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Incentives for Reforestation and Forest's Plantations Option, under the National Strategy of REDD+Program in Sudan

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Abstract: The assignment worked on the direction of elaborating the efforts done in regard to afforestation and reforestation (A/R) programs carried out by Forests National Corporation (FNC), within its strategies and mandate, with special concern to the period from 1990 till 2017. The assignment builds upon, desk review to the related documents, in-depth data collection and analysis, formal and informal contact with concerned persons, observations, using excel spread sheet for data analysis, as well as SWOT analysis, coming out with findings that; Sudan is one of the low vegetation cover countries, of an annual removal to about 1.6 %. The current vegetation cover after south Sudan secession was highly decreased from 40% to only 10.3% of the Sudan total area, out of which 4.9 % is the reserved forests. To achieve the strategic plan goal calling to increase the forest cover up to 20% by 2032, an area of about 75 million feddan[1] must be targeted. Enhanced total cultivated area was achieved for the whole period (1990-2014) reached about 2877.2 thousands feddan, out of it about 2012.3 thousands feddan, community based plantation, while the official one is reported as 1429.8 thousands feddan for the whole 24th years. The promoted cultivation process, is attributed to the enhanced awareness and mainstreamed participatory approach due to the efforts done by FNC, funded projects, NGOs among others, as well as observed adoption of biomass energy alternatives, such as improved stoves and LPGs. The adoption of the 10% &5% policy in the agricultural lands is proved to be the best practice potentially enriched the forest cover. Increased annual planned targets, were recorded in the period from 1990 till 2018, as the A/R inputs were increased, consequently the annual targeted plantation area increased from 10,000 feddan in the eighteenth to 473,176 feddan in 2017, and up to 750,630 feddan in 2018 (within FNC annual budget) and up to 1 million feddan including funded projects, investment &others. Based upon this fact, the annually targeted area by FNC is far lag behind to reach the 20% goal. The key challenges identified and considered on the top of the drivers hindering plantation, is the lack of secured adequate mobilized fund in due time, along with the absence of national land use frame work or strategic plan to organize the land use system in a way that enabling each sector to satisfy their needs and priorities. On the other hand, many opportunities are available to accomplish the A/R programs, such as the vast unutilized lands, amount to about 41.1million

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[1] 1 Hectare= 2.38 feddan

feddans, coupled by availability of different water resources which will positively contribute to elevate the forest cover, if the called upon needed measures are in place. Future perspectives, incentives and innovative initiatives which will far foster the sustainability of the A/R programs, were suggested such as provision of meaningful incentives like cash payment to prompt the arid land forests users, in addition to provide them with essential services, such as irrigation water, land physical measures, energy alternatives, among others. Building upon the international/ national plans and strategies, the forestry sector has to set up, a realistic strategic plan, to push the reserved forests lands towards sustainable forest management, promoted A/R programs addressing crucially, required financial institutional and policy gaps, to better shape the process.

1. Introduction

The highest portion of Sudan area lies in the arid lands, which formed 89%, followed by the bare lands 8.2% and the smallest area of semi humid lands, of about only 2.8% {1}; according to FRA assessments, in the period from 1990-2015, the vegetation cover decreased before fifteenth to 40%, and to 36% in fifteenth, then to 27% in the thousands, and decreased to 10.3% (after south Sudan secession) {2}.

Land degradation& deforestation in Sudan, is attributed to the change of forest land to other land use purposes according to the national development projects, among others and the anthropogenic interference, as an example the impacts of displaced people and refugees who living neighboring or construct their houses inside forests. The Initial National Communication (INC) of Sudan{3} indicates that forests could play a vital role in carbon sequestration in the country, suggests that afforestation and rehabilitation of forests and rangelands are the most suitable options to achieve GHG emission reduction objectives in the country under the UNFCCC. Due to Rio Earth summit, it was agreed to adopt criteria and indicators for sustainable forest management (Chapter 11 of Agenda 21), for this purpose, FNC assigned a national task force {4} representing the forestry sector where a number of national standards and indicators (7 criteria and 65 indicators) for sustainable forest management in the country were approved, for all forest types in the country.

2. Assignment context under REDD+ strategy in Sudan

This assignment was prepared for Hassan &Tag consultancy, as one of the REDD+ Strategy options in Sudan. Reducing Emission from Deforestation and Forest Degradation; (REDD+) is a global mechanism to mitigate the climate change caused by forest loss or degradation. The preparation of the REDD+ strategy including the main activities' options {5}, to address the drivers of deforestation and forest degradation, proposed, but not limited to:

1) Substitute unsustainable fuel wood and charcoal with Liquefied Petroleum Gas (LPG); Increase the use of sustainable charcoal; Increase firewood efficiency; renewable energy production and grid infrastructure;
2) Increase gum Arabic production;

3) Forest conservation and sustainable forest management;
4) Reforestation;
5) Crop intensification and balanced livestock production.

Therefore, the context of this study, lies under the option (no. 4), shedding lights on the best practices in plantation activities to enhance the biomass carbon stock, for sustainable carbon sequestration and secured emission reduction. According to Hassan &Tag {6} the definition of Afforestation is: Conversion through forest tree planting from other land uses into forest, or the increase of canopy cover to the 10% defined threshold for forest as has happened in rehabilitation of mining sites. Reforestation is the re-growth of forests after a temporary (< 10 years) condition with less than 10% canopy cover due to human-induced or natural perturbations as has happened in refugee affected areas such as Migrih Forest in Gadaref State {6}. In general, Afforestation (A) is referred to the activity of establishment of forest stands in a bare/ deforested area, which is defined as the lands converted to other land use purpose other than forest, while reforestation activities (R) to be done in the degraded forests lands, where the soil and forest stands functions may be disturbed due to fires, over grazing, illicit tree cut, timber loss in harvest and so on. However, the A/R activities will lead to the enhancement of biomass carbon stock via increasing the forest cover and sustainable forest management, therefore support the development of Forest Reference Level (FRL), while Forest Reference Emission Level (FREL) will be developed concerning the reduction of emissions caused from forest degradation and deforestation, by calculating loss and gain, to help the adoption of needed actions such as strategies, policies and so on. It is very important to understand these terms, when implementing A/R plans under the REDD+ context.

3. Objectives of the Assignment

The objective of the assignment, is to identify the Afforestation and Reforestation regime, undertaken in Sudan by FNC and the best practices to be implemented within the A/R context, so as to contribute to the overall strategy to be developed for REDD+ Program in Sudan as an essential part of the Readiness preparation phase of REDD+.

4. Methodology

For the purpose of this assignment, a desk review was done as a range of secondary data collected from the government's bodies in the HQ and FNC at the states, FNC annual progress reports, REDD+ documents. NGOs, CBOs….etc. such as working papers, reports, inventories, and most available records of the previous funded

projects dealt with A/R were reviewed. Primary data was collected from some states through direct contact with FNC states directors (Annex 7), and observations during field visits, in addition to informal discussions.The collected data was organized and in-depth analysis, comparability was done using excel sheet, and SWOT analysis.

5. Analysis & Findings

Forests Types in Sudan

There are several classification systems to Sudan forests, such as reserve forests owned by FNC and other forests either communal, private or institutional forests.

Sudan forests were classified according to their ownership {7} as below:

A. Federal forests serve federal purposes such as protection of water dividing lines, preventing the spread of the desert and meeting Sudan's obligations towards international conventions.

B. State / local forests serving local / local purposes such as shelter and feed for wild and domestic animals and wood forest products such as wood, charcoal and non-wood products such as gums and fruits.

C. Institutional forests, which includes forests stands in agricultural schemes, and sugar company's forests, community forests, private forests that serve their owners and benefit them {8}.

The Sudan forests are classified also according to their functions {9} see "annex 1"

According to forest cover: Sudan forests were classified according to Harrison and Jackson {10} to three forest cover types as below : (see to Annex 2 for more details)

1) Closed broadleaved forests.

2) Open broadleaved forests.

3) Closed coniferous forests other wooded land shrubs.

According to type of growth: Natural: an example of significant natural stands is *Acacia seyal* & *Balanites aegyptiaca* in Dinder National Park {11}.Also riverine *Acacia nilotica* forests growing naturally along the Blue and White Niles. Semi natural stands, such as Acacia's trees in the Gum Arabic belt. In the wet lands the mangrove plants are found, along the Red sea coast (5.27Km) in form of pockets of an approximate area around more than 300 feddan in Tokar, Sinkat and Port Sudan circles. It is observed that, the majority of broad leaved forests were vanished or endangered and mostly, replaced by thorny trees like *Acaia sayal* and others; which was reported to be happened in different parts of Sudan, and as an example almigrih reserved forest[2], in Gadarif state.

[2] Afforestation Administration, field visits reports 2018, FNC HQ, Eastern states field visit report 2018.

Planation Forests: According to FOSA {13} plantations areas were found within forest reserves, established for reforestation or production, such as Riparian forests plantation, growing near the river banks e.g. Blue Nile banks, in addition to forest plantations in Jabel Marra cover about 180 thousands hectares {11}.

Outside reserved forests includes community and private plantations. Shelterbelts or wood lots, within the adoption of 10% and 5% policy {12}, in agricultural schemes, some are located in Gezira, Rahad and Suki, institutional irrigated plantation such as "Kenana sugar scheme" and (Halfa, Khashm Algirba, Guneid, Asalaya and Sinnar sugar companies). The main species grown for this purpose *is Eucalyptus spp* representing 5% of the total forest area, in addition to the plantation to reduce the pollution due to air or water like plantations in the petroleum areas such a plantation program carried in partnership between Khartoum refineries in Algaily and FNC at Khartoum state. Successful plantations were achieved through Bioremediation & forestry experiences[3] in some Petroleum Concessions with greater Nile Petroleum Company. For more details, see these projects reports and technical papers and FNC Khartoum state reports. However, tree species used in A/R are normally indigenous in areas of less than 500 mm rainfall and exotic in more humid or irrigated areas. Moreover, there are other forest classification in Sudan i.e. according to topography (Gerf, Dahara and Kerab), as well, according to the species (hashab forest, sunut forest, kafur plantation and mahogany forests.

6. Afforestation and Reforestation programs in Sudan

Forestry activities started in the Sudan exactly one hundred years ago and the Department of Wood and Forests was established in January 1902, for the protection and reservation of the natural stands of sunut in the riverine. A/R activities have been practiced in the Sudan since 1911. The annual area covered, ranged from about 5,000 to 10,000 feddan, during the period 1910-1950, increased to about12,000 to 73,000 feddan in the 1990s {14} see the increased rate in figure 1.

[3]The Forestry & Bioremediation Project based at FNC HQ

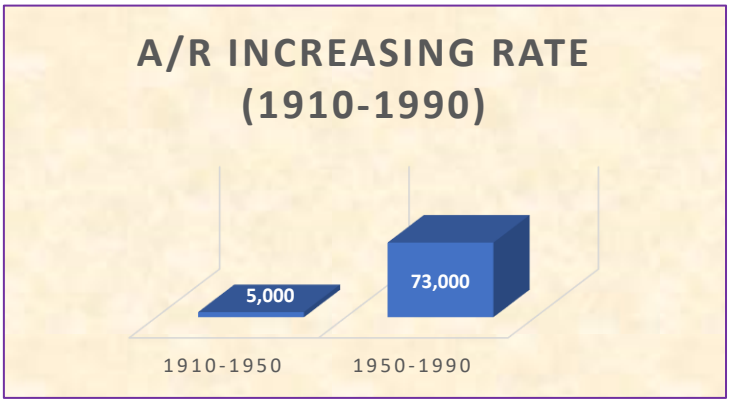

Figure 1: A/R Activities in the period 1910-1990

A/R activities, were on progress, up to the establishment of the FNC in 1989, and were highly accelerated by the implementation of many foreign funded projects such as, the fuel wood development, FAO funded project, Lower Atbara development by UNDP, SOS, UNSO, projects inter ilia, resulted in establishment of many community forests and A/R supported by the subsequent relevant legislation and policies[4] such as allocated area of 10% and 5% for forest trees, which considerably increased the forests cover. Furthermore promoted by issuing the strategic plans, calling to increase the forests cover {15}. However the achievement of A/R activities depends on the flow of the allocated financial resources, either from FNC annual budget, foreign funds, national development projects by Ministry of Finance &National economy (MOFNE), and other sources. The areas annually planted are by far below the strategic and policy targets. The constraint is always available funding {2}. A/R programs are usually carried out to cover the areas inside reserve forests[5] (restricted to FNC) {16}, and outside reserve forests, through partnership and supervision by FNC and some foreign funded projects implemented by FNC. Notwithstanding the above mentioned efforts in boosting forest plantations, yet the sustainability of these programs is rated as almost low, due to policies and many other deforestation drivers.

[4]The Investment Act of 1990 and the Ministerial Order 345/95 obliged old land proprietors to conform to the allocation of 10% and 5% for forest trees

[5] Forest reserves are all forest areas registered in the government gazette as Forest National Corporation assets. According to Badi et al

7. Live models of A/R in Sudan

In Sudan there are a lot of A/R models, which foster the partnership/participatory concept in forests management, executed via funded projects or/by other initiatives, inside and outside forests reserves. The most important A/R activities are done by refugee's projects, on purpose of rehabilitation of degraded lands affected by refugee's presence, funded by United Nation Refugee Agency (UNHCR) and implemented by FNC with others, in the period from 1984-1995, handed over for completely management by FNC, since 1996. The project sites cover areas lying in Gadarif, Kassala and White Nile states. The targets of these projects are plantation activities to rehabilitate and restock the degraded, inside irrigated and rain fed lands, successfully completed the silvicultural operations (tending); as the most important operation is the weeding process, which forms a success comparing with official annual plantation done by FNC. Almigrih forest in Gadarif State is considered as one of the success stories in adopting the proper weeding operation {17} which is annually targeted by an allotted area (for the area achieved see table 1). In addition, the projects provide other incentives such as energy alternatives including improved stoves, LPGs and solar energy units for cooking, which considerably enhanced the forest conservation. Other reported interventions include nurseries establishment; seedlings production 18}. Moreover, in the period (2005-2010), via a partnership with the River Algash training program funded by IFAD under Algash sustainable development project, the project succeeded to rehabilitate a degraded area of about 500 feddan which was replanted again by Dom palm & Sidir trees, after being deforested and invaded by mesquite {19}, which was considered as success in biodiversity conservation, protecting genetic resources of endangered species. More projects are shown in the underneath table "1" representing ongoing funded projects implemented by FNC tackling the A/R efforts:

Table1. Ongoing funded projects implemented by FNC tackling the A/R efforts:

Period	Project name	Targeted area/fed.	Achievement (area/fed.)	Location/ states	Main species
1984-2017[6]	Refugee's projects		83,000	Gadarif, Kassala, White Nile	A.senegal A. sayal
2015-2017	ICSP[7]	22,380	13,199	Gadarif and Gezira	A.senegal, A. sayal A. mellefra & Other Acacias
2015-2017	SSNRMP	41,412	37,700	Gezira, Kassala and White Nile	A.senegal, A. Sayal Other Acacias
2006-2017	Petro-energy bioremediation and forestrY PROJECT[8]		4,325	Petrol sites, Higlig, Moga & Ballela in Kordofan	A. Senegal in rain fed& other spp. With treated water e.g. Eucalyptus, Mahogany
Total			138,224		

Furthermore, the following selected models, may be of interest, form a real success:

Model 1/Shelter belts by adopting the 10 % and 5% in agricultural schemes {23}:

This plantation program was established in 1991, to serve the 10% policy, as an initiative from the local government and FNC, funded by many local institutions and banks, working up to date achieving a shelterbelt planted area of 101,949 feddan cultivated by Talih and Hashab. By now it is self-funded. It was evaluated as an outstanding plantation model deserve replication in the other states.

Model 2/ Community/Private forests:

The initiative of a woman private forest, which is located in Sinnar state, Alsoky circle, Aloo village, of an area about 24.7 feddan, managed by Haga bakheeta Adam Ishag. The legal status, indicates the clearance and registration of the land by the local authorities, see the ownership certificate in figure 3. She established this forest, in the year 2005 by firstly protecting the area, collecting the *Acaia nilotica* seeds from this wet land and selling them in the market (0.5 tons of seeds). Afterward upon communication with FNC office at the state, she was assisted by some *Acaia sayal* seedlings and seeds, in addition to the technical advice. Currently this private forest, after being well established with *Acaia sayala* & *Acaia nilotica* trees, is managed undertaking

[6] about 54,000 feddan in the period from 1999-2012
[7] See Annex 3
[8] See Annex 6

all the needed tending operations, such as thinning practice done in 2009, producing about 1,000 sacks of char coal.

The generated revenue from the selling of forests' products like seeds and fuel wood highly motivated the whole family to participate in the production and protection process {24}.

Model 3/North Kordofan innovative practice in Gum Arabic belt rehabilitation : { 25}

This practice was implemented, following a unique partnership between FNC at Kordofan state, World food program (WFP), Ministry of welfare & social insurance and the grass root societies, including small farmers.

Model 4/ Blue Nile Mannasy's forest : {26}

An agroforestry practice inside reserve forest, which indicates the positive role done by women who organized themselves in a women association and performed nice activities inside the reserve forest with a unique partnership and collaboration with FNC directorate (Annex 4).

Model 5/ Wad Elbasheer forest rehabilitation Gadarif state:

The good conservation of the forests by the nomads who are the forest's dwellers, that they managed their animal grazing and movement inside the forest and protect the new generation from being destroyed by uncontrolled grazing{27}.

Model 6/Nabag Forest-Southern Kordofan State:

This forest was completely rehabilitated by the community participation {28}.

Model 7/ Water harvesting for establishment of community forestry:

For over 10 years (1989-2001) at El Ain Forest reserve in North Kordofan SOS Sahel, in partnership with Forests National Corporation, was actively involved in tree planting for the rehabilitation of the degraded forest resources {28}.

Model 8/ Case Study: Rehabilitation of Rawashda and Wadkabou Forest, Gedarif State {29}

This case indicates best successful integrated partnership approach of tree planting for rehabilitation of Rawashda forest {29}. Moreover good management and successful tending operation was observed in Sawlail forest, Blue Nile state, planted with *Tectona grandis* as a successful model of good management, see underneath figure 2.

Figure 2. Blue Nile: Sawlail forest: *Tectona grandis* compartment as a successful model of good management

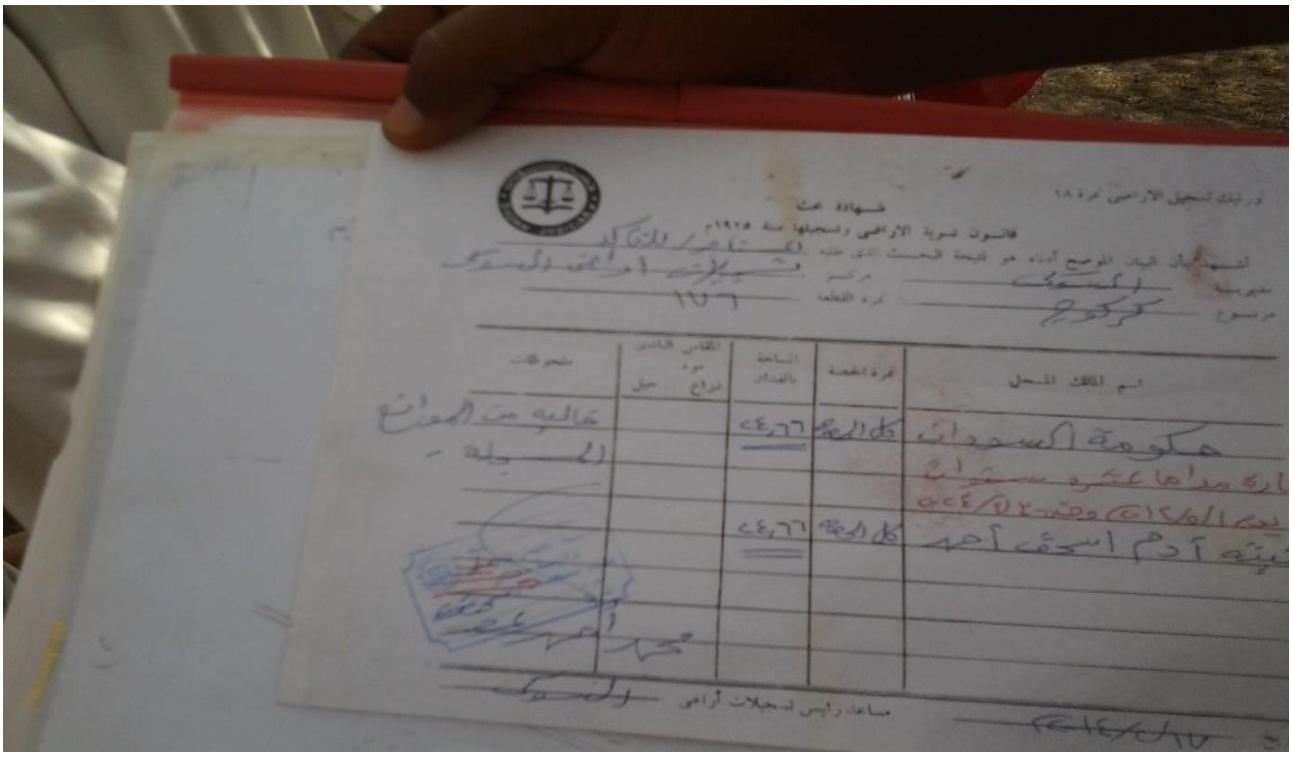

Figure3. Haga Bakheta private forest - Sinnar State holding her ownership certificates

Key outcomes from studies and funded projects, in relation to A/R in Sudan

Revitalizing the production and marketing of Gum Arabic project's studies recommended an inventory for the gum Arabic belt, assess the production capacity, to rehabilitate the Gum Arabic lands (Janaian Al-Hashab), to intensify the protection (through gum Arabic producers' associations GAPAs) and to enhance forests trees for sequestration purpose. One strong recommendation, by Gum Arabic project studies {31}: also extracted from other projects, called for the importance of provision of public services, particularly drinkable water, that will motivate people for further rehabilitation activities and settlement. Harmonizing the similar activities and creation links with related projects is also reported as a requirement, in addition to gender mainstreaming.

8. Results and lesson learned

The observations showed that, all the area planted and managed by refugee's project and other funded projects, is far better than that under the annual plan and budget of FNC, this is mainly due the weak budget allocated for the tending operation, critically the weeding operation which is very expensive and considered as the bottleneck of the plantation survival. It is approved that, the awareness creation for improved A/R, community based forest resources management approach, is in the top of each project mandate, with good consideration to gender. The efforts made by local communities in afforestation activities had resulted in an increased

plantations, as well as protection& seedling production by several folds, therefore, to continue invest in community participation will significantly contribute to attain the strategic target.

9. Plantation assessment along decades

1/Achievement of Sudan forests in the period from 1990-2014 (24 years)

Achievement in official and community planation in 1990 till 2014[9]

The achievement of the whole period of about 24 years "1990-2014", in regard to A/R activities, is presented in the below "table 1" indicating the increase in the plantations, averages and also stating that, the majority of area is rehabilitated by community efforts. The seeds amounts increased to about 2586.8 tons; seedlings production increased to about 134.4 million. Total planted area reported as about **2877.2** thousands feddan with annual average of ***119.9*** thousands feddan**,** the official plantation is reported as 1429.8 thousands feddan, with annual average 60 thousands feddan while community plantation highly exceeded it, raised to about 2012.3 thousands fed. with annual average 84 thousands feddan, with an obviously higher increase in the period 2010-2014,to about **1353.1** thousands feddan, with a five years average about 270.6 thousands feddan, illustrated in "figure 4".

[9] It worth to mention that, well arranged reports to a some extent can be found since 2002, yet the efficient data base management information system, to arrange and provide accurate verified data is still a challenge.

Table 2. Afforestation in reserve and community lands in the period from 1990-2014(5 years intervals for 24 years):

period	**Seeds /ton**		**Seedlings/million**		**Official A/R/Fed.**		**Community A/R/ fed.**		**Total A/R/fed.**
Years	Achievement	Annual average	Achievement	Annual average	Achievement	Annual average	Achievement	Annual average	
1990-1994	373	75	29.3	5.9	292.6	58.5	134.2	26.8	426.8
1995-1999	516	103	29	5.8	279	55.8	143.2	28.6	422.2
2000-2004	284	57	18.7	3.7	166.3	33.3	124.8	25	291.1
2005-2009	642	128	23.6	52.7	322.8	64.56	257	64.6	521
2010-2014	771.8	154	33.8	6.8	369.1	93.8	**1353.1**	270.6	1216.1
Total	**2586.8**		**134.4**		**1429.8**		**2012.3**		**2877.2**

Source: Aggregated from FNC progress reports[10] (2002 to 2016), FNC post south Sudan secession strategy, report to the ministry of cabinet 2017

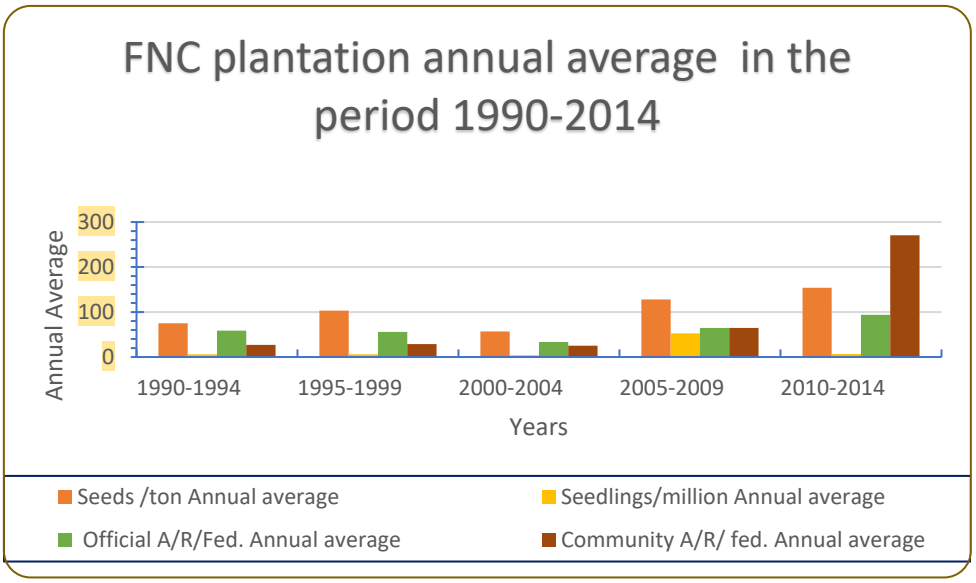

Figure 4: FNC plantation for 24 years in the period 1990-2014 Annual average (5 years interval)

2/Achievement in official and community planation from 2002- 2017

The below "table 2" shows the plantation trends inside and outside forest reserve per year in the period from 2002 to 2017, with about 83.786 million seedlings produced and about 2,147.22 tons of seeds collected. The area increased forming about 1,128.282 thousands feddan inside the reserve forest, and 2,485.05 feddan outside reserve forests, including the irrigated and rain fed areas by agricultural schemes, which were well11 recorded, in standalone column, amounts to 135.53 feddan, and 2,349.52 feddan with community, significantly performed observed contribution to enhance the forest cover to a total planted area amounted to 3,613.33 feddan, shown in figures 5, 6 &7.

Moreover a raised ambitions of plantation targets, by FNC, was observed, as the seeds collection annual planning targets increased from 12 tons to 70 tons during the eighteenth{9}, then up to 240 tons in 2017, and 323 tons in 2018 {32}; seedlings production increased from 2.6 million seedlings up to 9.930 million seedlings in 2017 and up to 11,911,000 seedlings in 2018, consequently the annual planned targeted plantation increased from 10,000 feddan to 358,288 feddan in 2017, and up to 750,63 feddan in 2018 {32}[12].

[11]Nevertheless some years were missed, A/R data collected from states when collected and organized, need a lot of care to avoid conflicts of figures, noted, upon the revision of FNC report 2017 A/R activities.

[12]Up to 1 million feddan with other sources

Table 3: Plantation inside and outside forest reserve per year in the period from 2002 to 2017

no	Year	Seeds /ton	Seedlings/ million	Plantation/'000" feddan				
				Official	Community	schemes(5%&10)	Sub total (community+5 %10%)	Grand total area
1.	**2002**	77	**5.1**	50.485	**128.5**	42.675	**171.18**	221.66
2.	**2003**	53	**4.2**	**24.4**	**10.5**	7.301	**17.80**	42.20
3.	**[13]2004**	57	**2.7**	29.764	**12.3**	1.200	**13.50**	43.26
4.	**2005**	66	**2.4**	**28.9**	**.13**634	2.531	**16.17**	45.07
5.	**2006**	92	**2.7**	**30.9**	**108**.14	0.940	**109.08**	139.98
6.	**2007**	150	**6.3**	75.473	24.995	9.462	**34.46**	109.93
7.	**[14]2008**	191	**5.7**	**104.245**	**.66**560	2.000	**68.56**	172.81
8.	**2009**	143	**6.6**	**59**.039	**72.2**13	10.450	**82.66**	141.70
9.	**2010**	147.7	**5.8**	**.55**629	214.198	1.0	**215.20**	270.83
10.	**2011**	161.12	**6.87**	**68**.01	**287**.557	2.587	**290.14**	358.15
11.	2012	98	7.2	106.267	96.3	3.500	**99.80**	206.07
12.	2013	215	6.391	64.1	89.4	0.500	**89.90**	154.00
13.	**2014**	150	7.5	75.5	161	9.000	**170.00**	245.50
14.	**2015**	**142**	**7.385**	**73**	**152**	13.820	**165.82**	238.82
15.	**2016**	**178**.3	6.94	**1**19.93	**48**2.6	15.140	**497.74**	617.67
16.	**2017**	**226.1**	**7.1**	**162.64**	**429.626**	**13.42**	**443.05**	605.69
Total		**2,147.2**	**83.786**	**1,128.28**	**2,349.52**	**135.53**	**2,485.05**	**3,613.33**

Source: FNC annual progress reports, General administration of planning, Information and statistics unit& Gadarif shelter belts &wind breaks fund report.

[13] Excluding Darfore states, due to conflicts.
[14] Increased planted area due to gum Arabic projects and green creeping project

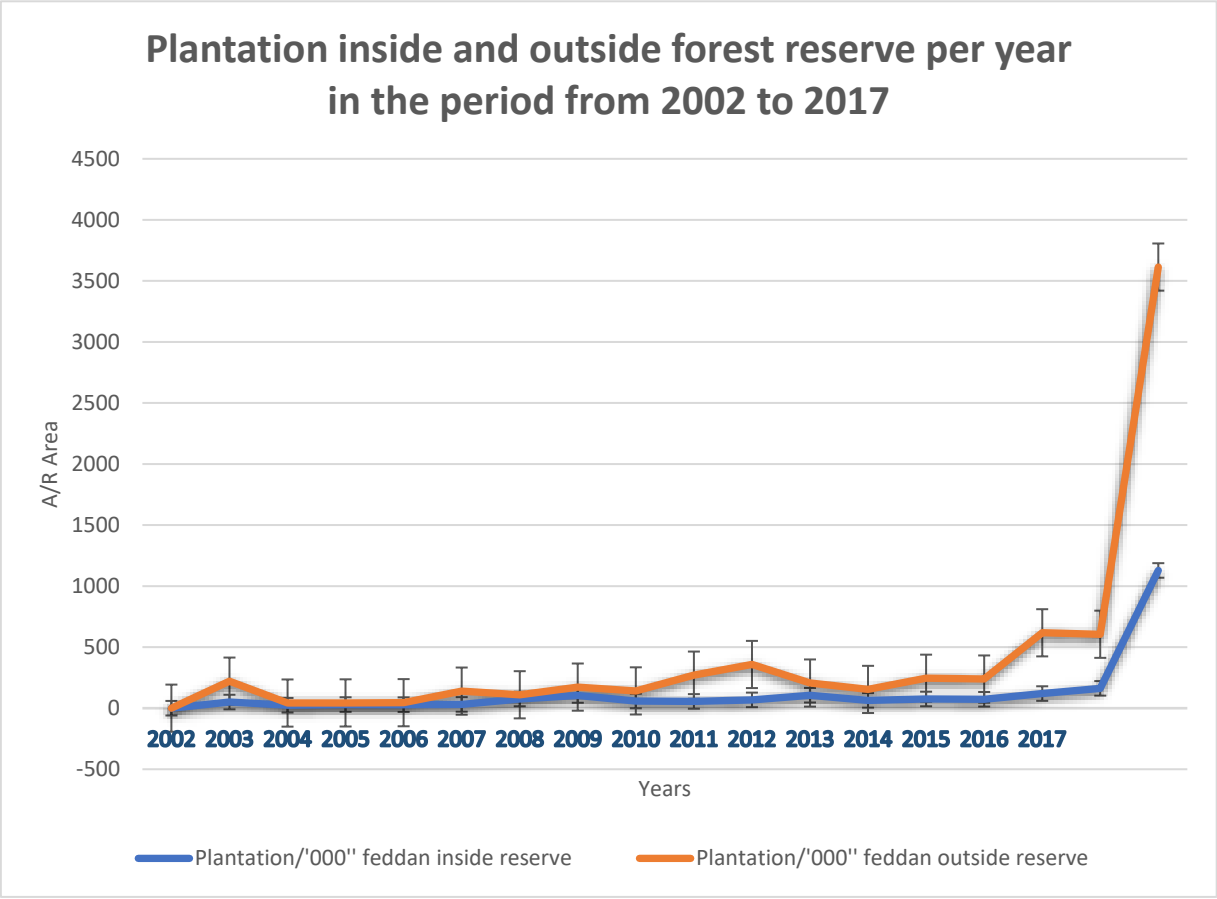

Figure 5. Plantation inside and outside forest reserve per year in the period from 2002 to 2017

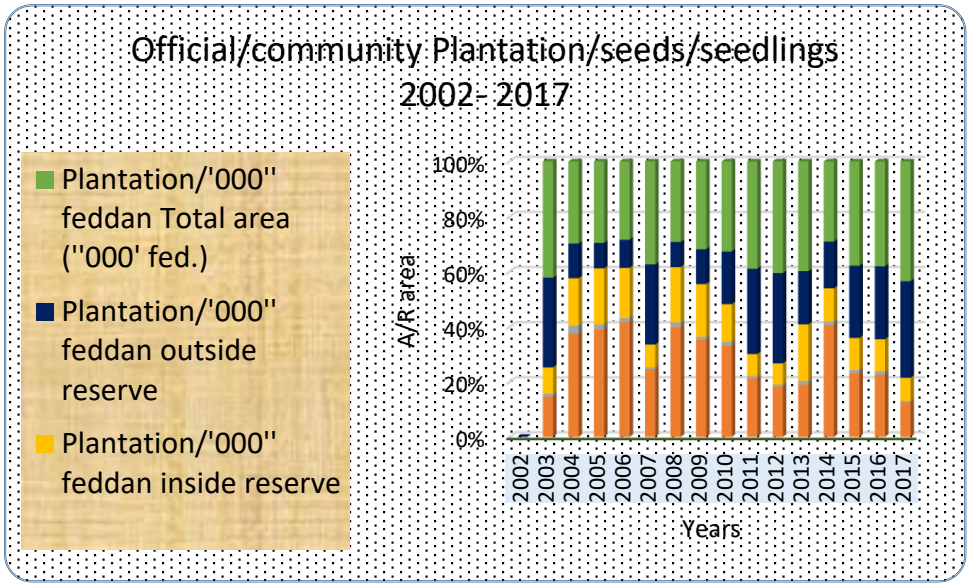

Figure 6. Plantation inside and outside forest reserve /seeds/ seedlings (2002 to 2017)

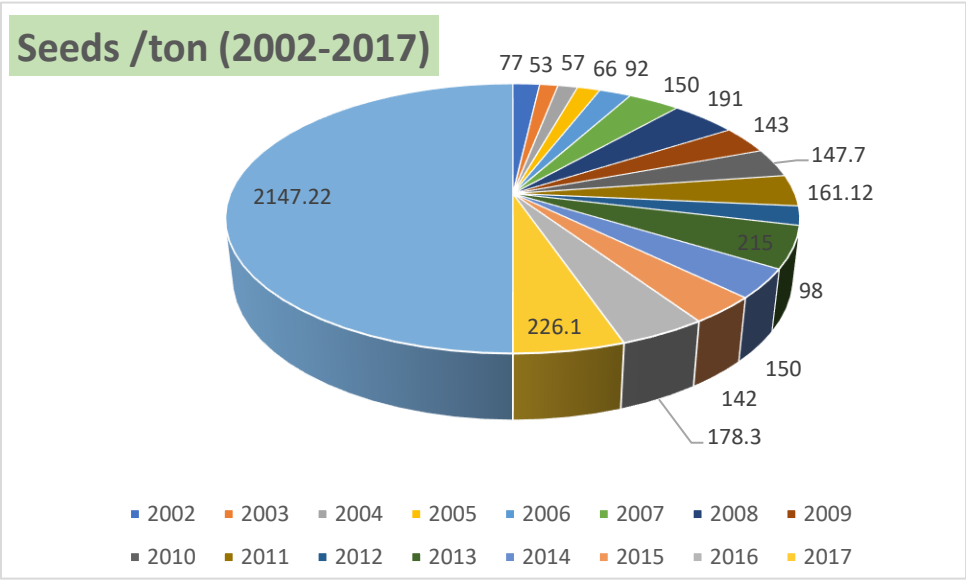

Figure 7. Seeds/tons per year in the period from 2002 to 2017

FNC Efforts in community participation:

The implementation of A/R supported by adoption of conservational nature policies, was highlighted within the issued regulatory acts in 1908 and 1917, through the enhancement of people participation in forestry activities, {7}. Community forests are well developed in the northern part of the country as a collaboration

between rural people and Forest National Corporation {11}, as well as private forests. FNC endeavored to enable the communities, to take part in the plantation activities, inside forests' reserves, which was galvanized and maintained momentum during the first establishment of an extension department in the year 1987 in FNC[15], leading to a significant shift and highly accelerated, the local governance adoption as fostering modality, which enabled local people to participate in both tree planting and conservation process, inside reserve forests as well as encouraging them to establish and register their own community forests. FNC continued to provide extension services and technical assistance though its extension offices at the state and HQ. An integrative practice is implemented inside reserved forests, by engaging communities and small farmers in the plantation process, cultivating their agricultural crops with forest trees (Taungya) {29}. This modality proved to be a meaningful option that will leverage degraded areas rehabilitation process to the target, bearing in mind the high cost and the limited annual budget secured from FNC own financial resources for this activity. Currently it is implemented in many states, such as in Gezira state in Almatama forest among others in Sinnar state, Blue Nile (Annex 4). *In the period (1994-1999),* according to {11}, a total community forests land of about 3,014, 97 million feddans were established in the Sudan's five sectors, see Figure 8 while "Figure 9" below indicates that the community plantation lands reaching a percentage of (69%) considerably exceeding official one forming only (31%) during the years 2002-2017

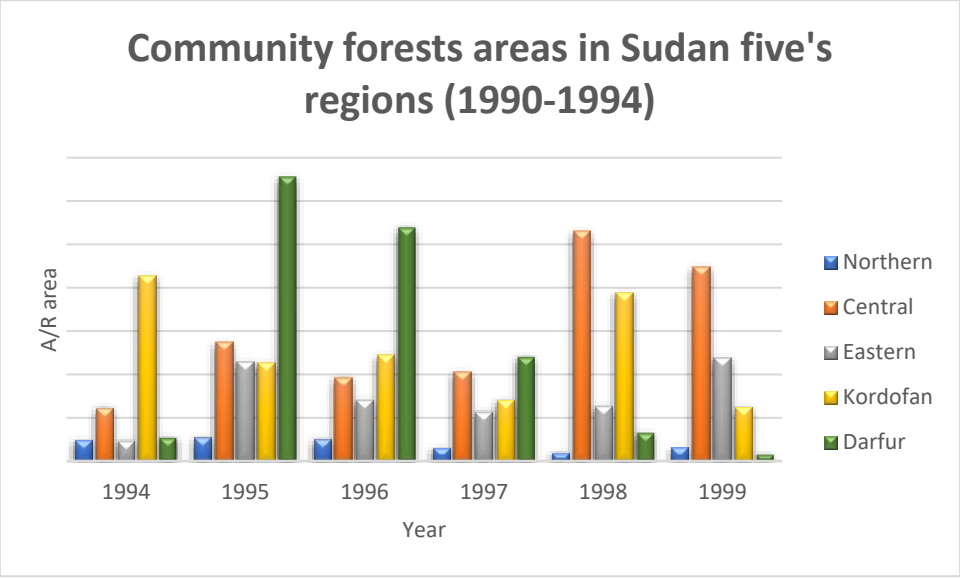

Figure 8. Community forests areas in Sudan five's regions (1990-1994)

[15] By the fuel wood development project

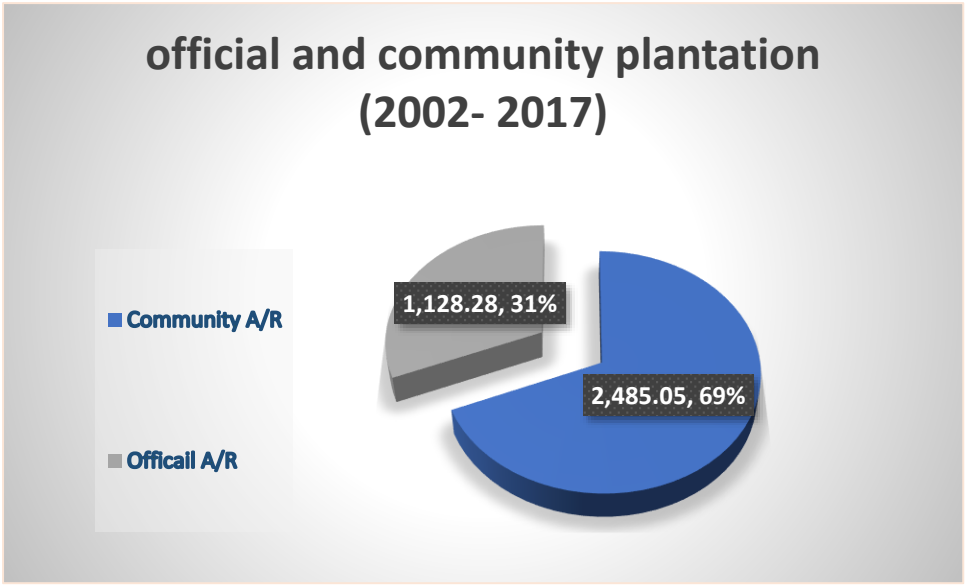

Figure 9. Community and Official Plantation (2002-2017)

FNC commitment to the plantation's plans and strategies in regard to A/R

FNC is committed to fulfil the quarter century strategy (QCS) targets, underscores the increase of the forests cover up to 20%[16], SUDNAIP[17], as well as to *Alnafra Akobra the five years programs for economic reforms (2015-2019),* which called for leveraging the plantation process by increasing the annual plantation targets through allocating additional area of 6,000 feddan to be worked on annually so as to reach an area of 30,000 feddan by 2019. Yet actually the proposed financial resources to cover these programs were not received by FNC, nevertheless some states made some efforts to execute the program by local initiatives. However the underestimating of the actual forest sector contribution in the GDP, highly jeop1ardized the flow of fund from the Ministry of Finance and National Economy (MoFNE), to implement the A/R program and the other forestry sector development programs. Currently, FNC working hard to identify the current forest cover and the area gap to be filled so as to achieve the requested targets, yet upon reviewing most of these documents different

[16] QCS (2002-2027) updated (2007-2032)
[17] Sudan National Agriculture Investment Plan (2016-2020)

figures[18] noted, needs discrimination and matching[19]. For concrete A/R activities, it is better to identify how much areas had been added by FNC, since the declaration of this QCS in the year, **2002**?. Accordingly realistic new quantitative targets must be set, to reach the goal by 2032. Right now, we can based on FRA 2015 {2} figures, stating that, the total reserve forest area is around 25 million feddan, forming about **4.9 %** of the total area of Sudan, so the strategic target to be reached, as per {33} is ***(15%)***, estimated to about 100 million feddan, to be reached by targeted area of about 75 million feddan.

Furthermore due to the data provided by FRA 2005 {35} only 1% of the total forest area was reported as protective plantation area, confirming that the hot challenge limiting the A/R success is the conservation factor, which deserve redoubling the availability of funds to promote sound conservation for sustainable development. Which unfortunately 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). This fact, necessitated an intensive attention to be paid for this critical parameter, if it is not well addressed, the entire A/R efforts may be collapsed, bearing in mind the vast areas annually cultivated are open to grazing, illicit cutting and fire hazards. Moreover, globally FNC is committed to fulfil the forestry sector contribution, via the set up A/R programs identified in the nationally determined contribution document of Sudan (NDCs) {36}, including implementation of REDD+ program, alternative energies and rehabilitation of gum Arabic belt. FNC is also committed to the sustainable development goals (SDGs): in accordance to articles 13 and 15, in line with the commitment to the climate change, the biodiversity and desertification conventions.

Based on the above, the forestry sector can be committed by implementing the following actions, which had been mentioned in the updated forest policy draft 2017, and will be eligible to have access to these conventions allocated funds:

Enhancing the greening of marginal areas by intensive protection for natural stands and AR programs and reducing the factors that lead to desertification in addition to set remedies for social, economic impacts caused by desertification's and its impacts imposed on the biodiversity in a way that leads to the populations more resilience to environmental problems, welfare and improved livelihood, through integrated holistic approach addressing the landscape challenges, wide coordination and involvement in transparent frame work.

[18] Total forest and wood land area in Sudan as reported in the FRA 2005 {7}is about 67,040.36 thousand ha (28%), according to Afri- cover 2010 {17}it is about 51.9**6** ha (11.6%), Post south secession strategy based on FRA 2010 figures, the FNC report to the ministry of cabinet 2017, stated that, the reserve forest area amount to *26,000,000 feddan* of about 5.9% and an area of *60,000,000* feddan amount to *14.1%* would be targeted to be reserved to meet the 20% strategic target, which is again differ from the above figures, in addition, ref {27} had set up figures and percentages in line with FAO 2015, and adding that about 15% of the country area forming about 90 million feddan, needed to be reserved. Based on FRA 2015{2}

[19] may be updated by the results of the ongoing national forest inventory (NFI)

Trends analysis

Upon analysis of the cultivation trends along many years ago, the promoted plantation process, is attributed to the efforts performed by FNC, funded projects, NGOs, CBOs, policies adoptions, through promoted extension work, to enhance communities participation in A/R as well as the adoption of biomass energy alternatives, such as improved stoves and LPGs (FNC Suda gas project). In addition it was reported that many of conflict sites being closed for such reasons, are by now restocked again via natural regeneration of forests stands e.g. Marra mountain, Blue Nile conflict parts in the south areas, for more information contact the FNC state directors at these locations. Notwithstanding, the noteworthy contribution of community in increasing the planted area, yet the adoption of 5%&10% policy, reported (2002-2017) proved to be a good parameter, needs consideration during the formulation of the A/R plans.

Nevertheless the enhanced plantations averages were doubled by 20 times, due to the above mentioned reasons, yet all these efforts, are far lagging behind, covering only 0.1 % of forest area that subjected to annual removal of 1.6%{2}. Generally speaking, it is believed that, to cover the required area, redoubled sustainable funds sources are needed to increase the annual A/R to undertake two scenarios, the 1st one will work on substitute the forest cover subjected to annual removal averages, the 2nd is to continue work in increasing the forest cover up to 20%. Recalling the commitment to Alnafra alkobra program, and building upon the 20% QCS target, an area of ***75***[20]million feddan (the gap to be filled), should be recorded in a time series data since 2002 up to date, in FNC records, to display the commitment of FNC to fulfil the target through monitoring the progress done thereafter. Up to date as per FNC records, the total plantation in the period from1990-2014 (24 years) amount to **2,877,200 feddan**, with annual average (***119,900)feddan*** while in the period 2002-2017 (15 years) amounted to **3,613,330** feddan with annual average ***(240,900) feddan.*** Comparing the annual averages for the 2 periods, there is an enhanced progress in the last 15 years. Anyway, if we based our predictions on the period (2002-2017), arguing that this is the period the data organizing was commenced, the achieved area amounted to about **3,613,330** feddan, will require an additional targeted area of >/< 70[21] million feddan, with an annual average of **7** million feddan; as tenth years plan (2017-2027). Bearing in mind that, although FNC had put large efforts to increase the A/R activities inclusively ***in 2018*** to about ***I million*** feddan, including about **750,630 *feddan*** from FNC annual allocated budget while the remaining part to be covered

[20] Based on the FAO 2015 statement the forests area amount to 25 million feddan, forming 4.9% so about 15% needed to be cultivated to reach 20% cover.

[21] Assuming that about 5 million feddan out the 75 million feddan (the targeted gap) were achieved in the period from 2002-2017

by funded projects and other sources, nevertheless, it is still far lag behind the assumed annual figure (***7 million feddan***).

However there is an observed data gap, may be due to fact that, some annually cultivated areas were not detected within the FNC records, especially in the period before the year 2002, so further work is needed in this regard for more verification.

On the other hand a potential large areas showed in table 4, are available, calling for expanded A/R programs, including the 10% of mechanized rain fed agriculture schemes, 5% of irrigated agriculture schemes, and the waste land between latitudes 10 and 22^{Oc}, mounting to a total area of about 41.1million feddan, which will positively contributes to increase the forest cover to 20% by 2027 if the needed critically financial, political and technical supports are in place.

Table 3: 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**
Bare degraded land between latitudes 10 and 22^{Oc}	**37.4**
Total Total	**41.1**

Source: INC report 2003

SWOT Analysis

Strength

1) The potentiality of FNC, regarding institutional and technical staff capacity.
2) The existence of some database on forest cover
3) The existence of the participatory management models.

Opportunities

1) Fast areas within the Sudan different states as per the table 4, forming 37,000 feddan,, are available for different kinds of A/R program, such as blue Nile forests karap land, ready for A/R programs, by highly economic trees like Hejlij trees for biofuel, Tarter, Sahab, Atbara river forests, Dom palm trees, natural gums areas, mangroves…etc.
2) Many kinds of water resources are existing.
3) Well mobilized communities waiting to be engaged in the A/R activities to improve their livelihoods.

4) Sudan commitment to the 3 Rio conventions, NDCS & SDGs, is a promising parameter to have access to global funds so as to fulfill the targeted A/R programs.

5) FNC commitment to the plantation's national plans and strategies.

Weakness

1) Weak means of protection, for vast scattered lands & weak budget.

2) Lack of well managed updated detailed database on forests resources tree species, areas, distribution and the needed treatments, silviciltural operations propagation, particularly species of high economic value.

Challenges/ Threats

1) The most important challenge that will face and considered on the top of the forest drivers, catalyzing reduction and removal of forests is the lack of national land use frame work or strategic plan, designed and implemented in a coordination base so as to organize the land use system in a way leading to meet each sector needs and priorities, which is critically needed for forestry sector to limit the conversion of forests lands to other land use purposes.

2) The horizontal expansion of the agricultural schemes, as the current mechanized lands covered an area of 25 million feddan in rain-fed and 5 million feddan as irrigated land, which is classified as one of the main drivers of forest removal and climate change {6}.

3) Lack of commitment to provide the required finance.

4) The majority of lands under A/R activities are open to the displaced people and refuges, grazing and other risks.

5) Benefit sharing mechanisms (not defined in most cases).

6) Increased demand of wood for different needs.

Future perspectives

Incentives to encourage A/R

Based on worldwide experience with communities, there was an experiment conducted with 1,200 villagers in five developing countries found that when people are given cash to conserve, they cut down fewer trees both while they are being paid and after payments cease[22].

Accordingly, the proposed incentives will be reached through a multi-fold approach which will focus on:

[22]source: Cash payments prompt tropical forest users to harvest less/ Science Direct | 14.03.18.

☒ Adoption of tools available for political decision making and governance schemes, like cash payments for ecosystem services to prompt the arid land forests users or voluntary certification systems.

☒ Supportive policies and laws that guarantee the sustainability of the A/R programs, including the right to own land (land tenure, innovative conservation laws…etc.

☒ Significant contribution to be done by FNC, in establishing community nurseries, community and private forests, accompanied by technical advice, and extension services, to be provided on due time and on spot.

☒ Provision of alternative energy like renewable energy (solar, wind & biofuel), energy efficiency, and hydroelectric development.

☒ Reduce the local people vulnerability to climate change, by strengthening their adaptive capacity through adopting agroforestry best practices, introducing new technologies for vertical expansion in agricultural activities and shelter belts policy.

☒ Sub/matching grants. (revisit gum Arabic project experience),

☒ Build the community capacity in the non-wood forest products (NWFP based industry) as an incentive for income generation.

☒ To invest in engaging both public and private entities with the aim of creating a wide transversal and horizontal interest among public and private stockholders via partnerships with agribusiness companies, to get benefit from the social responsibility mandated for these big companies and firms such as rail way station services, Hagar group &Dal to provide some essential services, like schools, hospitals, water availability among others, so as to catalyst the community participation in A/R projects.

☒ Gradual Shift to community and forests dwellers conservation rather than formal protection by forests guards via defined benefit sharing mechanism.

10. Recommendations

1) To set up the constitutional, legislative, political, institutional, financial and economical arrangements and measures, to upgrade the forest position in the permanent constitution as a national authority and wealth as well as the ratification of the updated forestry policy and law 2017.

2) It is critically needed to develop transparent data base and supportive management information system for better information handling and insured documentation.

3) Secured, adequate mobilized finance in due time.

4) Development of FNC capacities to be in place, via gaining benefits from international, regional protocols with countries and UN organizations, to provide technical knowledge, technology transfer and funding for the A/R programs.

5) To make synergies between the similar strategies/initiatives and conventions, either national or international and consequently incorporating them in the FNC strategies, policies and plans, such as Rio-conventions, REDD + QCS…..etc.

6) To mainstream the private sector participation in REDD+ activities by a holistic approach in landscape restoration of degraded lands, especially in the large scale projects in dry lands by using a high technology water harvest techniques, machines that reduces weeding costs and tending operations…etc.

7) To establish special judge body to enhance the forest conflicts set up and reduce the bottleneck of encroachment into forests lands especially in the mechanized schemes in Gadarif, which needs some sort of clever agreement and win -win benefit sharing approach.

8) To update and design technical innovative working plans including tailor robust monitoring protocol, for both wood and non-wood production, accompanied by local and international variables in this regards, importantly permanent sample plots for sustainable forest management.

9) Assess the demonstrative potentiality of Mangrove protection and carbon emission targets (refer to Red sea state FNC office), for blue carbon initiative.

10) Enhance the urban plantation for pollution control and carbon sequestration

11) FNC is better to establish technology seeds centers at the potential states for seeds collection leveraging the CTCN[23] support for developing countries as well as seeds orchards for genetic resources and seeds collection purposes.

12) The importance of land physical measures by adoption of innovative soil water conservation practices (SWC), in the dry lands to increase productivity, conserve biodiversity and to reverse land degradation and control desertification.

11. Conclusion

However, Sudan as one of the low forest cover countries, working hard to formulate rehabilitation and conservation national policies and strategies within National Forest Program, integrating the international requirements within the A/R strategies and policies, specifically incorporate the forests issues within the related sectors policies and programs, to reduce the tree removal, like mining, agriculture roads, infrastructure and

[23] Climate technology center network

other investment activities, taking the environmental requirement into account and linking knowledge, policies and practices for proper conservation measures, climate change integrity, biodiversity conservation, desertification control, communities livelihood enhancement. Serious efforts are now going on to put all similar programs in one table so as to avoid overlapping along with many other crucial actions and reforms to better shape the process.

Annexes

Annex 1.Forests functions & area in Sudan.

Annex 2. Forest types according to vegetation cover.

Annex 3. A/R: ICSP achievement 2015-2017 in Gadarif state coordination unit.

Annex 4. Women engaged in a best agroforestry practice inside Manassy reserve forest, Blue Nile state.

Annex 5. The Community Forests in Sudan 94 -1999.

Annex 6. Rehabilitated lands by Petro-energy bioremediation and forestry project

Annex 7. Persons contacted.

Annex 8.Assignment TOR

References

In principle the assessment done mainly based on the most common forestry sector promotion references but not limiting to:

Cabinet resolution No127/2017, which calls inter ilia, for the forest nationality as well as to adopt the forest policy and support the introduction of energy alternatives. Resolution 40/1990 for authority and wealth sharing. Post south secession forestry sector strategy 2011.

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Annexes

Annex 1: Forests functions & areas in Sudan

Forest type	Area/fedan	Function	Examples
Productive and protective forests	320,000	Serving both purposes protection and timber production.	Riverine forests e.g Blue Nile forests
Protective forests	10 million	Protecting purpose	River Atbara forests
Mountain forests	1, 410	Wood &non wood products	Marra mountain
Arid land (Dahra forests)	8,000	For gum Arabic production	Gum Arabic belt covering 13 states
FNC irrigated forests	8,000	Wood &non wood products	Algezira forests
Community and institutional forests.	?	Serving both purposes protection and timber production.	Sugar companies forests , shelterbelts

Source: Post South Sudan secession strategy

Annex 2: Forest types according to vegetation cover

Forest cover	Ecological zone	location	Example	Type of stand	Natural/planted
Closed broadleaved	tropical rain				
Open broadleaved forests.	Wood land savanna	central and southern parts of the country	Dinder National Park.	*Acacia seyal* & *Balanites aegyptiaca*	Natural
			Riparian forests e.g. Blue Nile	*A. nilotica*	Planted
Closed coniferous forests	tropical rain	Mountains in south& western parts	Jabel Marra	conifers	Planted/ semi natural
Other wooded land shrubs	semi-desert	North	Gum Arabic belt	Acacia Spp.	Planted/Natural/semi natural

Source: illustrated as per information extracted from {11}

Annex 3. A/R by Integrated carbon sequestration project (ICSP) achievement 2015-2017 in Gadarif state coordination unit

year	Targeted area/feddan	Total	Site reserve/community	Seeds type
2015	600	600	Almokharbash reserve forest	*A.Seyal* (Talih)
2016	1699	1,999		*A.Seyal (*Talih)
	300		Community shelterbelts-kasmour area	*A.Seyal (*Talih)
2017	10,000	10,600	Almokharbash reserve forest	Talih+few *A.senegal* (Hashab)
	600		Community shelterbelts-kasmour area	*A.Seyal (*Talih)
Total	13,199			

Source: ICSP, Gadarif coordination unit

Annex 4: Women engaged in a best agroforestry practice inside Manassy reserve forest, Blue Nile state

Annex 5. The Community Forests in Sudan 94 -1999:

Year	Planted area in feddan					
	Northern	Central	Eastern	Kordofan	Darfur	Total
1994	02435	06120	02388	21385	02745	035073
1995	02739	13691	11489	11301	32760	071980
1996	02577	09654	07045	12233	26909	058418
1997	01574	10276	05723	07030	12020	036623
1998	00970	26513	06336	19364	03320	056503
1999	01600	22400	11900	06200	00800	042900
Total	**11895**	**88654**	**44881**	**77513**	**78554**	**301497**

Source: Sudan Forests in Hundred Years 1902-2002

Annex 6: Rehabilitated lands by Petro-energy bioremediation and forestry project

Annex 7 :List of contacted persons

Name	Position	Address
Mohmed Yosif	Gadarif shelter belts fund director	01215512985
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Anas Ibrahim Ahmed	FNC Sinnar state extension office	0916938432
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Hader A. yousif	FNC Gadarif state director	0912572921
Mosa A. Easa	FNC Red Sea state director	0912858298
Haga Bakhita Adam Esa	Private forest owner-sinnar atate	
Sara M. Mobarak	Director environment section-Afforestation Adminstration-FNC HQ	0915096366
Fatma M.A.Ramly	GAPAs, coordinator north Kordofan state	0111437360
Mahmadeen Alamin M.	FNC, North Kordofan state director	0918027596
Mahmood Abbas	UNHCR, FNC project director (Gadarif, Kassal and Gezira states)	0113110617
Yosif A. Abdalla	FNC Gadarif state office	

Annex 8: Assignment TOR

1.The understanding of the concept, the axis title, and its content,

2. Definition of afforestation, reforestation, and the creation of natural and planted forests - living examples from Sudan,

3. Reviewing afforestation, reforestation and forestry activity since the launch of the Sudan Forest Walk to date, with a special focus on the period 1990-2017 and trend analysis,

4. The most prominent outputs of studies and technical assistance projects on afforestation and reforestation in Sudan?

5. Visions of the future about incentives - motivations - to encourage afforestation, reforestation and forestry - challenges and opportunities?

6. Providing and supporting the report with tables and data, their sources and references

7. Submit an introductory report with your understanding of the assignment and the approach to be followed in carrying out the mission within one week from the date of the contract

8. Submit an initial draft of the report within two weeks from the date of signing the contract.

Acronyms

A/R	Afforestation and Reforestation
FNC	Forests National Corporation
NGO	Non Governmental Organization
REDD+	Reduced Emission from forest degradation and forest deforestation
GHG	Green House Gas
INC	Initial National Communication
FRA	Forest Resources Assessment
CBO	Community based organization
UNHCR	UN Refugee Agency
ICSP	Integrated carbon sequestration project
HQ	Head quarter
LPG	Liquefied Petroleum Gas
MOFNE	Ministry of Finance &National economy
IFAD	International Food and Agricultural development
SSNRMP	Sudan Sustainable Natural resources management project

QCS Quarter century strategy

Fed. Feddan

SUDNAIP Sudan National Agriculture Investment Plan

SWOT Strength, Weakness, Opportunity, Threats

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