated fires may be more destructive than intensive grazing because they deplete the seed bank in the soil.

The most hazardous situation for a plantation fire is where there are large quantities of fine, dry fuel which is more or less continuous on or near the ground, or up into the canopy.

The heavy growth of tall highly inflammable grasses is a characteristic of the low rainfall savannah region. Extensive areas of grassland in these open forests dry up quickly and immediately after the last rains in October which witnesses the first bush and grass fires for the season. Table (2) shows the distribution of the fire incidents according to the month of occurrence.

Table (2): Percentages of cause of forest and rangeland fire sin Sudan

No.	Cause	%	Potential cause
1	Grazing	30%	<ul style="list-style-type: none"> ▪ Nomads leaving cooking fires ▪ Burning to kill ticks and mites ▪ Burning to make the green vegetation more available ▪ Burning by villagers to remove feed for nomads
2	Smoking	20%	<ul style="list-style-type: none"> ▪ Travelers on the high ways tossing cigarettes ▪ Carelessness by forest users with smoking materials
3	Forest products gathering or harvest	13%	<ul style="list-style-type: none"> ▪ Charcoal making, both legal or illegal ▪ Gum tappers burning to make easier access ▪ Gum tappers disputes on assigned areas ▪ Honey gathering using fire to smoke out the bees ▪ Poachers using fire to prevent the guards from following them
4	Miscellaneous	13%	
5	Agricultural burning	12%	<ul style="list-style-type: none"> ▪ Burning field residues before planting ▪ Burning clearing materials that is too small for firewood
6	Incendiary (Arson)	8%	<ul style="list-style-type: none"> ▪ Fire set due to disputes with others ▪ Fires set by people who are not happy with assigned gum collection areas

			▪ Fires set for the “thrill” of watching a fire
7	Equipment fires	< 1%	
8	Natural causes	> 1%	

Source: Badi (1999)

Table(3): Temporal distribution of fire incidents

Month	% of fire incidents	Remarks
October	7	Winter starts, winds NE
November	23	
December	19	
January	6	Lowest winter temperatures
February	6	
March	16	Low relative humidity
April	13	High summer temperatures
May	10	Highest summer temperatures

Timing of forest and range fires in the Sudan. Badi (1999) further grouped fire incidents by cause and timing (table 4).

Table (4): Fire incidents caused by Nomadic grazers and

Quarter	Cause of fire (%)		Total
	Farmers	Grazers	
Oct./Dec.	25	25	50
Jan./ March	11	18	29
April/ June	14	7	21
July/Sept	0	0	
Total	50	50	100

Source. Adapted from Stauber (1995)

Most forest fires are reported during Oct. –Dec. quarter. Most of the fires attributed to nomadic grazers are caused by sheer negligence of cooking and campfires. In the meantime, the farmers are active in harvest, burn the crop residues to tidy up and to keep the grazers off their farms. In Jan./March, the grazers deliberately burn the unpalatable dry grass to encourage the regrowth of fresh green grass making use of the residual moisture in the soil. In Apr./June grazers settle down and content themselves with the bits of the remaining fodder and water resources. Most important is that farmers are active in land preparation of their farms for the rainy season. Fire is the main tool for the preparation of the ground for cultivation.

Risk of forest fires in the Sudan. Few fire problems exist on the irrigated forests, e.g. Eucalyptus in Gezira, and those in riparian forests, e.g. *Acacia nilotica* along the Blue Nile banks. The current applied management practices includes intermediate thinnings that leave little-if any- debris to act as a fire fuel. Forest reserves on drier lands such as Al Rawashda forest reserve in Eastern Sudan experiences recurrent fires.

Most forest fires originate on the range and pasture lands or farm lands near the forest. Damage varies from total destruction of young plantations to bark scorch of mature or semi mature trees, which may ultimately cause their death.

There is an incomplete set of statistics of fire incidence, timing, duration, severity and damage. A fire reporting system is needed. Table (5) shows the best estimates of the local staff members of the FNC.

Table (5): National Summary of Sudan Fire Statistical Reports

State	No. of fires	Hectares burned	% offeddans		
			Forests& woodlands	Range	Farm
1. Eastern Sector					
1.1 Kassala	0	0			
1.2 Gedaref	4	1000	100%		
2. Central sector					
2.1 Gezira	0.4	3	100%		
2.2 Sennar	0	0			
2.3 Blue Nile	1.6	2100	50%	50%	
2.4 White Nile	4	504	10%	80%	10%
3.Kordofan Sector					
3.1 Northern K.	No	REPORT			
3.2 Western K.	No	Report			
3.3 Southern K.	2	1933	100%		
4. Darfur Sector					
4.1 Northern D.	No	Report			
4.2 Western D	No	Report			
4.3 Southern	3	534	70%	30%	
Totals for reporting states	15	6, 074			

Management of fires under forest law of the Sudan: Various forest laws of Sudan included

Issues dealing with fire protection and management. Forests and Renewable Natural Resources act (2002 Act No.14), which is the latest law, includes in chapter three, subsection 37(1) among the prohibited Acts in Reserved Areas is (a) Lighting, setting, bringing or keeping fire. In chapter four, section (41) Public to report on the incidence of fires or forests and range offenses. It reads” Any person having any information relating to the existence of a fire in any reserved area or in its proximity or if he has information about the perpetration of forest and/ or range crime or the existence of such an intention, must communicate this as expeditiously as possible to the nearest forest guard or to any Omdda, traditional chief or head of locality”. In section (42) Public to assist in Extinguishing Fires. It reads “In the case of fire or of fire disaster or any other accident resulting into any danger due to threaten a reserved area or any assets therein, any person in the reserved area or in its proximity is bound to help the forest guard, policeman, any tribal chief, Omdda, dignitary, attorney general, judge or any civil servant who

asks for reasonable help in order to extinguish that fire or protect that asset from danger or loss. In case any of the above-mentioned people is not present, any person must do what he can in order to achieve the above-mentioned objectives”.

Fire risk in rangelands. The range and pasture administration has the most flammable lands to manage. Fires burn up to 60% of some ranges on an annual basis (Stauber, 1995). Table (6) displays fires on rangeland in Sudan. Table 6.shows Range and Pasture Administration National summary of Sudan Fire Statistic Report.

A plantation in the path of a grass fire will almost certainly change the fire's behaviour and, as a result, can either help or hinder fire control efforts. Shading in established plantations helps to reduce ground fuel loads by limiting groundcover plant growth and helping to retain fuel moisture. Wind speed is also reduced due to sheltering effects.

Fire risk in Butana area. There is a serious fire problem on the Butana range. Typically 35% of the rangeland burn each year (Stauber, 1995). This is particularly important as the expansion of mechanized farms leaves limited options for the nomads

Table (6): Range and Pasture Administration National summary of Sudan Fire Statistic Report

State	No. of fires	Feddan burned	% offeddans		
			Forests& wood lands	Range	Farm
1.Eastern Sector					
1.1 Kassala	3.4	6,900	9%	90%	1%
1.2 Gedaref	4.6	23,400	3%	97%	
2. Central sector					
2.1 Gezira	2.9	1,280			
2.2 Sennar	No	Report			
2.3 Blue Nile	No.	Report			
2.4 White Nile	Unknown	2000		100%	
3.Kordofan Sector					
3.1 Northern K.	No.	REPORT			
3.2 Western K.	No	Report			
3.3 Southern K.	6	2,690,0000		100%	
4. Darfur Sector					
4.1 Northern D.	No	Report			
4.2 Western D	No	Report			
4.3 Southern	10	70,131	26%	72%	2%
Totals for reporting	37	4, 731,711			

states					
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Source. Adapted from Stauber (1995).

A plantation in the path of a grass fire will almost certainly change the fire's behaviour and, as a result, can either help or hinder fire control efforts. Shading in established plantations helps to reduce ground fuel loads by limiting groundcover plant growth and helping to retain fuel moisture. Wind speed is also reduced due to sheltering effects.

Fire risk in Butana area. There is a serious fire problem on the Butana range. Typically 35% of the rangeland burn each year (Stauber, 1995). This is particularly important as the expansion of mechanized farms leaves limited options for the nomads.

Incidence of forest and range lands fires in Butana is a recurrent phenomenon as reported by 16% of the community. Fire has become a real threat to rangeland degradation and destruction (BIRDP, 2006b). Outbreaks of fires cause great losses to range resources.

Records of forest fires incidence in Sudan generally and Butana in particular are missing or incomplete. Three of the five states that accommodate Butana region responded to the survey. Table (7) displays forest fire incidence in Butana during the period 2001-2011 according to reporting states' FNC.

Table (7): Fire incidence in Butana during the period 2001-2011

State	Month/Year	Forest	Burnt area (ha)	Cause	Type
Gezira	2001	Abu Galfa	21	Unknown	Surface
	2003	Wadbagl	126	Unknown	Surface
	2004	Tamboul	4	Unknown	Surface
	2007	Zurga	53	Unknown	Surface
	2008	Zurga	18	Unknown	Surface
	2010	Alburaiga	125	Unknown	Surface
	2011	Tamboul	6	Unknown	Surface
River Nile	11/2011 ¹	Alhawad	504	Unknown	Surface
Gedaref	3/2003	Umseraig	1500	Unknown	Surface
	4/2005	Umseraig	3000	Unknown	Surface
Kassala	No records				

No available records for the period 2001-2010

Existing fire protection measures: The existing fire management measures adopted to prevent forest fires are (i) the opening of fire lines or firebreaks, (ii) use of prescribed burning and (iii) fire belts.

Opening of fire lines. A fire line is a strip of open land in a forest or a prairie to arrest the advance of fires. The land areas from which plants have been removed in order to avoid fire..

Fire lines constitute one of the best management tools under normal conditions that suit the majority of the range and grass land areas in Sudan. It is a traditional technique largely practiced by communities up until the last few decades. It is usually now performed by the Forest National Corporation (FNC) around all forests reserves and by Range and Pasture Administration (RPA).

Subsection 35 (c) of chapter three of the Forest and Renewable Resources Act (2002) states that on the publication of the reservation of an area, the Director General shall have to open fire lines, not less than two meters within the diameter of the reserved area.

The public forests or forest reserves are protected against fire by fire lines which are open traces along the reserve boundary. On the river banks, the *Acacia nilotica* forests are surrounded by 6-10 meter wide fire lines (Badi, 1999). Very wide fire lines (50 m) have been used to separate blocks of Eucalyptus plantations in the Khartoum green belt. The fire line is 20 meters wide for the forest reserves in the plains where the grasses are normally tall, burning with very high flames when they catch fire. Such high flames can easily cross narrow gaps.

Fire lines are annually opened immediately after the end of the rains. The operation is mechanized making use of the agricultural soil working equipment. In Sudan, firebreaks are usually built with motor patrol or a tractor and disc. A large crowned tree dragging behind a tractor is very adequate for the job (Badi, 1999). Camels dragging tree branches is another technique (Stauber, 1995).

Technically, opening of fire lines involves ploughing two surrounding border strips or buffer areas between which the grass would be burned. The resulting burned strip is usually called fire line. However, if the ploughing is well performed (until weeds are completely eradicated and wide enough to prevent the fire from jumping), then there will be no need for the second fire burning operation.

Fire belts. The objects of fire belts (belts of fire-resistant trees established at right angle to prevailing winds) is to provide an area which doesn't readily ignite. Fuel breaks (fire belts) consisting of teak (*Tectonagrandis*) were used in the south to protect fire-prone species (Bayoumi, 1991).

Prescribed burning. Prescribed burning is used in natural forests in western Sudan (Jebel Marra) and used to be practiced as early burning in southern Sudan. The use of backfiring for controlling wildfires is forbidden except for certain conditions and under control of

appropriately trained foresters (Bayoumi, 1991). In traditional agricultural areas, people and farmers are guided by extension workers to protect their villages and lands.

Burning is carried out for several reasons (Zaroug, 2006). To clean the land for cultivation; for re-growth of perennial grasses for grazing animals; to bring wild game into the open; to drive away bees so that honey can be collected from wild hives. Some of these fires are deliberately set by the nomads to induce fresh growth and sprout of perennial grasses early in the rainy season, while others accidentally start, while herders are cooking their food (BIRD, 2006b).

Developing Fire Risk Management Plan

In managing fire risk there is no substitute for good planning before a plantation is established. But if it hasn't already been done, now is the best time to produce your Plantation Fire Risk Management Plan.

The Plan would include a physical plan of the plantation showing firebreaks, access tracks, water points and turning areas as well as fuel-reduced and safe areas. It could be drawn on an overlay to an aerial photo or created through a computer mapping program. Details of strategic works and an on-going maintenance program are also essential parts of the Plan.

The components of Fire Risk Management Plan of A/R activities in Butana region are:

(a) Human resource development

- (i) Creation of fire prevention/protection committees from representatives of nomads, farmers and other local community sectors and project staff.
- (ii) Create /raise stakeholders awareness on risk of forest fires where the project will work closely with fire protection committees, local institutions and communities (i) to control the causes of forest fires (ii) to develop the necessity of providing help in extinguishing fires and (iii) to communicate the existence of a fire in any A/R area or in its proximity.
- (iii) Selection and appointment in consultation of local community structures of fire-fighting teams, provision of proper training and of appropriate fire-fighting equipment.
- (iv) Establishment of fire patrol structures including official and community forest guards supplied with appropriate communication devices

(b) Physical plans

- (i) Distribution of regeneration areas. Large areas of young plantations adjacent to each other should be avoided to reduce fire risk

- (ii) Siting of regeneration areas within the plantation site which imply distribution of annual regeneration on non-adjacent geographic locations
- (iii) Opening of wider fire breaks along the boundaries of plantations. ensure that a perimeter access track and firebreak is allowed for. The minimum width is generally 10 metres in irrigated plantations and 20 meters for rainfed plantations. Wherever possible, take advantage of existing fuel breaks such as roads. It would be advisable to have a wider fire line of 30 meters on the parts of the reserve most susceptible to fire. Wider line is of course safer but remove more land from production. The key point is that the firebreak must be continuously clear
- (iv) In larger plantations internal access tracks, generally a minimum of 7m wide, should also be provided such that each 40 -50 ha of plantation can be circumnavigated.
- (v) Delineation of greater fuel reduction sectors to be heavily grazed or slashed immediately after rains stop and removal of brash in fire danger areas
- (vi) Potential sources of ignition should also be considered and noted on the Plan. For example proximity to roads, use and characteristics of adjacent land, and the degree of preparedness of neighbours. Erection of fire danger notices and warnings
- (vii) Water supply: Water supply needs to be considered so as to ensure adequate water will be available in the event of a fire. While this is often not a problem on irrigated plantations where stock are generally catered for, ensuring access to it for fire trucks must be addressed.
- (viii) In rain fed plantations provision of water may only be accessed within the
- (ix) Erection of fire observation towers is only justified if the area of young woodland is considerable
- (x) Thick-barked trees withstand fire better than thin-barked

Special study. The absence of and poor record in number and contents of forest incidence records necessitates the need for special study to generate fire history of Butana area and then understand fire regime (fire extent, frequency, seasonality and intensity) in order to assess currently applied fire management activities and provide proposal for better integrated fire management. Create a model for the biomass burned of each fire. The study will depend on space technologies for mapping and analysis. There are four aspects of fires that need to be examined for best practice management, i.e. frequency, intensity, duration, and seasonality.

There remains however, an important prevention measure that can be rigorously assessed – local forest closures. Most forest fire management agencies restrict travel or the use of campfires in designated areas when fire hazard is extreme. Such measures can have a number of impacts, three of which are a reduction in people-caused fire occurrence, inconvenience to forest users and a loss in revenue to local tourist operators. Clearly, such impacts should be balanced but I am not aware of any published efforts to do so.

Post fire management: Post-fire forest management deals with the restoration of burned areas and with the opportunity for establishing more resilient forests and landscapes (COST, 2011). It includes active restoration techniques (plantation or direct seeding) and passive restoration techniques (Protecting areas from further disturbances). Accepted post-fire management techniques, for instance, are (Vera Serrão, 2010): minimizing erosion and its effects on aquatic systems, retaining adequate forest structure for fire-associated wildlife, capturing the economic value of the wood through post-fire timber harvests, minimizing the likelihood of an insect outbreak among fire-stressed trees, reducing the potential for a severe reburn and ensuring tree regeneration

After a forest fire, depending on the management objectives, the artificial regeneration of the burned areas is an often used management approach. Many species have the capacity to regenerate after fire, from seeds or through re-sprouting. If managers are able to take advantage of this natural regeneration of trees, the restoration of burned areas may be achieved with higher success and less costs. Post-fire activities focused on the improvement of primary access roads. Rehabilitation was also done on major firebreaks that impacted natural drainage and/or wetland vegetation communities on the Forest (Bethea, 2001)

After a fire it is standard practice to remove any timber from large burned trees with potential commercial value, leaving the burned branches in situ along with other burned vegetation of no commercial value, post-fire activities that are normally subsidized by the government (Universidad de Barcelona, 2011)

Specially for project A/R activities in Butana, post fire management includes restoration techniques that depends on natural regeneration specially for *Acacia seyal* crop which is enhanced by fire. Opening and maintenance of fire lines is a recommended operation.

ii. OVERGRAZING

In the Butana the household economy is based on an agro-pastoralist system of production where both livestock and crop production (sorghum) are practiced. The geographical location within this important grazing area, and pastoralist mobility patterns, determine the proportion in the herd of each animal type as well as the relative importance of livestock production and cultivation in the household economy (Babiker, 1997). Except for the southern edge of the region where enough rain prevails, the annual rainfall throughout much of Butana is too unreliable to provide better opportunity for farming and grazing under the current traditional practices (BIRDP,2006b).

The expansion of irrigated agriculture in the Butana (New Halfa and Rahad schemes) provides additional sources of water through the network of canals that supply crop land with

irrigation water. In a few cases water is transported by tankers to meet commercial herd requirements during the dry seasons, so that livestock will be able to utilize the large quantities of dry grass available in water deficient areas (Zaroug, 2006).

The carrying capacity of most of the rangeland areas in Kordofan, Darfur and Butana can hardly support the large number of livestock in the area (NDDCU, 2006). Table (8) shows estimates of livestock population in Butana area. Table (9) major land uses in Butana in 2000

Table (8): Livestock in the project area, based on estimated figures for 2008

Livestock in the RAP project area	Number of heads in dry season	Number of heads in wet season for settlers and nomads	Difference
Camels	180900	556500	308%
Cattle	40300	394950	980%
Sheep	126000	775000	615%
Goats	37900	144200	380%

Source: socio-economic survey, BDA, 2009) (IFAD, 2009)

Table (9): displays main land use types in Butana in 2000

Land Cover/ Land Use Name	Area in Butana Region (%)
Deciduous Woodland	0.02
Open Grassland with sparse shrubs	38.89
Sparse grassland	20.03
Swamp bush land and grassland	16.12
Croplands with open woody vegetation	5.37
Irrigated croplands	2.40
Bare soil	15.96
Water bodies	0.81
Cities	0.23
No data	0.17

One of the major problems of livestock production in the Sudan is the deterioration of its rangeland resources. Several factors have contributed to this problem, including over-grazing and the expansion of large-scale mechanized agriculture on marginal grazing lands. Moreover, drought and desertification have contributed to severe rangeland degradation (Ahmed et al. , 2004). Ayoub (1998) exhaustively examined the status of soil and vegetation deterioration in Sudan and documented that the relative contribution of overgrazing, over cropping, large-scale clearance of land and regular exploitation of natural resources around the perennial water resources by congregated population to soil degradation is respectively 47, 22, 19 and 13%. Most of the degradation is observed in the overpopulated arid and semi-arid zones, 76% of the population exist here. The estimate of the present annual rate at which land is undergoing degradation is 1.1% of the forest cover (Elagib and Mansell, 2000).

The Butana's climate and soils are suitable for agricultural production. Hence, the pastoralists suffer from large-scale encroachment of both irrigated and rainfed agriculture limiting their movement to marginal areas which are over-grazed. The establishment of irrigated and rain-fed mechanized agricultural schemes has blocked traditional animal routes and reduced grazing lands. The increasing numbers of livestock grazing in diminishing pastures, complicated by drought and desertification, have resulted in overgrazing, with concomitant conflict build-up. Other developments include further movement towards the south, creating a sense of resource-allocation awareness among nomads, competition over crop stalks after harvest in the different agricultural schemes, and introduction of protected pastures taking many forms, such as pasture enclosures, especially in Darfur (UNDP, 2006).

The Butana area as a whole suffers from overgrazing and over cultivation, and from problems resulting from the introduction of agricultural and agro-industrial projects using relatively advanced technology (Babiker, 1979). Overgrazing is the most prevalent cause of desertification in almost all over Sudan. This is especially so around water points and where water table is often lowered after increased or excessive use of water. Sudan with its rich livestock is vulnerable to desertification through overgrazing. This has led to the disappearance of some palatable species and replacement by non-palatable types in some rangelands in Western Sudan. Overgrazing is also evident along pastoral migration routes, which are increasingly becoming narrower and shorter (between 150 and 300 metres wide as compared to 2-4 miles during the colonial time) due to the uncontrolled expansion of mechanised farming.

In addition to the expansion of mechanized rain-fed farming, pastoralism in the Gedaref state has suffered from the establishment of large-scale irrigated schemes. In the 1960s New Halfa Scheme was established on area of 210,000 ha, thus cutting out a significant area of the Butana rangelands. Similarly, in the 1970s the Rahad Scheme was established within an area of 126,000 ha representing a further encroachment on the rangeland hitherto utilised by the pastoralists. In the case of New Halfa, pastoralists were partially compensated by the allocation of tenancies. Out of a total of 22,367 tenancies 29 percent were allocated for the resettlement of the Nubians, with remaining 71 percent distributed to various pastoral groups. However, the

majority of the pastoral tenants did not give up animal husbandry; rather, they combined pastoralism with irrigated farming. Overgrazing is also evident along pastoral migration routes, which are increasingly becoming narrower and shorter (between 150 and 300 metres wide as compared to 2-4 miles during the colonial time) due to the uncontrolled expansion of mechanised farming. To add insult to injury, the overgrazed rangelands and migration routes are taken by the opponents of mobile pastoralism as evidence that traditional herding is environmentally destructive.(Babiker, 2011)

The larger size of communities in Butana may explain, at least in part, the observed depletion of range and forest resources due to excessive extraction around settlements. The coping strategies to mitigate the impact of this situation on livestock is to resort to crop residues near schemes during the period October –July which entails a high cost of feeding. On the other hand more able individuals graze their animals far away from settlements and water them by tankers which indicates a somewhat advanced degree of commercialization (BIRDP. 2006a)

Land pressure increased and grazing by different livestock as water became continuously available. Cattle numbers increased and with the Gneid, Khashm El Girba Scheme and recently El Rahad, more animals were kept and grazing pattern changed and migration to the south was modified. The valuable grazing species of the Butana were virtually annihilated and destroyed. *Blepharisedulis* which has been recorded in a survey by Harrison and Baasher (1955), covering the area between Jebel Mundra and Suba'ah is no longer there. Vast areas of *Sehimaischaemordes*, the valuable grazing grass locally known as "dambalab", had been destroyed. Two other herbs distribution also either became limited or completely disappeared; namely, *Ipomeacardiosepla* and *Crotolariamaxilaris*. . The local people confirmed that the shortage of pasture both in quality and quantity was due to the recent invasion of other tribes. They added that the area of palatable plants has decreased and new unpalatable plants have now appeared in some areas, e.g., *Xanthium* spp (Ramtuk) and *Calotropisprocera* (Usher) (BIRDP, 2006a)

Due to the expansion of cultivation on traditional pasture land and the growing livestock number, the grazing and browsing intensity of livestock have increased. Overgrazing has seriously affected pasture quality and sometimes productivity. Livestock production faces serious feed resource problems. At present dry season feed resources form the major constraint to the number and productivity of livestock in this part of the country. The crop residue market is becoming lucrative in the dry season. In the wet season pressure on feed resources is, therefore, increasing and resulting in serious overgrazing of the most valuable rangeland. To add to the predicament of pastoralism, sorghum stubble is becoming more and more inaccessible to the herders due to its recent commoditisation. Access to harvested sorghum fields, however, does not come cheaply. In 2005, to keep 100 camels, for example on sorghum stalks from January to July, herders paid the equivalent of US\$ 4,000 and a household normally needs to sell three or four camels to pay for this privilege. Additional problems regularly occur just before the sorghum harvest when it becomes difficult for herders to prevent their animals

from damaging the crop. This is especially so in dry years when natural forage is quickly depleted, and it requires considerable labour to keep the camels away from the fields. The situation is exacerbated by the frequently random spread of cultivation, which often results in grazing areas being encircled by cultivated fields. Punishments and fines levied against crop damage are harsh. To overcome these difficulties, vertical expansion to increase fodder production in both quantity and quality was thought to be the way out.(Ahmed et al, 2004; BIRDP, 2006B)

Fire lines are used as a management tool in the dry season grazing areas. For the dry season grazing, it is envisaged that rotational grazing will be adopted, fire lines will be constructed, range improvement will be effected and even restriction on animal species and numbers may be enforced

DEFORESTATION

Deforestation and destruction of the ecological balance in the vicinity of many areas in the arid and semi-arid zones of Sudan have triggered an increase in the frequency and intensity of dust storms (Babikir, 1982; Goudie and Middleton, 1992). Middleton (1985) linked the dramatic increase in dust-storm activity in the Sudano-Sahelian zone of Africa to the prolonged drought that have been occurring in the region (Elagib_ & Mansell, 2000).

To date biomass energy is considered the most important source of energy in Sudan with wood fuel accounting to about 70% of the total energy consumption. The average annual per capita consumption is approximately 24.3 kg for rural households. Most of the institutions in the rural and semi-urban areas in Butana region are relying on wood fuel as the main source of energy for cooking.

The high dependency of Butana population on biomass-based fuels and inefficient technologies such as traditional stoves has placed greater pressure on forest resource in Butana area. Alredaisy and Zubair (2011) revealed that, tree logging for energy contributed by 40%, agricultural expansions by 30%, grazing by 20%, used as building material by 7%, other human uses by 2% and for manufacturing agricultural tools by 1%. Clear felling of trees for energy has been enhanced by population growth in Butana. This population consumes 740000 cubic meter of woody biomass annually. It was estimated that a family of 7 members consumes half a tree per day, 15 trees/month or 180 tree/year. The result of such a unsustainable utilization of forest resources is a continuous depletion of forest area. Increased use of energy efficient stoves and energy alternatives technologies is part of the Sudan Energy strategy of sustainable development and environmental protection.

Desertification, mobile sand dunes and land degradation are a problem in many places. Clear cutting of trees for various reasons such as making fences to store sorghum stalks for livestock is a common practice in the Gezira. In the River Nile some grasses that have sand

dune fixing qualities are removed to be used in onion sacks to prevent spoilage of onion. Moreover severe range degradation is apparent. It is attributed to overgrazing and absence of good management. The re-instatement of native administration, construction of fire lines, appointment of guards and strong protective legislations are suggested by communities (BIRD, 2006a).

Felling of trees for different reasons and the use of fuel wood energy are the causes of deforestation leading to desertification in forest areas. Alternative energy sources (solar, wind, biogas...etc) must be thought of if desertification due to deforestation is to be controlled. The use of butane gas as a substitute to biomass as a source of domestic energy has significantly improved the situation in this respect. The recently launched FNC Scheme (Ghabat gas) is really commendable. (NDDCU, 2006).

However, there is ample evidence that the establishment of large-scale mechanized farming on what once forest and pasture is destroying the environment due to unsound tillage practices (El-Tayeb, 1985; El-Tayeb and Lewandowski, 1983). By stripping away the vegetation cover with mechanized cultivation, the soil is laid bare to be carried away by water and wind erosion. The area of land left is generally less fertile and too small to sustain mobile pastoralism. Overgrazing has denuded it and the consequent change in vegetation has made the rangelands less than they were productive before (Babiker,).

One of the persisting consequences of the expansion of mechanized farming into former pastureland that took up momentum particularly in the 1970s, when the Rahad Scheme was established, has been increasing pressure of pastoralists on forest resources in Butana. This pressure has been partly due to the intensification of woodcutting serving demand for timber, charcoal, and fuel wood both on urban markets and on agricultural schemes. A main reason for increasing pastoralist reliance on forests for pasture is however the virtual disappearance of public grazing land in the vicinity of schemes, which has prompted not only pastoralists but also local villagers to move their livestock into neighboring forests until after the sorghum harvest (BIRD, 2006a). Table (10) below illustrates the dramatic changes in land use in the Gedaref state over the past 50 years.

Table (10): Changes in Land Use in Gedaref State, 1941-2002

Type of Use	Area 1941		Area 2002	
	Km ²	%	Km ²	%
Mechanised Farming	3,150	8.7	26,000	72.2
Forest and Rangeland	28,250	78.5	6,700	18.6
Hills and Watercourses	3,300	9.2	2,000	5.6
Wasteland (<i>kerab</i>)	1,300	3.6	1,300	3.6
Total	36,000	100.0	36,000	100.0

The nomads in the Butana area cut trees to build houses and animal enclosures or to use for firewood. They also use the green branches or the whole tree to feed their animals. The expansions of the rainfed agriculture in the Butana area from the south and the irrigated schemes have also reduced the area of the natural pastures (Elhag, 2006)

The abolition of the native administration system encouraged other nomadic tribes who were previously not allowed to intrude into Shukriya grazing territories, thus rendering the Butana to more open uses. As a result of these changes, more crop lands have been developed, and insecurity spread with increased livestock losses due to theft; destruction of water sources, especially hafirs; overgrazing and drop of pasture quality; and recent low animal prices in domestic and export markets (UNDP, 2006). In conclusion, land security is well acquired for cultivation land (wadi, ma'yat and terus). Landsecurity for the range is less evident given the open access nature of the range and the encroachment on rangelands by the expansion of the semi-mechanized schemes and large private investments (BIRD, 2006a).

iii. Ranking of risks of afforestation and reforestation

Based on the likeliness of occurrence and the adverse impact on natural and human resources, and on physical structures, fire is ranked first of the deriving factors of desertification, followed by deforestation and overgrazing. socio-political and community-based factors as related to natural resource management is a cross cutting factor.

iv. The potential of micro insurance of CSPS products

General insurance contract is a legally binding unilateral agreement between an insured and an insurance company to indemnify the buyer of a contract under specified circumstances. In exchange for premium payment(s) the company covers stipulated perils.

Elements of an insurance contract include (1) property covered, property excluded; (2) perils covered, perils excluded; (3) location covered, location excluded; (4) time period the policy is in force; (5) persons covered, persons excluded; (6) policy limits; and (7) coinsurance requirements.

Both micro-finance and micro-insurance need to be affordable in order to sustain the claim of providing low-cost financial services to low-income groups (ToonBullens, 2006). If micro-insurance is to succeed on a massive scale, costs have to come down considerably, plain and simple. That paves the way for greater affordability and, hence, social acceptance.

Crop and renewable resources insurance: Crop insurance is purchased by agricultural producers, including farmers, ranchers, and others to protect themselves against either the loss of their crops due to natural disasters, such as hail, drought, and floods, or the loss of revenue due to declines in the prices of agricultural commodities. Obviously there will be a role for traditional insurance products – such as property insurance of renewable energy projects. However, there will also be a role for specialized niche products. Unsurprisingly, the

uncertainty inherent in CDMs is reflected in the price – The discounts being applied to the forward purchase of CERs/ERUs, are significant – up to as much as 70%.

Takaful— Islamic insurance: As in microfinance there is a growing demand for Islamic insurance as well. The basic fundamentals underlying the Takaful concept include the prohibition to derive advantage at the cost of others and the spreading of both losses and gains over the insured community.

Insurance in the Sudan: Sudan has known insurance services since the first half of the last century. There are now 13 insurance companies in the country but their activities are mostly confined, more or less, to urban requirements. The inclusion of the agriculture sector was considered only at the beginning of the nineties of last century. The reasons being poor comprehension by the farmers of the crucial importance of crop insurance in an arid environment, reluctance of insurance companies to accommodate the sector in view of the magnitude of the hazards and the problems and obstacles that faced the sector, absence of reliable quantitative data to base actuarial evaluation of the physical losses to calculate premiums, possible indemnities, etc., reluctance of the policy makers to adopt insurance as a vital instrument for sustained agricultural development.

Crop insurance options: There are two options for crop insurance. One option is input-based or loss cost. Here the actual costs of production, which may or may not include harvest cost, are calculated and insured. If the plant is damaged at any stage during the vegetative growth the incurred costs are indemnified. If the damage is partial and the value of the harvested crop does not cover the production cost then the insured shall be indemnified the difference between the value of the harvested crop and the insured costs spent on production. This shall enable him settle all his liabilities and get ready for the following season. The other option is yield-based, insuring a certain level of harvest agreed by the insured and insurer. If the insured harvest is not attained wholly or partially the insured is indemnified according to the actual loss. He is to end by revenue equal to the value of the insured crop.

The practice in Sudan is to use the first option for all annual crops, such as Cotton, cereals, vegetable oils, vegetables and to use the second option for perennial crops such as Sugar Cane, fruit trees, Lucerne etc.

Insurances Companies in Sudan. Sudan economy was first exposed to Insurance industry in the early Twentieth century during the Condominium Colonization. This was limited to agricultural schemes i.e. Gezira Scheme and Foreign Trade. After Independence, the major players of this industry were branches of foreign companies, agencies and brokers. In 1971, this industry was completely Sudanized. In general, Insurance concept was well deep rooted in the Sudanese culture by native co-operative groupings whether in field of agriculture, fishery and cattle raising, throughout Sudan vast geographical area under the slogan of “One for All and All for One”. Some of the Sudanese companies working in this field are Sudanese Insurance &

Reinsurance Company Ltd. (SUDINRECO), The United Insurance Company (Sudan) Ltd., SHIEKAN Insurance & Reinsurance Co., WATANIA Co-operative Insurance Company and others.

MFIs and community Microfinance have to be made sustainable also without the use of interest in Northern Sudan. The dominant Islamic microfinance mechanism in Sudan is Murabaha, whereby the Microfinance Provider acquires the good for the client and lends it to the client. The client acquires ownership of the good only after repaying the purchasing price plus a service fee. In the rural areas, where people want to buy animals, instead of lending the money to the clients, the microfinance provider buys the livestock for them.

There are two types of Islamic finance: one principle is based on acquiring items and lending them after adding some charges. There is also Profit & loss sharing, but it causes a lot of problems in the informal sector. The second principle is totally built on trust. Islamic financial principles are built on principles, not on policies. In terms of consumer protection laws, there is a lot of confusion in Sudan about what the actual prices of some of these loans are. The cost needs to be transparent to the client. This affects both Islamic and non-Islamic Microfinance.

The potential of micro insurance of CSPPS. Shiekan Insurance & Reinsurance Co. Ltd. (SHIEKAN) was established in 1983 with the objective of covering all insurance aspects. As Sudan is basically an agricultural Country, agricultural insurance was given high priority. Shiekan in Sudan is a full Takaful insurance provider. 10 crops, including Cotton, Sorghum, wheat, groundnut, sunflower, gum Arabic, sesame, vegetables, legumes and corn have been covered.

Shiekan Ins. & Re. Company is the main player of agricultural insurance in the present time. The concentration was made on agricultural crops, so far, without any actual coverage for forestry products even within the conventional forestry production systems. The company in consultation with the FNC attempted to establish insurance coverage for gum Arabic (Acacia Senegal) trees. However, it hasn't finalized yet.

Some encouraging factors for adoption of MI of CSPPS are the interest of Shiekan Company and presence of the insurance policy. However, special study is needed to deliberate the issue in more details. Particularly issues related to estimation of cost of production, value of the tree crop and its appreciation over time during the project life, multi-peril sum and insurance premium, the adoption of Islamic Takaful insurance policy as related to carbon market and most importantly the awareness, organization and role of beneficiaries.

REFERENCES

- A.C.J. Bullens, A. Houtekamer – van Dam, S. Kadijk, 2006. Micro insurance providers: the insurance industry. Papers on Micro Insurance (Booklet) Source: ASKMI.
- A.C.J. Bullens, A. Houtekamer – van Dam, S. Kadijk. 2006. Micro insurance and micro finance. Papers on Micro Insurance (Booklet). Document 2. Source: ASKMI Author(s):
- A.C.J. Bullens, A. Houtekamer – van Dam, S. Kadijk. 2006. Micro insurance and development. Papers on Micro Insurance (Booklet). Document 3. Source: ASKMI
- Ahmed, Idris and Teka, T. 2004. Dryland Husbandry in the Sudan. In: Muna M. M. Ahmed, Mohamed Fadl Elmoula Idris and Tegegne Teka (eds). Workshop on Dryland husbandry in the Sudan. Grassroots Experience and Development. Sharja Hall 29-30, November 1995.
- Ali Darag Ali and El Sadig Yousif. The Savannah Rangeland of The Sudan. Workshop on Dryland Husbandry in the Sudan. Sharja Hall 29-30, November 1995.
- Babiker, A. B. A. G. Role of Rural Industries in the Arid and Semi-arid Areas of the Sudan. In: **J. A. Mabbutt (edit.)**. Research and Training for Management of Arid Lands with Special Reference to Anglophone Africa and the University of Khartoum. Proceedings of a Workshop Held at the Institute of Geography, University of Hamburg, Federal Republic of Germany 29 October-2 November 1979
- Babiker, Mustafa. 1997. Resource Competition and the Future of Pastoralism in the Butana Plain. University of Khartoum.
- Badi, K.H. Protection against fire in the low rainfall savannah region of the Sudan. 1999. Sudan Silva 28(8):38-48. Sudanese Forestry Society and Forest National Corporation. Khartoum, Sudan.
- Bayoumi, A.M.S. 1991. Fire Situation in Sudan. International Forest Fire News No. 25, July 2001, p. 115-117.
- Butana Integrated Rural Development Project (BIRDP). 2006a. Socio-economic profile of project area
- Butana Integrated Rural Development Project (BIRDP). 2006b. Agriculture, range and water development. Working paper 2.

COST.Post-Fire Forest Management in Southern Europe.FPS COST Action FP0701
<http://www.cost.eu/fps>. Last updated: 02 May 2011

Fath El Rahman Ahmed Mohamed, Husein Mustafa Mohamed and Yagoub Mohamed. 2004. Dryland husbandry in the Sudan. Grassroots Experience and Development.Projectdescription.Organisation for Social Science Research in Eastern and Southern Africa (OSSREA) and University of Khartoum.

<http://www.shiekanins.sd>. 2009. Shiekan Insurance & Reinsurance Co. Ltd.

<http://www.sol-sd.com/news/117/> Insurances Companies in Sudan.

James, N.D.G. 1966. The foresters' companion. Basil Blackwell. Oxford. Second edition.

John M. Bethea state forest (Baker County). Initial State Acquisition: April, 2001. Primary Watershed(s): Suwannee River; St. Mary's River

Mahgoub G. Zaroug. 2006. Country Pasture/ Forage Resources Profile- Sudan. FAO.

Muna Mohamed Elhag. 2006. Causes and Impact of Desertification in the Butana Area of Sudan. Thesis submitted in accordance with the requirements for the degree of Doctor of Philosophy in Agro meteorology. Department of Soil, Crop and Climate Sciences. Faculty of Natural and Agricultural Sciences.University of the Free State. Bloemfontein, South Africa.

Mustafa B. Mobile pastoralism and land grabbing in Sudan: Impacts and Responses. Paper presented at the international conference on the future of pastoralism. 21-23March 2011.University of Sussex and Feinstein international centre of Tufts University.

Mustafa M. Baasher. Dryland Husbandry in Sudan With Emphasis on the Semi-Desert Zone. Workshop on Dryland Husbandry in the Sudan.Sharja Hall 29-30, November 1995

Nadir Ahmed Elagib and Martin G. Mansell. 2000. Climate impacts of environmental degradation in Sudan. Geojournal 50: 311-327, 2000.© 2001 Kluwer Academic Publishers.Printed in the Netherlands.

National drought and desertification control unit (NDDCU). Sudan national action programme (snap) A framework for combating desertification in Sudan In the context of the united nations convention to combat desertification. Khartoum – march 2006

National Drought and Desertification Control Unit (NDDCU). Sudan National Action Programme (SNAP) A framework for combating desertification in Sudan In the context of the united nations convention to combat desertification. Khartoum – march 2006

Stauber, R. L. 1995. Consultancy report on forest fire management in the Sudan. Forest National Corporation and Food and Agriculture Organization of the United Nations.

The Ministry Of Justice. The Forests National Corporation. The Forests And Renewable Natural Resources Act. 2002. (2002 Act No.14)

ToonBullens, 2006. Challenges for micro insurance companies. Asian Knowledge Centre for Mutual Insurance (ASKMI). Document NO. 11.

UNDP, 2006. Nomads' Settlement in Sudan: Experiences, Lessons and Future action.

Universidad de Barcelona. Improving post-fire forest management to promote biodiversity in the Mediterranean ecosystems. Science Daily, 4 May 2011. Web. 17 Jun. 2011.

Vera Serrão. 2010. Fires in Portugal: Post-fire Management Lessons from the Pacific Northwest—World Forest Institute. 4033 SW Canyon Road Portland, OR 97221 USA. <http://wfi.worldforestry>