SUDAN NATIONAL REDD+ PROGRAMME (FCPF/GRANT

LAND USE IN SUDAN: STUDY REPORT

Prepared by:

Omer Egemi (PhD, Geography)

January 2017

Executive summary

The report aims at reflecting the status of land use in Sudan in the context of future REDD+ to support the implementation of REDD+ in Sudan based on available information. In the process the report seeks to describe, quantify and analyze all relevant factors to sustainable land use practice in Sudan, in a spatially disaggregated context. The report was based on in-depth review of available information. Supplemented by maps as an integral part of the study applying object-based classification as a new approach of image classification in semi-arid areas. Varieties of software were employed depending on the nature of the t required maps.

Sudan is a dry country exhibiting a Sahelian zone with its characteristic low amount of rainfall that varies enormously over space and time. The agricultural season is short (3-4 month) and drought is a recursive phenomenon. In spite of the rapid pace of urbanization (from 8.3% in 1955/56 to around 40% in 2015) the country remains agrarian in social, economic and cultural outlooks. The majority of the population is rural pursuing environmentally extractive livelihoods founded fundamentally on crop farming and pastoralism. The UN categorizes Sudan as a low-income, poor and highly indebted country that ranks number 167 out of 188 countries and territories on the 2015 Human Development Index. By comparison, the country ranked 147 out of 177 countries in 2008 reflecting a progressive trend towards deepening poverty in the country. Impacts of climate change are also evident and climate change models predict a reduction in the length of the growing period of more than 20% between 2000 and 2020.

Land cover data classifies half of the country's total area as desert which, except for the recently established artisanal gold mining in Northern and River Nile states and the scattered seasonal nomadic presence, is void of significant land uses. The data challenges the mindset of Sudan having an abundance of renewable natural resources. Of the remaining 50% area agriculture, in its different categories (traditional rainfed, rain fed semi mechanized, and irrigated) accounts for almost 25% creating it as the major land use system in the country. Characteristic feature Sudan's agriculture is its rapid horizontal expansion, from around 6 million feddan in the early 1970 to over 45 million feddan in 2014. However, the figure excludes the land leased for semi mechanized but not fully utilized. A significant portion of the land under the semi mechanized sector falls under the undemarcated category that has no legal recognition or authorization; in Sinnar State this category accounts for almost 70% of the land cultivated. The expansion in the traditional sector and its accelerated market orientation are also apparent.

A conspicuous feature of Sudan land uses during the first two decades of the 3rd Millennium is dwindling of the forests and rangelands that were historically the dominant land uses preceding crop production activities. Forest cover is estimated at 10% of the country's area; over 90% of the forests domain is a natural structure contained in reserved forests. Over 60% of the country's forest cover at present is found in the three states of South Kordofan (38.3%), South Darfur (16.9%), and North Kordofan (15.2%). Sudan forests sector is under extreme pressures. The annual removal rate, estimated at 2.4%, considered one of the highest rates of deforestation in developing countries. Rangelands account for approximately 25.6% of the country's total area but remarkable distributional variations between the States exist where the rangelands account for over 60% of the land cover in South Darfur State. On the other extreme rang lands account for only 0.5% in Khartoum and Northern States and 0.7% in Gezira State. Rangelands in

the country are progressively dwindling and estimates suggest that Sudan has lost from 20% to 50% of its rangelands over the past few decades.

National parks and areas designated as protected areas gazetted or listed as having some form of legal protection cover 8.1% (150,963 km^2) of the country's total area. The three sites of Wadi Howar (100,000 km2) Radom (12,500 km) and Dindir (10,000) accounting for a large portion of this figure. Od these, the Dindir National Park is the most important protected area.

Petroleum and gold mining have emerged as important land users over the past two decades. The sectors are gaining increasing importance in the national economy following the loss of around 70% of the oil revenue to the Republic of South Sudan following the 2011 Referendum. Most of Sudan oil comes from Heglig and El Fula oil fields in the Muglad Basin (120,000 km^2) that straddles the North–South border in West Kordofan State. Oil explorations, including successful explorations at Al Rawat area to the south of Kosti (Block 7) in the White Nile State, are going on.

Gold production in Sudan has made a fundamental turn since 2009. Production has increased from an annual level of 6-8 tons prior to 2009 to peak at 73 tons in 2014. Over 90% of the production is from artisanal mining that has extended to cover over 10 states in more than 118 sites that have their main concentrations in the northern desert of Northern and River Nile States followed by North Darfur (Jebel Amir area), central Butana Plains (areas around Subagh) and other scattered areas in North Kordofan and eastern South Kordofan. According to some estimates the artisanal sector provides employment for more than one million persons and contributes directly or indirectly to the livelihood of over five million persons, thus becomes an important mechanism for poverty reduction in the country. Contribution to the national economy is also substantial as it accounts to around one third of the total value of exports exceeding by far the agricultural exports.

Land use and tenure has become a major cause of conflict, human insecurity and population instability in the country. Although the regional conflicts in Darfur, Blue Nile and South Kordofan cannot be attributed solely to land issues but it is not disputable that land had been one of the main drivers of the conflict in the three areas. Community-based conflicts, including farmers-herders disputes and tribal conflicts that straddle the rainlands of Sudan are essentially of land-related nature.

Sudan conflicts, especially in Darfur, have resulted in remarkable shift and transformation in land use. Vast lands that were once agricultural have been abandoned as a result of the conflict. Besides its wide range of negative environmental impacts, large scale displacement (around 1.9 million persons) has

introduced enormous land use and land tenure challenges that wait to be resolved. Important among these are: permanent occupation of land abandoned by displaced persons; establishment of IDPs camps on lands owned by recognizable individual farmers; possession of property by military, public institutions and new comers; sale of non-owned plots; temporary allocation of abandoned land and property turning into "de facto" ownership; multiple allocation of the same plot by local administrations or tribal chiefs; and unauthorized buildings on non-owned property. The influx of refugees from the east across the borders with Eritrea and Ethiopia and from the Republic of South Sudan constitutes another challenge.

Sudan presently suffers severe problem of land degradation and irrational management of land. The most visible manifestations of the problem include declining land capability and productivity, soil erosion, degradation of forests and rangelands and general loss of biodiversity. The social consequences of land

degradation are alarming including accelerated rates of rural poverty, high levels of rural-urban migration, and intensified competition and eventually over land and natural resources. Land degradation has disastrously impacted food security and incomes of the rural population. In many cases women are made disproportionately worse off by kand degradation. Increasing scarcity of fuel wood and water adds to the workload on women and in conflict affected areas land degradation remains a major cause of violence against women.

Land use change has been a significant feature of Sudan's land use over the past few decades. The most conspicuous feature of this change is the remarkable increase in land under cultivation, from around 6 million feddan in 1970/71 to approximately 45 million feddan in 2014.

The analysis of Sudan Land Use Change and Forestry LUCF reveals that the most dominant systematic land use change processes were deforestation including conversion of forest land to mechanized and subsistence agriculture; forest degradation (conversion of woodland to bushland and conversion of Rangeland (bush/grassland) to cropland. All these resulted in a net reduction in forest cover from 76.4 million hectares (ha) in 1990 to 70.49 million ha in 2000 and 69.95 million ha in 2010 (30.5% to 28.1% and 27.9% of the country total area, respectively) (FRA, 2010).

Based on the dominant land use change patterns in Sudan, the drivers and change in carbon stocks, it is so crucial to look for different options which could be pursued to implement a future national strategy which considers livelihood, biodiversity and climate change mitigation objectives. One of important option is to compensate land owners and users who would otherwise change their land use from high carbon stock to lower ones is REDD+ mechanism which is aiming to develop mechanisms to make payments to developing countries for reducing emissions from deforestation and forest degradation and also for conservation and sustainable management of forests

The context of land use in the country is also changing. There are emerging new demands oil, gold minining and the domestic and regional agribusiness investors; the independence of the Republic of South Sudan has closed off many pastoral routes and resulted in the need to relocate a population of returnees from that country in the border states; growing populations of both people and livestock are increasing the pressure on land; and climate change is multiplying the pressure on land and the livelihoods of both farming and pastoral communities.

Land administration and governance in the country is at cross roads. The policy, legal and institutional frameworks to deal with land have been rendered inadequate to respond to the tremendous changes posed by the present land use systems. in particular the multiple, parallel and weakly coordinated systems of land administration that exist; the sectoral nature of land use policies; the critical legislative gaps in land tenure and natural resource management; and the eroded legitimacy and authority of traditional leadership have created an environment in which land uses are poorly organized; land is open to disputes, confusion over claims to land and natural resources is common, and in which conflicts proliferate and play out in a destructive manner. Diffuse and ill-defined land governance arrangements have also contributed to the seriousness of land degradation problem and the unsustainable nature of land use. It is also evident that it is not always the lack of policies that is the problem; rather it is the fact that implementation of policy – in many cases enforcement of regulations – is simply weak.

Recognizing the apparent institutional gap for comprehensive land administration and governance the study calls for land institutional reform founded on an effective framework for land governance. For the

realization of that the study recommends the establishment of legitimized super structure (Land Agency or possibly a Ministry) for land administration, branched down to State and local levels and entrusted with the overall administration and coordination of land use-related issues, including securing land rights of smallholder producers; provide for law enforcement, research and knowledge production and capacity development in land management and administration. Other recommendations include: need to engage people in dialogue and popular discussions to negotiate, reconcile and secure the rights and interests of the various groups in lands, including the rights and interests of the government of Sudan; need to focus popular attention on headline issues around land use issues and land degradation problem in particular as a major problem with damaging social consequenses. Landscape approach in which the various land uses and interventions are planned together, with an emphasis on integrate land use planning is recommended to develop and implement land use plans at landscape scale, to integrate production and conservation

A national conference intended to inform and arouse the attention of the public as well as planners, decision makers and politicians is recommended. Other recommendations include the developemnt of thr national land use map; bridging the existing critical gap in knowledge, advocacy to the establishment of multidiciplinary land research centre and capacity development in land administration and management.

1. BACKGROUND

Sudan is one of the most geographically diverse and complex countries in Africa. The country falls almost entirely within the dry regions of the world but ecological variations are conspicuous and drought is a recursive phenomenon. The rapidly growing population (2.6% annually) is highly divided along lines of ethnicity, tribe and economic activity. In spite of the rapid pace of urbanization (from 8.3% in 1956 to approximately 40% in 2015) Sudan remains rural in social, economic and cultural outlooks with the majority of the country's total population (around 36 million in 2014) living in rural areas and pursuing extractive livelihood systems based fundamentally on the direct utilization of land and natural resources. Land-based renewable natural resources are also the backbone of the other sectors of the economy, especially manufacturing, trade and transport. However, the natural resources of the country are poorly managed and the potential of transforming these resources into broad based socio economic development has not been realized with poverty incidence remains remarkably high approaching 46% on average[1]. The UN categorizes Sudan as a low-income, poor and highly indebted country that ranks number 167 out of 188 countries and territories on the 2015 Human Development Index. By comparison, the country ranked 147 out of 177 countries in 2008 reflecting a progressive trend towards deepening poverty in the country[2].

Sudan entered the twenty-first century mired in several conflicts and enormous human security risks that created Sudan as the host to one of the largest concentrations of IDPs (estimated at 3.1 million persons) in the world. Competition over land and natural resources has been recognized as one of the root causes of conflict and tension in the country. Such conflicts usually involve local conflicts between pastoralists or nomads on the one hand, and farmers on the other, or among pastoralist communities, over land, water, grazing and forest resources. They also include competition within and between tribal groups over community boundaries, mining resources and livestock routes that become major zones of conflict. Because of that the last two-decades have seen an unprecedented preoccupation with land management issues. This report is prepared within that context.

The report aims at reflecting the status of land use in Sudan in the context of future REDD+ to support the implementation of REDD+ in Sudan based on available information. In the process the report seeks to describe, quantify and analyze all relevant factors to sustainable land use practice in Sudan, in a spatially disaggregated context (State, irrigation scheme, ecological domain, etc.). Appreciating the limitations of time and resources the report was based principally on in-depth review of available information.

The methodology also involves development of maps as an integral part of the study. In this respect object-based classification was applied as a newly approach of image classification in semi-arid areas. Varieties of software were employed depending on the nature of the t required maps. The ERDAS IMAGINE (Earth Resources Data Analysis System) Image version 2014 and ENVI (Environmental Visualization) software version 5.1 were used for image processing, masking and classification. QGIS (Open Software) was employed for database development, spatial data analysis, producing thematic maps and extracted spectral reflectance. Defines Developer (eCognition®) version 7.0 software was also applied for segmentation and classification of some imagery. Data derived from Image processing transferred to the GIS for maps preparations and layout. Some images used for layout preparations and

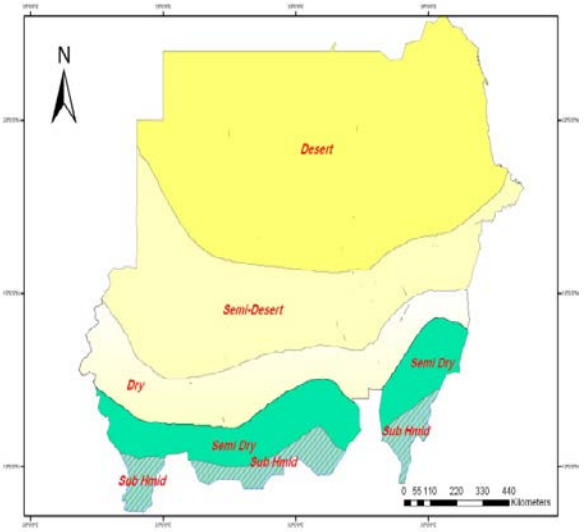
[1] *Sudan Interim Poverty Reduction Strategy Paper IPRSP, 2011, Ministry of Finance*
[2] *UNDP, Human Development Reports 2008 and 2015.*

overplayed. Data sets were taken by Land Sat 8 (OLI). The approximate scene size is 185 * 185 kilometers. The data received from the GLCF was pre-processed to level L1G (geo-referenced).

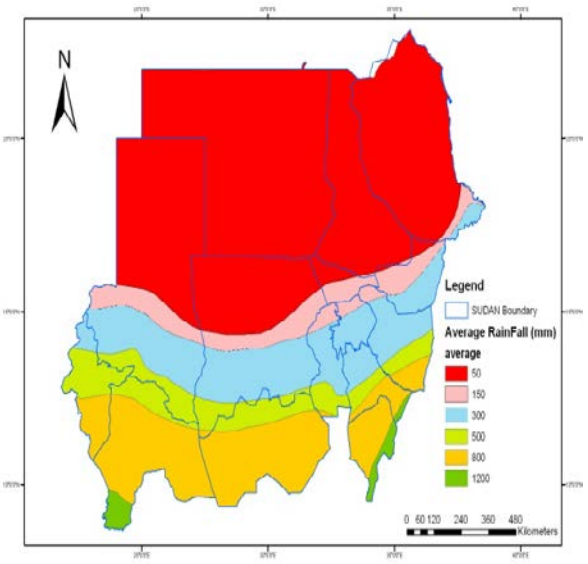
2. ENVIRONMENTAL CONTEXT OF LAND USE

2.1 Ecological conditions

The secession of South Sudan in January 2011 has left the whole of Sudan as Sahelian dry land country. A recent study (FAO and UNEP 2012)[3] indicates that out of the total area of the country (1.87 million km^2), 1.13 million km2 (60.4%) is desert and semi desert (rainfall between less than100 mm and 299 mm per year); the remaining 0.740 km2 (39.6%) is divided between low rainfall savannah (300- 500 mm per year) and the rich savanna (above 500 mm of rain per year) that extends extensively in South Sudan.



In their 1958 ecological classification of Sudan Harrison and Jackson distinguished three ecological zones: (i) Desert Zone that receives an annual rainfall of zero to 75 mm and is only used for short periods by camels and sheep in good years of rainfall; (ii) Semi-Desert Zone where annual rainfall varies from 75-300 mm and where vegetation is valuable for grazing and its distribution is more related to soil types rather than rainfall.



The characteristic dominant woody species are Acacia sp while the dominant grass cover is mainly annual with few perennials and; (iii) Woodland Savanna that covers the southern parts of the latitudinal belt extending along the border with the Republic of South Sudan from the borders with Central African Republic in the west to the Blue Nile in the East along Sudan's borders with Ethiopia.

Pronounced spatial and temporal variations in the amount of rainfall and duration of the rainy season are evident. Drought is a recursive phenomenon and frequent drought cycles extending over 2-3 years are common. The Table below provides a chronology of main drought years over the past three hundred years.

3 FAO and UNEP (2012) Land cover in Sudan, FAO, Sudan

Table 1: Recorded severe drought years in Sudan[4]

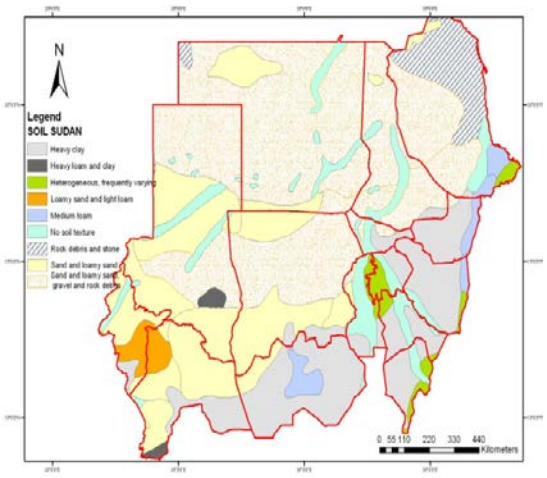
Year	Local name and damage	Location
1684	"The great famine" (Urn Lahm: meat)	Central Sudan
1835-38	"Years of famine"	Central Sudan
1836	Cholera spread through country	Central Sudan
1885	Slight famine	Central and eastern Sudan
1888-89	Sanat Sitta: Complete failure of rains and Nile flood, crop failure, locust attacks, and Mahadist wars ,Prices rose to US$60 for two sacks of dura (sorghum) and people sold their children as slaves to save their lives; an estimated 40% of the country's population died of famine and disease	Central, north, and E Sudan
1890	Locusts and mice consumed the products	The Nile area
1913	Poor rain, corn brought from India and issued free of charge in distressed areas and cheaply elsewhere	Central and Northern Sudan
1914	"The year of the flour" (flour brought from India because of poor rains)	Central Sudan
1940-41	Fouliya (named after Egyptian horse bean, foul Msasri, was distributed and crushed to be used instead of dura); years of poor rains and crop failure	East Sudan
1947-49	Sirar Hoyokia (named after the appearance of shooting star); three consecutive years of rain failure and lack of crops. Described as the worst famine during Condominium rule (1898-1955)	East Sudan
1958-60	American (after American relief distributed); failure of rains and crops	East Sudan

4 Tesfaye Teklu, Joachim von Braun. Elsayed Zaki (1991) Drought and famine relationships in Sudan: Policy implications, International Food Policy Research Institute, Research Report 88

1970-72	Kiloiate (relief ration was distributed in kilogram's); years of bad rains and crop failure	East Sudan
1984-85	Years of severe drought and famine described as the worst Famine in Sudan during the 20th Century. Around 1.8 million Persons were displaced and 8.5 million receiving food aid.	Western, Central and East Sudan
1990	Undeclared famine caused by failure of rains	West, Centre, E Sudan

2.2 Soil

Sudan soils



According to the Food and Agriculture Organization of the United Nation (FAO, 1995), soil resources of the Sudan can be divided into seven broad regions as follows: (i) Xerosol soils of the hyper-arid area (about 78 million ha) comprising part of the Sahara Desert composed of superficial deposits of sand with bare rock debris, shifting dunes and consolidated dunes. Recent alluvium provides a basis for productive agriculture in the narrow Nile valley north of Khartoum. Elsewhere soils are sandy with little agricultural potential. (ii) Arenosols (about 28 million ha) towards the south and are known locally as Goz and gardud soil. These are the typical soils of North Kordofan State. (iii) The 12 million ha of the more weathered Arenosols in the semi-arid climate of western and central Sudan. These soils are low in nutrients and organic matter and have a high sensitivity to erosion. The sands are free draining, with some clay or ferruginous clay as a bond near the surface, making them firm after the rains. Under high torrential rains their nutrients could be easily leached. (iv) Vertisols (about 70 million ha) have considerable agricultural potential in the semi-arid zone of the Sudan. They form the central clay plains extending southwards to the eastern part of the flood plains. Special management practices are required to secure sustained production of these soils. (v) Ferrasols (about 30 million ha) are the soils of the dry sub-humid areas. The low natural fertility and very low nutrient retention capacity are serious limitations of these soils. Their great depth, high permeability and stable microstructure make them less susceptible to erosion than many soils in the country, other than the Vertisols. (iv)The rocky soils of the Red Sea Hills and parts of Marra mountains, classified as Leptosols, constitute about 18 million ha. The Red Sea Hills soils are shallow and poor in nutrients and with high gravel content. The Marra mountain soils are relatively rich volcanic soils. Because of the limited soils depth and sloping terrain these soils are liable to erosion by water (iiv) Cambisols is the smallest soil group (about 2 million ha) but could be among the most productive soils in the country. These soils lie along the undulating Ethiopian Highlands under dry and moist sub-humid conditions, and thus are prone to water erosion.

2.3 Water Resources:

Sudan has a substantial fresh water resource base as almost half of the Nile Basin is found within the country and it also has substantial, but poorly developed groundwater reserves of which the largest is the globally renowned Nubian Sandstone Aquifer System. However, there is a very wide disparity in water availability between regions, as well as wide fluctuations between and within years. These imbalances are a source of much hardship in the drier regions as well as a driving force for conflict in the country

Sudan's total natural renewable water resources are estimated to be 89 km^3/yr including 20% from rainfall; the remaining 80% flowing over the borders from upstream countries. This reliance on externally generated surface waters is a key feature of Sudan's water resources and is of critical importance to economic development in the country as flows are both highly variable on an annual basis and subject to long term regional trends due to political, environmental and climatic changes. Sudan is now utilizing about 14.6 md.c.m. of its 18.5 md.c.m share of the 1959 Nile Waters Agreement. The overwhelming part (96.7 %) goes to agriculture. Withdrawals by the domestic and industrial sectors amount to 2.6% and 0.7% respectively.

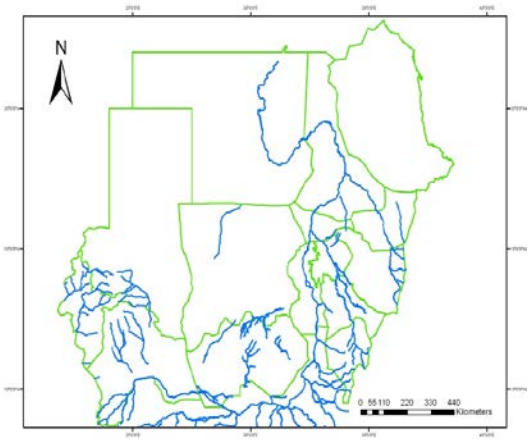


Figure ; Rivers and Wadis in Sudan

The diversity of environmental conditions, especially in relation to water availability, rainfall amount and soil type has given rise to a wide variety of habitat, livelihood options and land tenure arrangements as well as being detrimental to large scale land acquisition. On the rain lands of the country, as in much of the African Sahel, where water is the main limiting factor, resource management and human adaptation were centred on traditional rain-fed cultivation and animals herding but with great variation due to local environmental conditions and technical and marketing constraints. Seasonal movements across zones, hunting and gathering and wage labor were supportive engagements. However, animal herding based on traditional pastoralism remains the most extensive land use system in terms of spatial coverage. This type of adaptation processes has also affected cultural and political boundaries between groups. Aadaptational movements have also helped forging links between groups, violent ones as well as peaceful ones. Reciprocity, rendered imperative by ecological variations was common. Close symbiotic relations, amounting to 'alliances', forged through negotiations between tribal leaders were also common.

3. LAND USE SYSTEMS

3.1 General

The FAO/UNEP 2012 land cover study (Table 2) classifies around half of the total area of the country as almost desert (bare rocks and soils and other unconsolidated materials mainly sands) that has its main stretches in Northern State (37.8%) followed, but far behind, by Red Sea State (20.5%), North Darfur State (19%), River Nile State (12.7%) and North Kordofan (5.5%). In fact, desert conditions account for 98.3% and 90.1% of the total area of the Northern and Red Sea States, respectively. What follows provides general mapping of land use systems in the country.

Table 2: Main land cover category in Sudan (hectares)[5]

	AG	TCO	SCO	HCO	URB	BS	WAT	TOTAL
Blue Nile	1,275,917	1,582,755	553,158	338,253	13,413	16,248	37,209	3,816,953
Gadarif	3,458,932	598,354	197,738	1,207,604	39,799	331,314	124,163	5,957,904
Gezira	2,075,149	68,536	16,991	335,004	75,660	128,948	13,149	2,713,437
Kassala	1,077,738	401,488	157,925	791,092	23,756	2,377,681	41,544	4,871,224
Khartoum	224,523	44,618	34,301	203,224	84,682	1,513,983	15,578	2,120,909
Northern	110,858	29,635	112,526	150,729	55,148	35,995,792	114,488	36,569,177
N Darfur	1,458,402	469,914	2,733,627	8,853,330	47,407	18,081,358	107,158	31,751,197
N Kordof	4,571,176	2,852,632	5,776,385	5,135,514	146,862	5,188,063	385,136	24,055,768
Red Sea	30,155	458,962	1,030,880	578,602	17,522	19,479,544	27,033	21,622,699
River Nile	227,937	22,408	72,130	507,026	44,245	12,112,321	42,828	13,028,895
Sinnar	2,458,947	480,173	504,186	400,492	37,659	9,963	32,808	3,924,228
S Darfur	2,122,492	3,157,458	4,722,374	4,034,753	48,996	10,414	66,245	14,162,732
S Kordof	1,963,585	7,174,761	4,134,598	675,395	36,182	11,999	89,235	14,085,754
W Darfur	599,674	1,120,237	1,690,251	1,969,654	17,016	9,771	69,258	5,475,861
White Nile	2,054,539	271,251	494,257	802,049	41,985	10,328	124,166	3,798,575
Grand	**23,710,025**	**18,733,182**	**22,231,327**	**25,982,720**	**730,331**	**95,277,727**	**1,290,000**	**187,955,312**
%	**12.6**	**10.0**	**11.8**	**13.8**	**0.4**	**50.7**	**0.7**	**100.0**

Source: FAO/UNEP 2012 Land Cover map of Sudan

Key:

AG: *Agriculture in terrestrial and aquatic/regularly flooded land*

TCO: *Trees closed-to-sparse in terrestrial and aquatic/ regularly flooded land*

SCO: *Shrubs closed-to-sparse in terrestrial and aquatic/ regularly flooded land*

HCO: *Herbaceous closed-to-sparse in terrestrial and aquatic/regularly flooded land*

URB: *Urban areas*

BS: *Bare Rocks and Soil and/ or Other Unconsolidated Material(s)*

WAT: *Seasonal/perennial, natural/ artificial* ***water bodies***

[5] *Hectare = 10,000 m^2 = 2.38 feddan*

Geographical variations are also documented in available data on land use in Butana which is shared between the five States of Khartoum, River Nile, Gedarif, Kassala and Gezira suggests that 29% of the total area is bare land with grasses and woody vegetation covering 41% and 9%, respectively (Table 3).

Table 3: Land use in Butana

State / Land Use		Gedaref	Gezira	Kassala	Khartoum	River Nile	Total Land Area	%
Bare land	Area	688.092	256.738	5,648.50	2,189.32	14,905.40	23,688.06	29 %
	%	3%	1%	24%	9%	63%		
Cropland	Area	10,107.47	1,975.74	517.914	3,497.28	1,028.39	17,126.79	21 %
	%	59%	12%	3%	20%	6%		
Grassland	Area	12,983.50	4,309.32	5,739.13	4,404.10	5,637.76	33,073.80	41 %
	%	39%	13%	17.5%	13.5%	17%		
Tree cover	Area	3,855.40	743.268	66.082	1,454.95	1,488.57	7,608.27	9 %
	%	51%	10%	1%	19%	19%		
Total Land by State	Area	27,634.46	7,285.06	11,971.63	11,545.66	23,060.12	81,496.92	
	%	34%	9%	15%	14%	28%	100%	

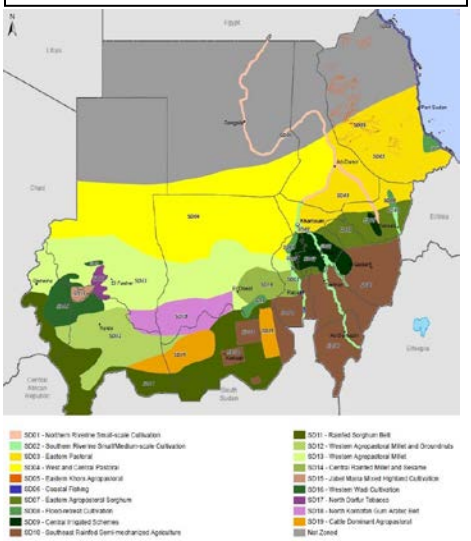
Source: IFAD Co-Funded Project: Butana Intigrated Rural Development Project, 2015

3.2 Main Land Use Systems

3.2.1 Agriculture

Agriculture, a major land use in the country, underpins food Security and rural development in the country: it contributes 30% to the GDP, provides for the employment of 48% of the labour force, supplies the bulk of industrial raw material, contributes over 80% of non-petroleum export revenues and provides subsistence and incomes to the bulk of the population. Agriculture is also the engine of growth for other economic sectors such as trade, industry and transport. Four major agricultural and production systems are practiced in the county, namely traditional rainfed, irrigated agriculture; semi mechanized farming and traditional pastoralism.

Map of livelihood zones in Sudan 2015; source: FEWS Net, 2015



Available data (Table 4) show that the total area under cereals (dura, millet and wheat) cultivation in the country is progressively increasing, from 7.8 million feddan in 1953/54 to an average of 30.8 million feddan in 2012/2013, Around 93% of the cropped areas are under rain-fed cultivation in both the traditional and semi mechanized sectors.

Table 4: Areas under dura, millet and wheat cultivation 1953/54-2012/13 (000 feddan), 15 years average

Period	**Dura**			**Millet**			**Wheat**			Total
	Trad	Mec	Irrig	Trad	Mec	Irrig	Trad	Mec	Irrig	
1953/54-67/68	2,971	2,954	423	1,399					72	7819
1968/69 -83/84	3,421	6,499	577	3,973					429	14,899
1984/85 -97/98	4,277	13,610	981	7,026					607	26,501
1997/98-2012/13	7,621	13,310	1,160	7,954					713	30,757

Source: Based on data compiled from the Directorate of Agricultural Economics and Statistics, MoA

Traditional rainfed farming

This is the predominant type of agriculture in the country. The system covers around ten million hectares (approx 24 million feddans) in 2014[6] representing more than 50% of the total national cultivated land and is, accordingly, covering much larger areas compared to the 17 and 2 million feddan under semi mechanized agriculture and irrigated agriculture, respectively. The system reflects wide geographical distribution as it dominates the rainlands of the country away from the Nile and its tributaries. Being essentially village-based form of agriculture it constitutes the main source of income and food security for the individual rural households on the rainlands of the country.

The rain-fed areas of the country contribute about 60 percent of the total food grain production in the country and provide for more than 60 % of the total labour force in rural areas in the country are engaged in or depend on traditional agriculture as the main livelihood and economic activity and source of income and food. Most of the coarse grains like sorghum, pearl millet, groundnut, and sesame, watermelon and hibiscus "karkade" are grown in dry lands in general and many only under the rain-fed. The system reflects certain characteristics, namely:

- It evolved as specific form of adaptation to prevailing environmental condition;
- Founded on common property customary land tenure arrangements;
- It is essentially household- based activity;
- It is based on low level of technological input; and
- low level of productivity and yields

The sector was historically portrayed as subsistence in nature, household-based small holdings, dependence on family labour and minimal or no external inputs. However, recently, and owing to commitments to market economy the sector has become progressively market-oriented. The introduction of modern technology, mainly tractors, has also contributed significantly to the remarkable increase in the individually cultivated plots a situation that turned to be one of the main factors behind land degradation, increased competition over land, closure of livestock routes and fueling of local level conflicts

[6] *FAO, Country Programming Framework for Sudan PLAN OF ACTION (2015-2019): Resilient Livelihoods for Sustainable Agriculture, Food Security and Nutrition*

The system is practiced under enormous risks as the virtually complete dependence on rains constitutes the main limiting factor. The system is also the subject to enormous external pressures including the very poor infrastructural base of production and marketing. Lack of title to land contributes significantly to the economic marginalization of farmers as it denies them access to public resources (for example credit) as they cannot use the land as collateral. The system is also manifestly neglected in national policies and national development frameworks and declining in crop yield, from over 350 kg/feddan in the 1960s to an average of 150 kg/feddan in 2012/13, has become a characteristic feature of the sector. The influx of rural youth to artisanal gold mining areas has impacted the sector negatively through the acute shortage of labour. Shortage of agricultural labour has also inflicted the border States with South Sudan following the secession of the South in 2011.

Semi mechanized farming

The system is predominately concentrated in the semi-dry savannah between Latitudes 10^{o} N and 14^{o} N in the Central clay plains. According to the Task Force report on the Revised Role of Mechanized Farming Corporation and other sources[7], there are more than 60 million feddans of land in this belt which can easily be developed and put into semi mechanized farming. Moreover, additional land in the humid savannah along the border with the south could be developed and put into semi-mechanized farming after some reclamation processes.

The sector was introduced to Sudanese agriculture in the mid-1940s in the Central Clay Plains to utilize the abundant agricultural recourses there. The initial development was in Gedarif area. Technical back-up for the new system was provided by Canadian experts who rained Sudanese agricultural engineers and mechanics to look after the new machinery and running the overall system.

Since its introduction in the 1940s the sector started to expand dramatically, from 214,000 feddan in 1954/55 to 2.0 million feddan in 1970/71 (Ministry of Agriculture and forests 2009). By 2014 the area reached around 17 million feddan. Taking into account the fact that the semi-mechanized farmers do not usually cultivate more than 60% -70% of the allocated land, the land leased for the sector is estimated to range between 30 million and 40 million feddan.

This sector is made up of two distinct elements: on the one hand, those farms schemes that have legally acquired from Government through leasehold and on the other those schemes that have been established without any form of official approval. Though there is a severe lack of knowledge as to how large this sub-sector actually is, available estimates[8] suggest that 50% of the area under cultivation in the semi–mechanized rain-fed farming in Gedarif State in late 1990s was un-demarcated. In Sinnar State, 70% of the total schemes' area (5.4 million feddan) is classified as un-demarcated schemes[9]. The land in the un-demarcated semi-mechanized farming has neither been allocated formally for crop production and efforts to re-demarcate these lands have not been successfully implemented. The study of semi mechanized farming in Sudan (2009) summarizes the main reasons behind the expansion of un-demarcated rain-fed farming as follows:

---

[7] *Government of Sudan: the Study of the Sustainable Development of the Semi Mechanized Farming Sector in Sudan, Prepared for the government of Sudan and Sponsored by World Bank, 2007*

[8] *Study of the Sustainable Development of the Semi Mechanized Farming Sector in Sudan, 2009*

[9] *IFAD, Land policy Report, Sinnar and Butana Co-Financed Projects, 2014*

1. Failure of the agricultural authorities from the beginning to meet the increasing demand of the private investors.
2. Availability of abundant land for SMRF, with very weak government supervision.
3. High profits gained by the pioneers of the private investors in the semi-mechanized rain – fed farming.
4. Declining yields of the old demarcated semi-mechanized rain-fed schemes.
5. Encroachment on lands cleared for charcoal production by private investors.
6. Decisions by local administrative or political authorities to allow some local farmers and important personnel to gain access to un-demarcated land.
7. Formal credit being made available to the un-demarcated semi-mechanized rain fed farming under the same terms as for the demarcated farming from the Agricultural Bank of Sudan.

The Study of the Sustainable Development of the Semi Mechanized Farming Sector distinguishes three stages in the development of the sector:

Stage 1: covers the period 1945-1967 where the sector evolved and established in the Central Clay Plains of Sudan as the mechanized crop production schemes (MCPS). The period witnessed the influx of private investor where the areas under the sector went up dramatically to about seven million feddans in late 1967.

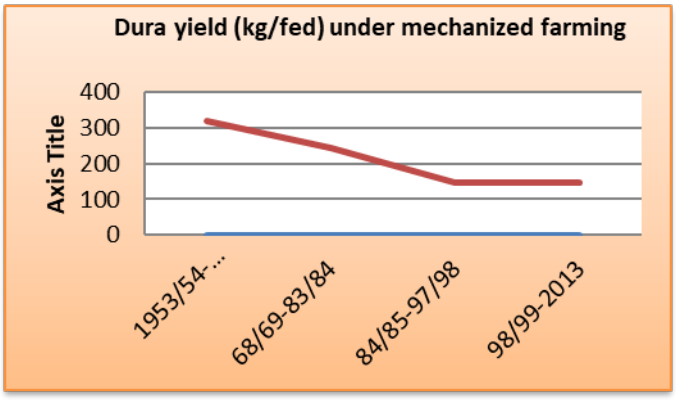
Stage 2: witnessed the establishment of the Mechanized Farming Authority (MFA) in 1968, and the Mechanized Farming Corporation (MFC) in 1975. It ended in the 1992 after dissolution of MFC. During this period, the arrangements and regulations to control and orient development of the demarcated schemes were developed. During this period (second half of 1970s) and through facilitation of Investment Encouragement Act in 1976 a total area of 2.9 million feddan that used to be under pastoral and traditional farming, had been allocated for big companies investing in the semi-mechanized farming particularly in Blue Nile state. These were:

- Sudanese Egyptian Agricultural Integration (SEAICO) 250,000 feddan (Blue Nile State).
- El Sheikh Mustafa El Amin Company: 600,000 feddan (Blue Nile State).
- Damazin Agricultural and Animal Production Company: 500,000 feddan (Blue Nile State). No longer existing.
- Arab Sudanese Blue Nile Agricultural Company (ASBNACO): 379,000 feddan (Blue Nile State).
- The Blue Nile Livestock and Crop Production Company: 1,000,000 feddan (Blue Nile State).
- The Green Valley Agricultural Company: 100,000 feddan (Blue Nile State).
- Abu Sabika Agricultural and Animal Production Company: 56,000 feddan (Gedarif State).
- African Plantation Company: 44,000 feddan (Gedarif State).

Stage 3: This is the stage which followed the dissolution of MFC and transference of its responsibilities to the states and other entities. This followed the adoption of free market economy policies and the adoption of the federal system of government. A characteristic feature of the period is the continued expansion of the sector in an unorganized nature. The former MFC subsidiary corporations became part

of the state Ministries of Agriculture under their Directors General, except in Gedarif and White Nile states. In Gedarif, it continued as a state autonomous body under the Minister of Agriculture, while in the White Nile it became a Department under the Minister of Agriculture. Subsequently, in 2003, The Federal Ministry of Agriculture and Forestry established a rain-fed unit within its structural organization to coordinate the affairs of the sector.

Land management under semi mechanized farming could be described as largely unsustainable. In many schemes soil has been exhausted, and eventually schemes abandoned, as in Northern Gedarif State. Land productivity has also been on the decline, dropping from 353 kg of sorghum per feddan for the period 1954-1970 to 176 kg for the period 1998/99-2012/13. The unsustainable nature of this type of land use is attributed to multiplicity of factors including:



i. The expansion of cultivation on marginal lands
ii. Wholesale clearance of trees from the scheme area despite the legal obligation of the scheme owner to have 10% of his scheme area under tree cover
iii. Absence of land or crop rotation
iv. Monoculture practices
v. Use of machinery causing soil compaction in many cases
vi. Lack of investment to conserve land and enhance its productivity. This can truly be described as extractive agriculture.
vii. The negative environmental impacts of the sector could be easily understood if we appreciate the fact that all areas that were put under SMRF were previously partially either forests or range and pastures. At present these have either been fully cleared or alienated from resource users.

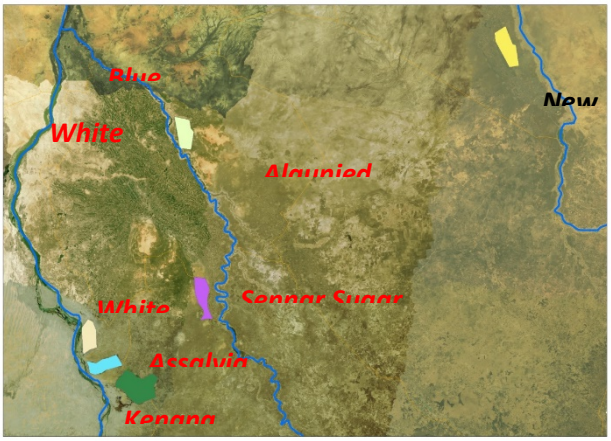
Irrigated agriculture:

This is essentially a commercial form of agricultural activities mostly concentrating in a belt across the centre of the country extending for approximately 1100 km from east to west between latitudes 10° and 14° north, in the arid and semi-arid dry savannah zone[10]. The irrigated sector in Sudan covers approximately 3.5 million feddan and involves two main categories: (i) irrigation for crop production; and (ii) sugar plantation. The irrigated sector for crop production in the Sudan broadly falls into traditional irrigation along the Nile and its main tributaries (gerif cultivation) and modern irrigation based on scheme cultivation. However, approximately 90 percent of the irrigated area falls under the modern system which comprises the three main categories of gravity, pump and flush irrigation; this is in addition to some small basins along the main Nile in north Sudan. Although irrigation only covers about 7 per cent of the cultivated area, it accounts for more than half of the crop yields (UNEP 2007). Large-scale irrigation schemes were Sudan's leading economic investment and backbone of national economy till the late 1990 when oil exports started in 1998.

[10] *UNP, Sudan Post Conflict Assessment, 2007*

The Sixty Years period of the Condominium Colonial rule (1896-1956) with its characteristic massive state interventions in the then traditional economies of the country is the most important period in the development of modern irrigated agriculture in the country. Following the development of Zeidab (1903) and Gezira (1925) irrigated schemes, both Gash and Tokar Schemes for production of cotton were established during the first half of 1920s. During the same period irrigated pump schemes, first started in Gezira Abba in 1927, started and continued to expand along the banks of both the Blue and White Niles and later along the main Nile in Northern Sudan[11].

Establishment of irrigated schemes continued and progressed during the early decades of the post independence period. By 1964 New Halfa irrigated scheme (355,000 feddan) was established on the Butana plains of Eastern Sudan to resettle the Nubians dislocated by Aswan High Dam on the Nile in Egypt. By 1970s large irrigated schemes for production of cotton were established in Rahad and Suki areas in central Sudan.



Sudan sugar belt covers 460,000 feddans (Table 5) and is constituted by Sudan sugar plantations in El Guneid, New Halfa, West Sinnar, Assalaya, Kenana and currently the White Nile Company resulting in the transformation of vast tracts of formerly rainfed cropping, forests and grazing lands into sugar cane cultivation.

Table 5: Irrigated schemes in Sudan

Scheme	Area (hectare)
Gezira and Managil	870,750
New Halfa	152,280
Rahad	121,500
Gash Delta	101,250
Suki	35,235
Tokar Delta	30,780
Guneid Sugar	15,795
Assalaya Sugar	14,175
Sinnar Sugar	12,960
Khashm El-Girba	18,225
White Nile Sugar Company	52,200
Kenana Sugar	45,000
Total	1,470,150

Source: UNEP, 2007

3.2.2 Nomadic Pastoralism

Nomadic pastoralism has been of the two main livelihoods and land use systems of Sudan dry lands. The other system is traditional rain-fed agriculture. At present, Sudan is the home to one of the largest concentrations of traditional pastoralism in sub-Saharan Africa. Although reliable data is missing their number is estimated to account for about 13% of total population in early 1990s (Ahmed1996; Casciarri

[11] *Egemi, Omer (1994) the political ecology of subsistence crisis in the Red Sea Hills, PhD Thesis, University of Bergen, Norway.*

et al 2009). The 2008 Population Census suggests that the number of pastoralists in Darfur account for almost 25% of total population. Under the pastoral system an estimated 106 million head of livestock of cattle (30.2 million), sheep (40.0 million), goats (31.0 million) and camels (4.8 million)[12], are raised in Sudan with the major concentration being in the savanna belt. In many cases pastoralists combine animal raising with subsistence cultivation, but the animals remain pivotal in their livelihood, social, political and economic systems.

The pastoral system in the country varies along a north-south axis with camel pastoralism dominates the desert and semi desert areas north of latitude 16 degrees and cattle herding in the savannah belt towards the south. Main camel herders in the country are the Zaghawa, Northern Rezeigat, Midob and Zayyadia in North Darfur; Kababish, Dar Hamid and Kawahla in North Kordofan, Shanabla in North Kordofan and White Nile, Hawawir and Hassaniyya in River Nle State, Bisharien in Red Sea, Rashaiyda in Kassala, and Shukriyya in Kassala and Gedarif States. Main cattle herders are the Baggara tribes of South Darfur (Beni Helba, Taaisha, Habbaniyya, and Southern Rezeigat), South Kordofan (Misseriyya and Hawazma), Southern White Nile (Awlad Himeid, Kenana, Sabaha, Ahamda and Musallamiyya) and Blue Nile (Rufaa Al Hoi and Ambarrarow).

Livestock routes ; after El Hassan 2008

Similar to other herding groups in the African Sahel the pastoralists adapt their livelihoods to fluctuations in pastoral resources through extensive mobility between wet season grazing towards the north and dry season grazing towards the south. However, the banks of rivers (White and Blue Niles, Atbara River, and Bahr Al Arab have historically been important dry season refuge areas for many pastoral groups. The Baggara groups particularly Misseriyya and Rezeigat used to reach River Bahr Al Arab in South Sudan where they stay for approximately six months (October-April). Through such mobility pastoralists have managed to establish a dynamic relationship between the drier and wetter parts towards the south. This has been attained through numerous pastoral routes linking dry season and wet season grazing areas creating these areas as part of pastoral territorial domains.

[12] *Ijaimi, Abdelatif Ahmed, 2016, Increasing production and productivity in the Five Years Programme 2015-2019, Council of Ministers General Secretariat*

Because of that the landscape of Sudan has been criss-crossed by a web of livestock mobility routes; the length of some routes reach more than 600 km as exemplified by the route used by the camel herders of N Darfur and which extends from Wadi Hawar (lat 19º N in North Darfur) to Umm Dafug area along the border between West Darfur State and Chad; during periods of drought and resource scarcity the route continues deep in Chad. The prevalence of drought conditions since the early 1970s and the related environmental degradation have forced camel-herding groups to move far deeper into South Sudan reaching places like Raja in Western Bahr Al Ghazal. The banks of the White and Blue Niles and their main tributaries (River Atbara, River Dindir, Bahr Al Arab and Sobat) have traditionally provided important refuge grazing areas during the dry season.

Despite their vital role in national and local economy, food security and environmental viability pastoral communities in the country are in a persistent state of crisis and progressive shifts in livelihood systems (Box). Manifestations include continuous drop out from the sector, herd decapitalization, spontaneous resettlement, and decreased resilience to drought and climate change, and resort to violence as source of livelihood and increased migration to towns. Customary rangelands and migratory routes are shrinking in the face of spreading cultivation and heavy capital investments especially in the semi mechanized farming and oil sectors. Lack of clear pastoral development policies, lack of secured access to land and livestock corridors and limited access to education and health services particularly among pastoral women and children have created pastoralists among the most politically and economically marginalized groups in the country a situation that rendered them susceptible to radicalization and recruitment by insurgent groups and conflict entrepreneurs. Because of that, it is no wonder that most of the conflicts in the country are involving pastoralists pushed by feelings of neglect, marginalization and quest for survival. Other constraints to the pastoral sector include:

- The undeveloped nature of pastoral sector that still runs on traditional practices with minimal investments in human capital development, livestock services and commercialization of the sector
- Lack of long term vision to the pastoral sector
- Almost full dependence on the natural range that is progressively shrinking
- Conflicts with other land users over access to grazing resources, especially along livestock corridors that suffer lack of water and management arrangements
- Low productivity of the livestock.
- Poor community organization at grassroots level

3.2.3 Oil industry

Oil discoveries started in 1959 at Abu Jabra, by the US oil major company Chevron. Other discoveries followed in the Mug lad Basin, in the early 1980s[13]. However, commercial exploitation of oil started in 1998 when oil was exported for the first time. Sudan‘s oil output averaged 120,000 barrels per day in 2014, not far above domestic consumption requirements. Of this volume, less than one-third, or 40,000 barrels per day, was being exported—all by the oil companies, as the government’s share goes to domestic refineries.

[13] *Laura M. James, Laura M. James, 2015, Fields of Control: Oil and (In)security in Sudan and South Sudan, Small Arms Survey HSBA Working Paper No 40, 2015*

Most of Sudan's oil fields and known reserves are located in the Muglad and Melut rift basins. Oil fields are linked to the country's refineries via pipelines. The largest pipeline which is managed by the GNPOC runs across the Misseriyya area from Heglig to Port Sudan. The other two lines are the Petrodar pipeline, which extends for 1,380 km from the Palogue oil field in the Melut Basin to Port Sudan and El Fula pipeline (428 km), which connects El Fula oil fields (Block 6) to the refinery in Khartoum.

The Muglad Basin straddles the north–south border in West Kordofan State and covers approximately 120,000 km^2. It contains a number of hydrocarbon accumulations, the largest of which are the Heglig and El Fula oil fields. Successful explorations at Al Rawat area to the south of Kosti (Block 7) in the White Nile State have been achieved. Oil exploration also takes place in many Blocks including off shore Blocks (13, 16, 17,18 and 19).

In spite of its unquestionable role in Sudan's economy the oil has also been associated with a wide range of environmental and local level socioeconomic problems. Environmentally, the sector contributed to large-scale deforestation. In the hope of receiving compensation from the oil companies, a number of people around El Fula have started to cut down vast tracts of forest and fence the empty areas with *zaribat hawa* (literally, 'air fences', fenced off enclosures usually created by settled farmers on grazing land either as new farm plots or as a reserve pasture for their animals or for the sale of the grasses). This has destroyed grazing resources of pastoralists and resulted in intensified competition over land. Pastoralists believe that the oil industry has contaminated water supplies and pastures[14]. There is also a general conviction among local communities that polluted water is said to have become a threat to animal health in Heglig, Defra and Sitaib areas. There are also concerns about the impact of the roads built by the oil companies, alleging that these roads resulted in the alteration of the drainage system. The drying up of Lake Keilak is largely attributed to soil works and roads construction. Depressions such as Abu Kadma and Danbaloiya, used as seasonal water sources, are also said to be endangered. Conflicts over land have heightened. The conflict between Awlad Sirrur and Ilad Hiban over land was attributed significantly to the rising stakes over land associated with oil exploitation in the area.

Impact of oil on Misseriyya pastoral system and land tenure arrangement

- Loss of vast tracts of grazing lands to concessions to oil companies
- Severe contamination of water and pastures
- Changes in drainage system, flow of water and distribution of resources cause by earthworks associated with oil industry
- Intensified competition and conflicts over land and natural resources
- Erosion of land tenure arrangements and relationships related to it
- Increased conflict with oil companies

The introduction of oil industry together with the separation of the South and the unresolved question of Abyie has created a new reality in West Kordofan State with conspicuous land use transformation. The apparent tendency among Misserriyya pastoralists to replace cattle raising by sheep and to start focusing on agriculture are important manifestations.

3.2.4 Gold mining

Gold production in Sudan has made a fundamental turn since 2009. Production has increased from an almost constant annual level of 6-8 tons prior to 2009 to peak at 73 tons in 2014[15]. Over 90% of the

[14] *Pantuliano, Sara and Omer Egemi et al, Put out to pasture: War, oil and the decline of Misseriyya Humr pastoralism in Sudan, 2009*

[15] *Ministry of Finance and National Economy, General Directorate of International Cooperation, 2015, Impact of traditional mining of gold on the social and economic life in Sudan and on the environment*

production is from artisanal mining that has extended to cover over 10 states in more than 118 sites that have their main concentrations in the northern desert of Northern and River Nile States followed by North Darfur (Jebel Amir area), central Butana Plains (areas around Subagh) and scattered areas in North Kordofan and eastern South Kordofan.

According to available estimates[16] the artisanal sector provides employment for more than one million persons and contributes directly or indirectly to the livelihood of over five million persons, thus becomes an important mechanism for poverty reduction in the country. Contribution to the national economy is also substantial as it accounts to around one third of the total value of exports exceeding by far the agricultural exports. This is besides generating growth in other sectors of the economy, especially the service provision, transport and trade and entrepreneurial sectors. Because of that the sector is considered by the Government of Sudan as a top priority sector with enormous future potentialities on the national economy, especially after the loss of more than 70% of the oil revenue to the Republic of South Sudan. This is besides the revenues generated by the localities, especially from local taxes imposed on the small businesses created by the gold mining.

The sector operates under the Mineral Wealth and Mining Act for 2015, the basic law that organizes the gold mining sector including artisanal gold mining. Several other laws which cover several aspects of the mining sector exist including, Environmental Protection Act 2001, Environmental Health Act 2009, Child Act 2010, and Labor Act 1997. The Ministry of Mining, with its affiliates, is the responsible government organ for supervising the mining activities in Sudan and ensuring that conducive investment environment and appropriate procedures are created to encourage investments in the sector.

In spite of its recognizable economic importance at national and local levels the sector is largely unorganized with far reaching socioeconomic and environmental impacts. Although the information gap is acute, available data suggests that agriculture, livestock sector and Gum Arabic production have been seriously affected by shortage of labor. There are also immense environmental negative impacts on the people, vegetation, soil and water. Competition over land with agriculture, forests and lands has also been recognized, especially in Butana area.

3.2.5 Forests

Data on the exact extent of forest and rangeland as land use categories in Sudan is extremely limited if not totally lacking. In spite of the recent efforts made the state of forests and range cover can only be extrapolated from the *ad hoc* surveys and available global ones.

Sudan can be classified among the countries with scarce forest cover. The land cover map produced by FAO and UNEP (Table 6) describes 10% of the total land cover in the country as tree cover (closed-to-sparse). The table reveals that South Kordofan is the richest state where tree cover accounts for almost 51% of the state's total area and accounts for more than one third of the total tree cover in the country. The effect of conflict in Darfur is reflected on the tree cover in South and West Kordofan states which used to be very rich in tree cover. The low coverage in the Blue Nile, Kassala, and White Nile and

[16] [16] *Ministry of Finance and National Economy, General Directorate of International Cooperation, 2015, Impact of traditional mining of gold on the social and economic life in Sudan and on the environment*

Gedarif states is attributed mainly to the vast expansion of semi mechanized farming in these states. The comparatively higher percentage in Sinnar state is attributed principally to the presence of the Dindir National Park which is the largest reserved area in the country. Excluding the Dindir National Park the situation in Sinnar looks gloomy.

Sudan forests domain is basically a natural structure contained in reserved forests (government and out-growers tenure) and natural non-reserved forests. The plantation area is not more than 3% of the reserved forests area. The total forest reserve area is estimated at 9,236,033 feddan[17] (Table 7) or 38792 km^2 representing 2.1% of the country's total area. Most of these reserves are found in West Darfur, South Darfur, Gedarif, Blue Nile and White Nile states.

Table 6: Area under tree cover (000 hectare) by State, 2012

State	**Total Area**	**Tree cover area**	**% of State area**	**% of total tree cover**
Blue Nile	3,817	1,582	41.4	8.4
Gadarif	5,958	598	10.0	3.2
Gezira	2,713	68	3.1	0.4
Kassala	4,871	401	8.2	2.1
Khartoum	2,121	45	2.1	0.2
Northern	36,569	30	0.1	0.16
N Darfur	31,751	470	1.5	2.5
N Kordof	24,056	2,853	11.9	15.2
Red Sea	21,623	459	2.1	2.5
River Nile	13,029	22	0.2	0.1
Sinnar	3,924	480	12.2	2.6
S Darfur	14,163	3,157	22.3	16.9
S Kordof	14,086	7,175	50.9	38.3
W Darfur	5,476	1,120	20.5	6.0
White Nile	3,798	271	7.1	1.4
Total	**187,955**	**18,735**	**10.0**	**100.0**

Table 7: Forest Reserves in Sudan 2013, by State

State	No. of Forests	Area in feddans
Khartoum	16	29768
River Nile	22	32044
Northern	8	32130
Gezira	65	270094
Sennar	197	350133
Blue Nile	271	961948
White Nile	78	848231
Kassala	43	89289
Gedaref	80	1 002 796
Red Sea	53	44 851

[17] *Feddan = 0.42 hectare*

North Kordofan	107	701 655
South Kordofan	144	704 648
West Kordofan	174	173 332
North Darfur	9	16 993
South Darfur	49	3 513 938
West Darfur	32	464 193
Total		**9,236,033**

Source: Abdalla Gafar, 2013, Report to Sudan LGA Land Governance Report

Forests distribution by mode of ownership show that most of the forests resources in the country (66.3%) are owned by the Government and managed and administered by Forests National Corporation. Forests owned by gum Arabic producers (groups and families) account for around 31% and those by individual represent 2.5% while forests registered under names of communities and companies represent 0.8% and 0.6%, respectively (Abdalla Gafar, 2013).

Sudan forests sector is under extreme pressures at present. The annual removal rate, estimated at 2.4% is considered one of the highest rates of deforestation in developing countries. Such conditions were imposed by the secession of South Sudan. Sudan (Table 8) is confronted with various challenges including serious environmental problems represented in deforestation, land degradation, desertification and climate change that threaten the Sudanese people's wellbeing and peaceful life which are strongly linked to food security and sustainable development.

Table 8: Effect of South Sudan secession on forests in Sudan

Changes	From	To	Remarks
Forest cover ratio	29.4%	11.6%	Most of forests shift to South Sudan
The annual removal rate. (90% of removal in the north)	0.74%	2.2%	Sudan is one of the countries with high forest removal at rate global level.
Average annual rate of forests increase (million cubic meters)	11.0	8 million cubic meters	lower growth rate due to widening removal rate and low tree density
Green area per capita per feddan	5.89	1.68	Because of the decline in forest area and population increase
Average tree density per feddans	700 - 400 (from north to south)	500 - 200 (from north to south)	Decreased density due to shift in forest resources and over-cutting. Density can be increased through-management plan and protection

Source: Abdalla Gafaar, Report to Sudan LGAF Report, 2013

3.2.6 Range lands

Forestry, range and pastures were land use systems preceded crop production activities. The areas that are currently under cultivation were previously partially either forests or range and pastures. Substantial variations, however, exist in land classified as actually used or potentially usable for livestock grazing. In

addition, most of the figures available relate to the period before 2011 thus combining figures for both North and South Sudan making it of very limited value for focused research on Sudan. This has created the FAO-UNEP land cover study 2012 as the most recent and reliable source of information. The study identifies 11.8% of the land cover as shrubs and 13.8% of the cover as herbaceous areas making the rangelands accounting for approximately 25.6% of the country's total area. However, remarkable variations in the distribution of range lands exist between the States with the rangelands account for over 60% of the land cover in South Darfur State. On the other extreme range lands account for only 0.5% in Khartoum and Northern States and 0.7% in Gezira State (Table 9).

In both Khartoum and Gezira States range land are constituted by the geographical extent of these states into Butana plains. The same applies to River Nile, Kassala and Gedarif states. The table also reveals that nearly two thirds (64.7%) of the country's rangelands are found in the three states of North Darfur (24%), North Kordofan (22.7%) and South Darfur (18.2%). These are states where semi mechanized farming is not practiced (North and South Darfur) or introduced on restricted areas (North Kordofan).

Table 9: Rangelands areas and distribution by State, 2012

	State Area	Shrubs	Herbaceous	Total Sh+ He	% of State area	% of total Sh+ He
Blue Nile	3,817	553	338	891	23.3	1.8
Gadarif	5,958	198	1,208	1,406	23.6	2.9
Gezira	2,713	17	335	352	13.0	0.7
Kassala	4,871	158	791	949	19.5	2.0
Khartoum	2,122	34	203	237	11.2	0.5
Northern	36,569	112	151	262	0.7	0.5
N Darfur	31,751	2,734	8,853	11,587	36.5	24.0
N Kordof	24,056	5,776	5,136	10,912	45.3	22.7
Red Sea	21,623	1,031	579	1,610	7.4	3.3
River Nile	13,029	72	507	579	4.4	1.2
Sinnar	3,924	504	400	904	23.0	1.9
S Darfur	14,163	4,722	4,035	8,757	61.8	18.2
S Kordof	14,086	4,135	675	4,810	34.1	10.0
W Darfur	5,476	1,690	1,970	3,660	66.8	7.6
White Nile	3,799	494	802	1,296	34.1	2.7
Total	**187,955**	**22,231**	**25,983**	**48,213**	**25.6**	**100.0**

Source: Compiled and calculated from FAO/UNEP 2012 Land Cover map of Sudan

Range lands in the country are currently under extreme pressure, particularly from the expansion of cultivation, in both the traditional and semi mechanized sectors. There is general consensus among land users, planners, researchers and decision makers in Sudan that the spread of farming wherever land is deemed suitable for crop cultivation has removed much of the woodland and pasture on which the livestock formerly depended. Available data from UNEP[18] from various locations in the country (Table

[18] *UNEP, Sudan post conflict environmental assessment, 2007*

10) suggests that Sudan has lost from 20% to 50% of its rangelands over the past few decades. This major reduction in the amount, quality and accessibility of grazing land is considered to be a root cause of conflict between pastoralist and agriculturalist societies throughout the drier parts of Sudan,

Table 10: Changes in rangeland cover in some selected sites across Sudan

Study site and state	Original and current pasture land (% of total area)	Annual linear rate
Ed Damazin, Blue Nile	18.5 to 0.6 from 1972 to 1999	- (96.7 %)
El Obeid, Northern Kordofan	50.4 to 33.5 from 1973 to 1999	- (33.5 %)
Gedaref and Kassala states	13.0 to 8.2 from 1972 to 1999	- (37 %)
Kassala	36.1 to 26.4 from 1972 to 2000	- (2.6 %)
Sunjukaya, Southern Kordofan	39.2 to 13.7 from 1972 to 2002	- (34 %)
Timbisquo, Southern Darfur	65.4 to 59.3 from 1973 to 2000	- (9.3 %)
Um Chelluta, Southern Darfur	42.4 to 32.7 from 1973 to 2000	- (65 %)

Source: UNEP, Sudan post conflict environmental assessment, 2007

3.2.7 National parks and protected areas

A significant number of areas throughout Sudan have been gazetted or listed as having some form of legal protection. In practice, however, the level of protection afforded to these areas has ranged from slight to negligible, and many exist only on paper. National parks and areas designated as protected areas cover 8.1% (150,963 km2) of the country's total area. The three sites of Wadi Howar (100,000 km2), Radom (12,500 km) and Dindir (10,000) accounting for a large portion of this figure (Table 11).

Table 11: Wild life and protected areas

Protected area(* proposed)	**Type (* proposed)**	**Km²**	**Habitat(s)**	**Key species**
Radom	National park/ MAB reserve/ Important bird area	12,500	Savannah woodland	Buffalo, giant eland, leopard, hartebeest
Dinder	National park/ MAB reserve/ Ramsar site/ Important bird area	10,000	Savannah woodlands and flooded grasslands (mayas)	Reedbuck, oribi, buffalo, roan antelope, red-fronted gazelle
Jebel Hassania*	National park	10,000	Semi-desert	
Wadi Howar*	National park	100,000	Desert	
Jebel Gurgei Massif*	Game reserve	100		
Rahad*	Game reserve	3,500		
Red Sea Hills*	Game reserve	150		
Sabaloka	Game reserve	1,160	Semi-desert	
Tokor*	Game reserve	6,300	Semi-desert	
Erkawit Sinkat	Wildlife sanctuary	120	Semi-desert	

Erkawit	Wildlife sanctuary	820	Semi-desert	
Jebel Buwzer (Sunut) Forest	Bird sanctuary/ Ramsar site*	13	Semi-desert	
Jebel Elba*	Nature conservation area	4,800		
Jebel Marra Massif*	Nature conservation area/ Important bird area	1,500	Savannah grassland and woodland	Greater kudu, redfronted gazelle
Total		**150,963**		

Source: UNEP, 2007

Dinder National Park is the most important terrestrial protected area in Sudan. Established in 1935 the Dindir National Park DNP is the oldest in Sudan, covering an area of approximately 10,000 km^2, of which 70% as biosphere reserve and 30% as buffer zone. The most important features of the park are a series of permanent and seasonal wetlands known locally as *mayas*, which are linked to the Dindir seasonal stream running off the Ethiopian highlands to the east. The DNP falls within three States: Blue Nile State (South East), Sennar State (North) and Gedaref State (North East). The Park's area constitutes an important and rich ecological zone in the arid and semiarid Sudano – Saharan region.

Till late 1960s, the Park was considered as one of the outstanding African wildlife heavens as the area surrounding Dinder was relatively uninhabited. Since then, however, migration and land use changes have resulted in development around the park, to the extent that some forty villages now exist along its borders. Large-scale mechanized agriculture to the north and west has not only pushed traditional agricultural communities to the edge of the park, but by taking over most of the land previously used for grazing, has also led pastoralists to invade the park in large numbers. Livestock compete with wildlife for fodder and water while burning degrades the grassed woodland habitat. Poaching is also a major problem, as is the felling of trees for firewood by trespassers and fires set in the course of honey extraction. The expansion of the semi-mechanized farming sector together with the delineation of the Park in the 1980s have resulted in the appropriation of vast tracks of agricultural and grazing resources that resulted in proliferation of conflict particularly in the Kadalo area of the Blue Nile State over land and the progressively diminishing natural resource base a situation that increasingly straining the Park's resources.

In response to problems facing the Park and in an attempt to curtail habitat a Management Plan for the Park had been drafted in 2004. The Plan divided the Park into three zones: Core Zone, Buffer Zone and Transitional Zone where the natural resources may be used by the surrounding residents under the control of the Park's administration. The Plan was revised in 2010 with support from the EU and the Nile Basin Small Grant Projects where number of activities was implemented in the buffer area with the objective of enhancing livelihood security in villages around the Park as a measure to maintain and conserve the Park's habitat.

Radom National Park was designated as a biosphere reserve in 1979. Encompassing 1,2,500 km^2 the reserve is situated in southern Darfur State close to the border with the Central African Republic. The area

is characterized by savanna woodland with riverine forests. The mountain range within the biosphere reserve constitutes a watershed dividing the Central African and Sudan hydrographic system. Increasing number of people, including refugees, have settled within the biosphere reserve boundaries. Major human land use activities include agriculture (sorghum, watermelon, and sugar cane), honey collection, pastoralism and tree felling for trade and charcoal. Severe pressures on the reserve have been introduced by the Darfur conflict since 2003 and the artisanal gold mining that started over the past few years.

4. Land governance

Land governance refers to the policy, legal and institutional frameworks for land administration and natural resource management. This involves addressing the laws, norms and regulatory frameworks governing the management of land and natural resources, and in particular how these are interpreted and implemented.

4.1 Land Use Policies

However, the lack of clear and comprehensive frameworks for land administration and management remains a defining feature of Sudan's land policy inherited from the first plan development in the country (Ten Year Development Plan 1960-1970) and the following strategies up to early 1990 including: Five-Year Plan 1970/71-1974/75; Six-Year Plan, 1977/78-1982/83; First Public Investment Program, 1978/79-1980/81; Third Three-Year Program, 1982/83-1984/85; Four-Year Salvation, Recovery and Development Program, 1988/89-1991/92; and the Three-Year National Economic Salvation Program, 1990/91-1992/93[19].

a) Decentralization of land administration and natural resource management

The 4th Constitutional Decree of 1991 and Sudan Interim Constitution (2005) recognised Sudan as a federal country and gave the States the responsibilities over the administration of their lands and the management of their natural resources.

B) Comprehensive National Strategy (1992-2002)

It is perhaps the National Comprehensive Strategy (NCS) 1992-2002 that provided special attention to land management and spelled out the objectives and priorities for sustainable development maintaining that environmental issues must be embodied in all development projects. Poverty alleviation, popular participation and incorporation of indigenous knowledge were recognised as key elements for sound land management. The NCS stressed horizontal expansion of agriculture as the driving for the attainment of food security. This was founded on the politically-led national slogan "we eat what we produce and we wear what we manufacture" which set in motion a rapid and uncontrolled process of agricultural expansion and large-scale land acquisition. The NCS stressed the adoption of number of policies and directives that had not been realized including:

[19] *Mahran H.A., 1994, Development strategies in the agricultural sector of the Sudan: 197 0 – 1990, Cahiers Options Méditerranéennes; pp:157- 179*

- Planning of development project must consider continuous productivity, renewal of resources and application of technology appropriate to environment and life styles
- Environmental Impact Assessment (EIA) is a requirement for any development project
- Establishment of national body with branches in the states to guide, coordinate and supervise land-based activities
- Improvement and updating of land and environmental legislations
- Use of incentives, charges and taxes to encourage environment friendly activities and interventions.

C) National Action Plan to Combat Desertification 2006

The Plan document provided a description and analysis of the scale and magnitude of desertification in the country and proposed actions to be undertaken besides proposing the establishment of a national council to combat desertification with a general secretariat at federal level, councils at state level with monitoring and coordination units and local committees at the level of implementation.

The Plan is still not widely known or recognized owing to: (i) very poor and restricted implementation as the recommended Higher Council for Coordinating Drought and Desertification Control Programmes (HCCDDCP) has not been realized and the proposed restructuring of the National Drought and Desertification Control, Coordination and Monitoring Unit (NDDCU) of the federal Ministry of Agriculture to promote it to a General Secretariat for HCCDDCP has not taken place.; and (ii) the sectoral nature of the strategy as linkages with other sectors have been poorly conceived or established. New challenges to the Plan have also been introduced by the independence of the Republic of South Sudan which greatly challenged and questioned the relevance of the Strategy and its appropriateness

D) Quarter Century Strategy 2007-2031

An interesting aspect of the Twenty-Five-Year Strategy (2007-2031) is that it does not accord special section or specific strategy for land and environment as they come under the Economic Strategy. This reflects the gross failure to incorporate and mainstream land issues in development policies. However, the Strategy calls for the sustainable management of land and contains policy lines that provide the potential for achieving that. But again contradictory policies that are likely to compromise sustainable land management are included. The main policies specified by the Strategy include:

i. Optimizing land use according to its productivity

ii. Implementing the national plan for land uses and completing the allocation of 25% of the total land for grazing and forests in order to benefit livestock and wild life thereby contributing to balanced environment and life

iii. Developing available water by increasing reservoirs and rivers and ravines storage capacity, exploiting artesian water, expanding water catchments methods and providing drinking water for societies and livestock

iv. Rehabilitating irrigation services in order to upgrade the efficiency of water uses, introducing appropriate technologies to optimize water uses and disseminate water awareness

v. Doubling the cultivated area by artificial, flowing and flooding irrigation to the tune of 10 million feddan. Doubling the cultivated area for rain fed agriculture to close to 50 million feddan. Affecting a vertical increasing to realize high productivity rates thereby increasing competitiveness.

vi. Increasing the forestry area by natural and artificial breeding in reserved forests, institutions and national forests.

vii. Expanding exploration and exploitation of mineral resources and spreading them to all oil quadrates which cover all parts of the country

viii. Expanding investment in the field of oil by introducing incentive policies, procedures and laws guaranteeing the non-expropriation of local and international capital. In addition, providing security in exploration and production

Liberalization the tourism sector to encourage investment, taking into account the risks of environmental contamination.

E) The Interim Poverty Reduction Strategy I-PRSP, 2010

The I-PRSP 2010, a detailed and costed medium-term plan provides the general policy framework (Table 13) and road map for the elaboration and implementation of the full PRSP that will guide national development planning for the coming five years. The strategy included number of well -articulated policy directives and guidelines that relate directly to land use. Table 13 provides summary of those policy guidelines.

Table 13: Policy frameworks established by Sudan I-PRSP[20] for land use related issues

Sector / General objectives	Policy Measures / Programs
Recovery and Growth of the Agricultural Sector	• Institutional reform and enforce of land use regulations, research, extension and pest control. • Land policy that provides farmers with formal and secure tenancy. • Revise land policies so as to create stability in tenure rights for small farmers and pastoralists • Improve agricultural productivity by increasing efficiency of management and application and adoption of model technologies • Efficient management of water resources • Implement liberalization policies regarding gum Arabic • Increase efforts to halt and reverse desertification as a threat to agricultural develop • Enhance private sector to play a leading role in the production process.
Environmental and	• Preparation of land use maps especially for marginal areas forestry and

[20] *Ministry of Finance and National Economy, I-PRSP, 2010, Khartoum*

natural resource management	food crop production. • Enhance role of community in resource management and launch environmental awareness campaigns. • Strict enforcement of environmental laws and supporting legislation. • Increase the capacity of both federal and state governments to monitor and enforce land lease conditions on clearing and cultivation in areas subject desertification. • Comprehensive land reform and security of title • Pilot demonstration of soil and water harvesting programmes • Promote private investment in forestry gum Arabic production.
Good Governance 1. Empowerment of local communities and involvement in decision-making	• Review present federal structures with a view to devolve significant powers and obligations to people at the locality and village levels. • improved federal, state and local-level policy coordination to eliminate the overlapping fees, taxes and custom tariffs, as well as cross-state tariffs in some areas that are currently hampering economic activities • Improved federal, state and local-level policy coordination to eliminate the overlapping fees, taxes and custom tariffs, as well as cross-state tariffs in some areas that are currently hampering economic activities

Source: I-PRSP, 2010.

F) Pastoral policies

The national policy towards pastoralists, although not explicitly stated, it seems to have been guided by the Soil Conservation Report (1944) published by Sudan Government and which states that:

> *where nomadic pastoralists were in direct competition for land with settled cultivators, it should be the policy that the rights of the cultivators be considered as paramount, because his crops yield a bigger return per unit area" (Egemi 2014[21]).*

Associated with the above, is the apparent neglect of pastoralists and pastoral sector in national development plans. Examining the place of pastoralists in national development frameworks Ahmed (1980[22]) remarked that:

> *Despite the major role of nomads in the national economy, the livestock sector has not been given the attention it deserves from the government*

Besides the above, pastoral development policies are loosely defined by decision makers who see them as synonymous with livestock development with the assumption that a trickle-down effect would eventually

[21] *Egemi, Omer, 2014, Pastoralism as a sustainable livelihood system: policy review for Sudan, Technical Paper, Tufts University, Boston, USA*

22 Ahmed, Abdelghaffar M.,1980, Planning and the neglect of pastoral nomads in Sudan, in Gunnar Halland (ed) Problems of Savanna development: the Sudan Case, Occasional Paper No. 19, pp: 39 – 54, Department of Social Anthropology, Bergen, Norway

diffuse economic benefits and improve the living conditions of the pastoralists (Mohamed Salih 1990[23]). Because of that pastoral development policy was dominated by sheer provision of water and, but to a lesser extent, health and education. Khogali (1987[24]) describes this policy as "being interested in livestock and not in animals' raisers. According to Mohamed Salih (1990):

> The pastoralists are seen as mere keepers of livestock, providers of cheap livestock products and indispensable source of revenue to the national treasury

G) Nomads' sedentrization

Another line of the national pastoral policy was based on the resettlement and sedentrization of the pastoralists. In this respect enormous experiences were tried. The most important experiences include:

- To resettle the Misseriyya cattle herders of west Kordofan in the 1960s through the establishment of Babanosa milk factory;
- To resettle the Hadandwa Beja on the Gash Delta agricultural scheme
- To resettle the Shukriyya pastoralists on the Rahd Agricultural Scheme in the 1970s
- To settle the Beja pastoralists on Suki Agricultural scheme in the 1970s
- To resettle the Beja pastoralists in the Fashaga Agricultural area around Gedarif in 1970s.

All of the attempted experiences to resettle the pastoralists have failed. This could be attributed to the followings:

- The top-down approach followed as the pastoralists themselves were not part of the planning or the decision making process
- Poor understanding of the pastoral sector among planners and decision makers. It was not clear for planners and decision makers whether they wanted to resettle the animals or the people (animals owners)
- Failure to help the pastoralists with other livelihood options
- The complete separation between animals and agriculture with strict restriction of animals movement in the agricultural schemes[25]

H) Demarcation of livestock routes

Demarcation of livestock routes is largely viewed as a top priority agenda since the late 1990s. The main rationale behind route demarcation is to minimize conflict between pastoralists and farmers rather than being an attempt to facilitate and secure the rights of pastoralists to their seasonal mobility between wet and dry season grazing areas. Route demarcation has also become one of the main programmatic interventions of the INGOs and national organizations involved in peace building efforts.

---

[23] *Mohamed Salih M. A, 1990, Government policy and options in pastoral development in the Sudan, Nomadic People, No. 25-27, pp 65-78*

[24] *Khoglai, Mustafa M, 1980, Sedentrization of the nomadic tribes in the Northern and Central Sudan, Ph.D. thesis, Department of Geography, University of Khartoum, Sudan*

[25] *Egemi, Omer, 1994, the political ecology of subsistence crisis in the Red Sea Hills, Sudan, PhD Thesis*

Evaluation of efforts exerted by government and INGOs in route demarcation (SOS Sahel UK 2009) shows that the intervention has produced very limited success. The major shortcomings stem from the reductionist approach followed in dealing with the routes sectorally in isolation from the dynamic and progressively changing socio-economic, ecological and political realities of contemporary Sudan. Changes in land use patterns and the accelerating transformation towards market economy under conditions of increasing human and livestock population and increased competition over land have all combined to create new realities that require concrete placing of corridor demarcation within a wider framework of sustainable land use planning and equitable natural resource management.

Added to the above is the fact that route demarcation has been fully guided by the "corridor legislations" drafted by the States from a security perspective with the main intention being to repressively minimize conflict rather than the development of nomads and security of their rights to mobility and access to resources. Lack of investment in physical infrastructure, especially water sources along the corridors to serve the pastoralists and their animals has in turn forced pastoralists to take their animals to the nearby water sources at the outskirts of villages or in the agricultural schemes resulting in confrontation and disputes between nomads and villagers.

4.2 Legal Frameworks:

4.2.1 Land Tenure

Land tenure is a very complicated issue and is widely viewed as one of the most complex current issues to be addressed. The existing land tenure arrangements take two forms: the statutory and customary arrangements. On the basis of statutory law the country had long had a legal system of land registration through which an individual, an enterprise, or the government could establish title to a piece of land as provided for in the Land Settlement and Registration Ordinance, 1925 which provided for registration of title to land. The registration had been extensive along the River Nile while the rainlands, the majority of the country's land, were not included and thus become unregistered.

In 1970 the Unregistered Land Act declared that all waste, forest, and unregistered lands were government land. Before the act's passage, the government had avoided interfering with individual customary rights to unregistered land on the rainlands of the country. and in the late 1980s it again adhered to this policy.

The Civil Transaction Act, 1984, is the latest legislation concerning land that abolished a number of scattered land laws. The Act also repeals the 1970 Unregistered Land Act but is more comprehensive giving some details and guidelines for its practical implementation. The Act maintains the basic principles of usufruct rights but recognizes that registered tribal or individual usufruct rights are of equal status to registered ownership. The Act also considers the following issues that are important to securing land tenure:

- Transfer and inheritance of rights
- Compensation for land appropriated by the state
- Granting of land leases to cooperative bodies and communities
- Conditions for obtaining usufruct rights
- Possibility of registering easement rights (rights of way)

The Act legalizes elements of *Sharia* Law by recognizing the unregistered land rights (urf) while confirming the role of the state as land owner and manager. According to the Act "*No court of law is competent to receive a complaint that goes against the interest of the state"*.

The customary law on the other hand follows historically derived tribal territorial rights initially constituted during the successive indigenous kingdoms of pre-colonial Sudan and reinforced through considerable legislations during the British colonial administration. Within the tribal homeland the collective security of the tribe is constituted and individual rights to land were recognized and could be inherited but with no power to alienate land from the ownership of the tribe (Shazali 2002).

Within the customary land tenure arrangements security of access to land among sedentary communities, was legitimized through membership in a village community. Pastoralists legitimized access to the rangelands by membership of fluid structures of tribal groupings organized around power centres controlling strategic resources or through negotiated arrangements with village leaders.

Today the government owns urban lands; land under registered forests and national parks; under the modern irrigated agricultural schemes which are leased to tenants or to private entrepreneurs as most operators of the semi mechanized rainfed farming. On the other hand the great area of land used for pasture and for traditional cultivation is communally owned under customary land laws that varied somewhat by location but followed a broadly similar pattern.

The interface between statutory and customary land laws and legislation is complex issue that has created a confused environment over which law has the dominance, the statutory of the customary. This complexity of the issue had made it necessary for all Sudan peace agreements to call for harmonization of the two systems of law and for that purpose the establishment of Land Commissions (National Land Commission, and one for each of South Kordofan, Blue Nile, Darfur and Eastern Sudan) was stipulated. With the exception of the Darfur Land Commission none of the others has been established.

The unresolved land issue has turned to be one of the main factors fuelling conflicts in the country besides constraining investment in land and natural resources and the realization of their social and economic huge potentialities.

4.2.2 Forests Legislations

Legislation concerned with Sudan's forests dates back more than one hundred years when the law of Forests and Bush Lands was promulgated in 1901. In 1932 the Central Forest Reserves and Provincial Forests Ordinance was declared and continued to hold for nearly fifty years until it was amended by the Forests Policy in 1986. By 1989, the Forests Act and the Forests National Corporation (FNC) Act were declared and implemented. The most recent law is the Law of Forests and Renewable Natural Resources declared in 2002.One of the general features of the law is the inclusion of FNC Act of 1989 (administrative) and Forests Policy Act of 1989 (technical) in this new law as a single law to facilitate its implementation. It also brings together the renewable natural resources of forests, soils and pastures under one law, as essential step to deal holistically with natural resources rather than sectorally as prevailed before. The idea was good and could have yielded positive results, but it remains a piece of legislation that is little known outside of the FNC. Unfortunately, the attempts and good intentions to avoid sectoral approaches to land management have been aborted by promulgation of the Range and Pastures Law in

2015. The attempted comprehensive approach is also challenged by the existing institutional arrangements based on administrative enclaves fragmented between different ministries.

This 1989 Act together with the Forests and Renewable Natural Resources Act that followed in 2002 have been commended for being the first set of comprehensive legislations to recognize new types of forest ownership aside from national and state forest reserves. Forest ownership could now include private, community and institutional forest reserves managed by individual owners, community-based committees and institutions respectively. Thus, providing for conceptualizing a new culture found on community forestry which has further implications on land tenure as it essentially provides an important impetus for securing community rights to land. The acts, however, determine that all types of forest reserves would fall under the technical supervision of the FNC.

Recognition and emphasis placed on the role of traditional leaders and the native administration system are also challenged by the weak capacities of the institutions and the contestation of its legitimacy at local level. Provisions for the rights of local communities of establishing village and community forests is considered as an important innovation in the law but concerns about facilitating encroachment on pastoral routes and fuelling conflict between pastoralists and settled communities are raised.

There has also been a confusion of roles between federal and state levels when it comes to forests. Some of the forests gazetted during the past decades have been challenged by the expanding urban landscapes as exemplified by the case of the Khartoum Green Belt which had already been removed and Nyala Forest which is now part of Kalma IDPs camp and has been seriously damaged. The Federal system has also brought about number of challenges including the contestation of federal forest by the States that claim sovereignty over forests within their territories.

4.2.3 Range and Pasture Law, 2015

The law recognizes and identifies the four categories of rangelands: (i) public grazing lands; (ii) private hema; (iii) commonly held hema; and (iv) privately cultivated range. The management of rangeland is vested in the state authorities in coordination with users of the range including right holders of hema and private leaseholders. Defining the roles of responsible authorities and the restricted actions in the rangelands the Law gives State authorities the right to impose restrictions on grazing as to time and space and to allocate land for grazing for the benefit of the whole community and the protection of animal resources. The Law also offers the opportunity to allocate, and possibly to register, pasture land in the name of the community but it also and paradoxically gives the authorities the right of restricting and cancelling such benefits. Closure of livestock routes is explicitly prohibited. One of the main limitations of the law is its failure to specifically to identifies what constitutes the rangelands as all of the lands considered as rangelands are held under customary system of land ownership that rarely recognized the legitimacy of the State as the owner of land. In addition, access to pasture land is vaguely described by the Act.

4.2.4 Water legislations

Regulatory frameworks in the form of laws and legislations, policies and strategies constitute a critical gap for effective governance of the water sector in the country. Although there are various acts and strategies under different institutions and sectors including Water Resources Act 1995, State Water

Corporation Acts 1998 and the Public Water Corporation Act of 2008 contradictions and irregularities are widely perceived contributing to the fragmentation of authority and responsibility among various institutions without effective or institutionalized mechanism of coordination. The lack of clear and ratified strategic plans has also contributed to the instability and frequent change of the water sector institutional set up. However, the main water legislation relating to land use is the Civil Transaction Act of 1984. The Act stipulates the followings:

- Rights to develop and access water resources cannot be separated from rights which are exercised over the land, as long as permission is granted by the respective water authority whose job it is to ensure that the water point in question has no harmful side effects.
- Access to public water sources is given to all people, subject to the parameters listed by existing legislation. This access is ceded through the licensing of a contract.
- All water resources that are constructed are recognized as private property, and therefore access rights must be negotiated with the owner of the land on which these resources are found
- In the event that a tenancy agreement is in place, a landowner will bestow the relevant rights of access to the tenant, including the right to use water.

Sudan suffers the lack of recognizable and legitimate institution responsible for rural land management, administration and policy.

4.2.5 National Parks and Protected Areas Act, 1986

This is the key legal instrument available for wildlife management at federal level. The main features of the Act are as follows:

- It defines the national park and identifies the competent authority that gives permits for entering, staying in and hunting in the parks
- It lists the prohibited acts inside national parks, namely the felling of trees, the setting of fires, the excision of parkland, the construction of houses, digging or mining, entry of domestic animals, the carrying of guns, the disruption of water courses, and the culling or disturbing of game
- It indicates the measures and the competent authority for declaring new areas as game reserves and/or bird sanctuaries in which hunting without a permit is prohibited. Th e general manager of a park or sanctuary may issue hunting permits and also has the power to determine the rules that govern hunting in terms of the hunting season, the means and duration of hunting, and the types and ages of animals to be hunted
- It sets out the regulations for trade in game animals and/or their parts
- It indicates the level of penalties for all wildlife off ences It lists the animals that are prohibited from being hunted, animals that may be hunted under permit, and animals that are prohibited from being exported without a permit

4.2.6 Investment Act 2013:

In December 2011 the government eliminated the Ministry of Investment and replaced it with the High Council for Investment, headed by the President. The Council is mandated to carry out efforts to create an

enabling investment climate through facilitating procedures and put in place the rules and procedures to attract private capital investment and protect the rights of the investors. Branched down to the States, the High Council is the highest authority assuming the responsibility for policies, plans and programs, follow-up implementation and creation of an attractive climate for investment. It also mandated to identify areas of investment priorities and reviewing laws and regulations relating to investment. The 2013 Investment Act gives the Council, among other things, the authority to:

- Prepare investment plans in cooperation with the relevant ministries and States. The investment map is conceptualized by the Act as the document which sets general policies and rules for investment in the country;
- Approval of investment requests;
- Determines and allocates the national land designated for investment in accordance with the investment guidelines prepared and in coordination with the concerned ministries and States

From the above, it could be remarked that the Investment Act has in reality equipped the Council with the power and mandate to perform as the sole institution to decide the designation and allocation of land for investment in the country, with the consultation of minimal stakeholders as the Act does not give communities the right to be consulted. This has created issues of compensation, transparency and accountability as important challenges to the Act. The Act, in its present status could also be described as one of the drivers of conflict taking into account the unresolved question of land tenure in the county and in particular the place of the customary arrangements with the Sudanese legal sphere. Added to this is the fact that existing land-related institutions, in their present status, are poorly equipped with required capacities and procedures to identify economically, environmentally, and socially beneficial investments and to implement these effectively.

4.3 Institutional aspect

The structure of land administration, at both the federal and state level, is characterized by the presence of large number of actors (Table 14) who, although influence land use decisions in one way or another, are not closely linked or integrated. Key structures are the Ministry of Agriculture; Ministry of Environment, Forests and Physical Development; Ministry of Justice; Ministry of Tourism and Wildlife; Ministry of Water Resources, Dams and Electricity and the National Agency for Investment. At the State level a wide range of institutions and actors do exist including: the Walis, Ministries of Agriculture, and Forests National Corporation, Investment Commissions, Land Dispossession Committees at the Mahaliyya level and the Native Administration and Popular Committees at the local or village level.

In addition, land related institutions; especially at State level suffer problems of coordination, capacity, accountability, and overlapping authorities. Years of underfunding have rendered these institutions manifestly incapable to deliver services and to perform their responsibilities. Lack of law enforcement mechanisms is a defining feature of land governance. Added to this is the immature process of decentralization of natural resource management which manifestly failed to proceed to a robust devolution of authority to the states and localities. The encroachment of the Federal Government on the powers of the States is common and battles over decision related to land are not uncommon. The situation has been complicated by the absence of nationally recognizable institution for land management and administration.

Table 14: Institutions related to land use in Sudan.

Presidency and State's governors	o Designation of land o Authority of land acquisition o Establishment of local councils (Localities)
Ministry of Environment, Forests and Physical Development	o Established in 2003 with a mandate covering surveying, construction, urban planning and, more recently, environment o FNC responsible for the overall management of forests in the country (reservation, protection, conservation and replacement) falls under its overall auspices
Ministries of Agriculture	o At federal level the Ministry is engaged in land policy formulation and decisions over land use o At State level the ministries allocate agricultural land, especially in the semi mechanized sector; keeps register of leasehold; collect revenue from land rental
Ministry of Animal Resources, Range and Fisheries	o Management of rangelands through Range and Pasture Administration o Mapping and demarcation of livestock routes
National Council for physical Development and Land Disposition	o General policies for urban planning o Drafting of laws and regulations concerning physical planning
National Investment Council	o Identification of land for agricultural, industrial and other purposes o Allocation of land for investment
States Councils of Ministers	o Final approval of urban land use and housing plans
Native Administration	o Application of customary law to land management
National and State Fund for housing and rehabilitation	o Allocation of housing to the poor through rental selling
Physical Planning and Land disposition committees	o Approval of locations and purposes of land use o Designation of governmental land for institutions, individuals and corporations
Physical Planning Administration	o Preparation of physical plans for approval o Conduction of socioeconomic studies for planning and establishment of rights, on behalf of the state
Land Administration	o Support to land registration at the judiciary after approval
State Ministers of Physical Planning:	o Approval of housing plans o Surveying and deciding on village hema (haram hilla) o Approval of changes in village boundaries o Looking into appeals pertaining to land within the power of the Ministry
Department of Surveying	o Surveying and mapping of lands o Preparation of land maps o Information centre for land issues o Physical handover of land to those entitled

Land Registration Offices	o Keeping land registers of the town o Information centre on town land and planning
Locality Legislature	o Establishment of administrative Units
Land Courts:	o Arbitration and conflicts over land
Range and pastures Department	o Mapping and demarcation of livestock routes o Protection and management of range lands
Land Disposition Committees	o Allocation of agricultural land o Policy making on agricultural land uses
Nomads Commissions	o Policy making for the development of pastoralists o Mapping and demarcation of pastoral routes o Advocacy for and defending of pastoral rights
State Security Committee	o Reporting on land and resource-related conflicts
Locality Security Committees	o Resolution of conflicts over land
Locality Executive body	o Issuing of certificated that the specific piece of land is void of conflict o Approval of temporary locations for services/ related uses

Source: Adapted from UNEP, 2007, Sudan Environmental Post Conflict Report

5. Factors Affecting Present Land Use

Present transformation could be attributed to a complex web of interrelated factor, important among which are:

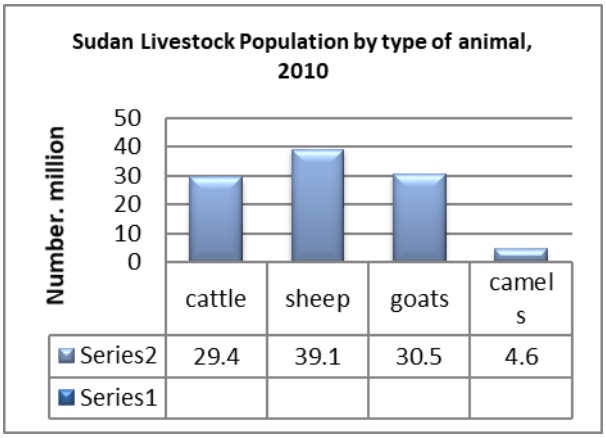
5.1 Population growth and mobility

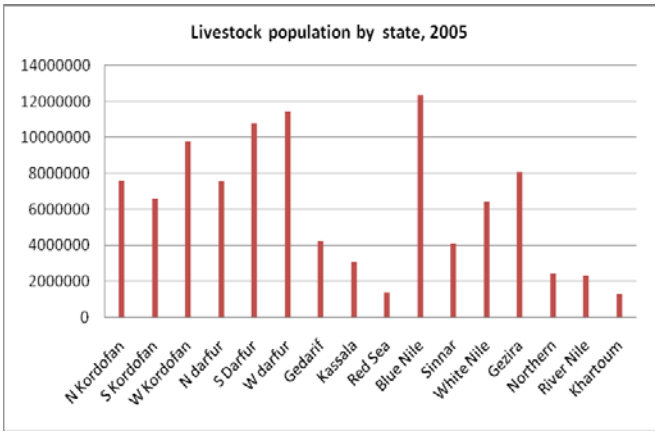
The rapid growth in human and animal population exerts heavy pressures on land through increased demand for cultivation and grazing land. Human population has increased from around 7.8 million in 1955/56 to 30.9 million in 2008 and to approximately 36 million in 2015. Livestock population is also rapidly increasing, from around 30 million head in 1975 to over 100 million head in 2010[26] and 106 million in 2015[27].

Population instability associated with the great drought of the late 1980s and the severe famine associated to, together with the proliferation of conflict particularly in Darfur, Blue Nile and South Kordofan, and the impacts of climate change has resulted in drastic changes in land use patterns. While some areas have been depopulated especially along the southern margins of the Sahara in Darfur and Kordofan, other areas particularly the rich savanna areas and the fringe of urban centres have become major concentrations of population with rising stakes and demands for lands. In fact there is the general observation that over the last three decades both population and economies of the rainlands of Sudan are moving steadily southwards, from the semi desert areas to the savanna belt.

[26] *Roy Behnke, Odessa Centre, 2013, the economics of pastoral livestock production and its contribution to the wider economy of Sudan, UNEP and Feinstein International Centre, Working Paper*

[27] *Ijaimi, Abdelatif Ahmed, 2016, Increasing production and productivity in the Five Years Programme 2015-2019, Council of Ministers General Secretariat*





5.2 Land degradation

Sudan has been experiencing serious problem land degradation. Vast tracts of land that were previously agricultural and pastoral have been converted to desert. UNEP 2007 remarked that a particular problem in Sudan has been the conversion of semi desert habitat to desert suggesting that a 50 to 200 km southward shift of the boundary between desert and semi desert has occurred since the 1935s. Evidence from Darfur suggests that the conflict has resulted in an unprecedented destruction of environmental resources[28]. The environmentally destructive impacts of the semi mechanized farming in the six states of Blue Nile, South Kordofan, Sinnar, White Nile, Gedarif, and Kassala is documented by a recent Government report which suggested that in the 1970s alone, an average of 8,750 square kilometers of forest were removed annually to make room for mechanized cultivation[29]. Land degradation and the declining income from land, under conditions of population growth and rapid transition to market economy has forced the people to expand their cultivable plots enormously, from an average of 10 feddans in the 1960s to more than 30 feddans during the 2000s; this has been facilitated by the tractors in nearly all villages in the savanna belt.

5.3 Poverty

Income poverty is a major factor contributing to land degradation and land use transformation. Forest resources continue to be either the major or the supplementary source of income for considerable size of the poor in rural areas exerting heavy strain on land. The predominant dependency of domestic energy in rural areas (over 60%) on biomass takes a toll on the environment (soil erosion, desertification, etc.).

5.4 Conflict

The long years of the conflict, especially in Darfur have brought about a radical process of land use transformation in Darfur. Because of the coflict vast lands that used to be agricultural in the homelands of the Fur, Massalit, Dago, Zaghawa and Birgid, especially in North, West and Central Darfur have been abandoned to IDPs camps. Most of these lands have been transformed to grazing lands. The displacement, on the other hand, and besides contributing significantly to land degradation poses enormous land use and land tenure challenges that take various forms including:

- Permanent occupation of land abandoned by displaced persons
- Establishment of IDPs camps on lands owned by recognizable individual farmers

---

28 UNEP (2007), Sudan Post Conflict Environmental Assessment

[29] *Government of Sudan: the Study of the Sustainable Development of the Semi Mechanized Farming Sector in Sudan, Prepared for the government of Sudan and Sponsored by World Bank, 2007*

- possession of property by military, public institutions and new comers;
- Sale of non-owned plots;
- temporary allocation of abandoned land and property turning into “de facto” ownership;
- multiple allocation of the same plot by local administrations or tribal chiefs;
- unauthorized buildings on non-owned property

5.5 New demands on land

New and rising demands for land in Sudan are presently emerging. These include demands from the growing populations of both people and livestock; from petroleum sector, the gold mining sector, the growing levels of poverty, and the domestic and regional agribusiness investors. The independence of South Sudan has closed off many pastoral routes while resulted in the need to relocate a population of returnees from that country.

5.6 Erosion of land governance and administration

This involves a wide range of issues including:

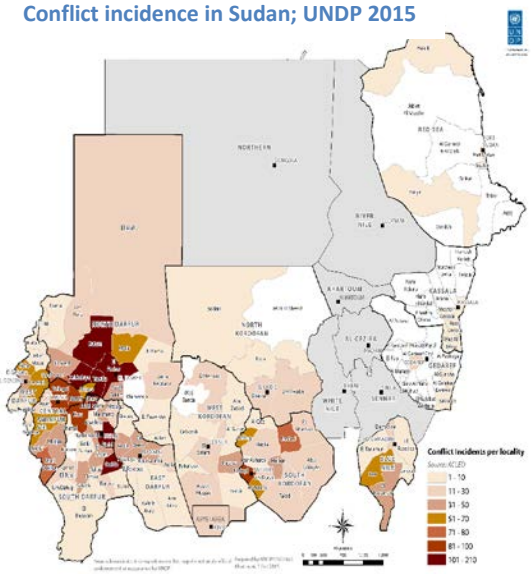
- Absence of a clear and recognizable institution for the administration and management of rural lands
- The multiple, parallel and poorly coordinated systems of land administration and governance.
- The critical land tenure legislative gap which is apparent in the existing dichotomy between statutory and customary law
- Ambiguous and confusing division of power between the federal and state governments that has resulted in conflicting decisions over land and the continuous encroachment of the federal government on land in the states
- Poor law enforcement is one of the critical problems affecting the present land use in the country. Sudan is littered with laws, Acts and local orders intended to regulate land use. Examples include prohibition of cultivation north of latitude 14° in Gedarif State; the law of the organization of agriculture and grazing in North and South Kordofan, Sinnar, and Gedarif States; the prohibition of tractor use on the Baja in the White Nile, the 10% shelter belt around semi mechanized schemes, the land rotation law in Gedarif State…etc. None of these law finds its way for enforcement
- The legitimacy and authority of the native administration system, that historically played an important role in land management, have been significantly declined and progressively contested by the emerging new political forces led by the youth, particularly in the conflict-ridden Darfur.
- The critical knowledge gaps owing to lack of funding and investment in scientifc research, human capital development, and institutional capacity building

6. LAND USE – SOCILA AND ENVIRONMENTAL RELATED ISSUES

6.1 Conflict

Sudan entered the twenty-first century mired in several conflicts and enormous human security risks. Most of the conflicts are of resource-based nature and are particularly inflicting the rainlands of the country where traditional crop farming are the main livelihood systems. UNEP 2007 report identifies key links between four different natural resources and conflicts in Sudan: (i) oil and gas reserves; (ii) fresh water resources; (iii) hardwood timber; and (iv) rangeland and rain-fed agricultural land.

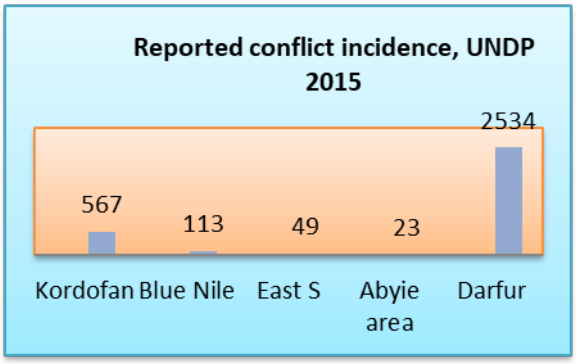
Conflict incidence in Sudan; UNDP 2015



Conflict map produced by UNDP in 2015 shows that over 75% of registered conflict incidences happened in Darfur, followed by 20% of incidences in the Kordofans. The ongoing or potential violent conflicts in the country can be characterized into the following five broad categories:

a) Local level Conflicts:

Conflicts in this category include local conflicts between pastoralists or nomads on the one hand, and farmers on the other, or among pastoralist communities, over land, water, grazing and forest resources. They also include competition within and between tribal groups over community boundaries, mining resources and livestock routes that become major zones of conflict. These conflicts can range in intensity from ad hoc, occasional skirmishes to large-scale violent conflicts between entire population sub-groups. Examples of such conflicts include: Beni Hussein-Rezeigat Mahameed conflict over gold mining resources in North Darfur (Jebel Amir); Awlad Sirur and Awlad Hiban conflict in West Kordofan; conflict between the Misseriyya Awlad Omara and Misseriyya Zeyod in West Kordofan; conflict between Rezeigat and Maalia in East Darfur; conflict between Zayadiya and Berti in North Darfur; conflict between Fallata and Salamat in South Darfur; an conflict between Maália and Birgid in South Darfur. This is in addition to many other conflicts such as that between Nuba and Misseriyya in Lagawa area, and between the Rezeigat and Massiriya along the border between Wrest Kordofan and South Darfur States. The increased vulnerability to climate change in recent years has resulted in a remarkable and progressively increasing shifts in population and economies towards the relatively richer areas in Central Darfur, Blue Nile and South Kordofan states leading to intensified pressures on resources, rising stakes and competition over land and fuelling of conflicts that have started to take ethnic dimensions.



b) Conflicts over the Residual Elements of the CPA:

These involve a wide range of conflict drivers including border demarcation, Abyie issues, and the contestation of many areas along the border. Because of that the security situation along the border between Northern and Southern Sudan has remained tense. The present conflict in South Kordofan and Blue Nile States relates, in one way or another, to that. In addition, the resurgence of violent conflict in Abyei is likely to spark similar conflagrations in other areas along the Sudan-South Sudan border.

c) Conflicts over Investment Capital:

Large-scale investments in land, water, and natural resources—especially involving dam construction, mechanized agriculture, oil exploration and drilling have fuelled a wide range of conflicts in the country. These conflicts were symptomatic of a wider lack of capacity on the part of the state and other stakeholders to ensure that large-scale investments in land and natural resources take into account local needs and rights, and that wealth generated through these resources yield dividends for the affected communities. Inroads by semi mechanized agriculture into both community farming as well as the movements of pastoralist and nomadic communities have incited conflict in many parts of the country through the debasement and displacement of many rural populations, appropriation of pastoral resources and closure of pastoral routes.

d) Internal Regional Conflicts:

Conflicts in this category involve the current conflicts in Darfur, South Kordofan and Blue Nile. Conflict in the three regions share several common parameters:

- perceptions of long histories of neglect and marginalization from national governance and economic development on the part of key population groups categorized collectively as non Arab groups
- The relations between groups that have taken up arms have been characterized by infighting, splitting and an inability to develop credible platforms for development and participation. The case of Darfur where more than 30 rebel groups exist provides a typical example.
- Many groups not directly involved with the primary insurgencies have themselves taken up arms and formed militias, sometimes as a proxy for external forces

e) Cross-Border Dimensions:

This involves potential conflicts over contested areas with neighbouring country, especially with Ethiopia in the east (Fashaga area), Egypt in the north (Halaib) and the Republic of South Sudan (over Kafi Kingi; Abyie; Lake Abiidh; Migenis; Heglig).

The social, economic and political costs of conflicts in Sudan have been extremely high. These involve:

loss of human lives; This could be exemplified by the conflict between Beni Hussein and Reziegat Mahameed over gold mining resources in North Darfur that claimed the lives of that

Darfur Conflict and shifts in the livelihoods of Rezeigat camel herders

- Emergence of highly militarized pastoral economy with close links to war economies
- Sedentreization and land occupation
- Military salaries (as government-backed militia)
- Dependence on captive IDPs markets
- Increased cultivation
- Secret trade agreements
- Shift to sheep and goats
- Skewed assets portfolio providing food security in the short term
- A bleak trajectory of a livelihood system that is unsustainable in the medium to long term (Source: Tufts study 2008)

claimed the lives of estimated 839 persons were killed and forced the displacement of 150,000 persons from twenty villages30; conflict between Awlad Sirur and Awlad Hiban in West Kordofan over land that claimed the lives of more than a hundred persons; the conflict between Rizeigat and Maalia in 2013 claimed the lives of more than 500 persons; the conflict between Misseriyya Awlad Omran and Ziyod which resulted in the loss of tens of lives.

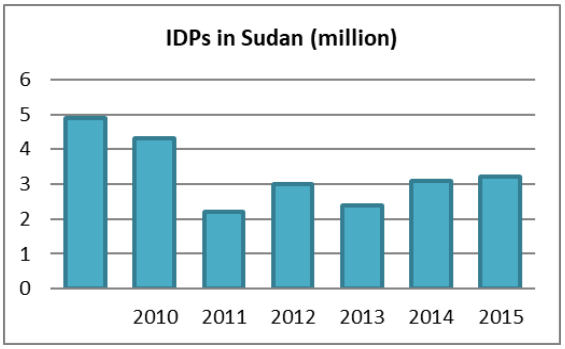
- Population displacement where more than two million people were displaced the majority of them in Darfur. Large numbers have also been displaced in Blue Nile and South Kordofan since 2013.

- Massive loss of economic resources. Some estimates suggest the loss of over two billion dollars to military operations since 1983[31].

- The onflict, especially in Darfur, has resulted in remarkable shift and transformation of land use. Vast lands that were once agricultural have been abandoned as a result of dispacement.

- Destruction of environmental resource, especially forests., this is the result of war tactics and also the limited economic opportunities for the IDPs who are largely involved in trading in wood. The booming of the housing sector in the capital cities of Darfur is widely recognized as one of the most environmentally destructive aspects of the conflict.

a) Displacement and refugees:



Sudan hosts one of the larest concentrations of internally displaced persons IDPs and refugees. Displacement in the country could be related to three landmark events in the modern history of Sudan, namely: (i) the North-South conflict which started in 1983; (ii) the severe drought and famine of 1984 which dispalced around 1.8 million persons32; and (iii) conflict in Darfur which started in 2003. Although reliable figures are not easily attainable owing, partly to the high mobility of the IDPs and refugees and partly to the seasonal return of some IDPs, available data suggest that around 3.1 million persons33 are currently living as IDPs in the country. The largest number of IDPs (approximately 1.9 millions)34 is found in Darfur where the IDPs live in 39 camps distributed unevenly between the Darfur States. This is in addition to large numbers living as refugees in eastern Chad. The conflict in Jebel Merra between the Government and Darfur rebels that started in January 2015 resulted in the displacement of 90,000 persons

[30] ACLED, *Country Report, Sudan and South Sudan, January 2015*

[31] *Elbadawi, Ibrahim (2005) "An MDG-based Strategy for Re-building the Post-conflict Sudanese Economy" a paper presented at the workshop on "Rebuilding Devastated Economies in the Middle East", sponsored by the G.E. von Grunebaum Center for Near Eastern Studies, UCLA, February 3-5, 2005*

[32] *Egemi, Omer, 1994, political ecology of subsistence crisis in the Red Sea Hill, East Sudan, PhD thesis*

33 International Displacement Monitoring Centre IDMC, 2016. web: www.internal-displacement.org//database

[34] *United Nations, 2012, Sudan-UN and partners Work Plan, 2012*

to North Darfur state. 90% of the displaced were reported to be women and children. Other unverified 50,000 were displaced in Central Darfur. In 2016 the total number of displaced people from Jebel Marra in the two states was estimated at 250,000 of whom 50,000 have reportedly returned[35.]

The armed conflict that erupted between the Government of Sudan and SPLA North in South Kordofan State (in June 2011) and Blue Nile (in September 2011) has affected more than300,000 people in South Kordofan and 66,000 people Blue Nile State36 while created thousands as internally displaced persons in the two States, of whom large numbers moved to locations outside the respected State. The number of IDPs produced by conflict in East Sudan prior to the peace agreement in 2006 were estimated as 68,000 persons in camps in Kassala State and around 100,000 in the Red Sea State who settled around the main urban centres in Tokar and, but more importantly Port Sudan.

Total refugees and asylum-seekers in Sudan accounted for 363,069 persons towards the end of 2015 including 112,283 Eritrean refugees in East Sudan and 221,000 Southern Sudanese refugees who arrived in Sudan since the start of the conflict in South Sudan in Dec 2013. In Eastern Sudan of the 112,283 Eritrean refugees – 83,499 live in 12 camps and 28,784 in urban situations. Taking into acoount the poltical instability and unresolved conflict in South Sudan and the insecurity, famine and drought in Eritera, together with the porousity of Sudan borders the influx of refugees from both countries is expected to continue. UNDP[37] identifies six key entry points for migrants and refugees from Eriteria in East Sudan, 4 of them in Kassala state. The IDPs and refugees issue has far reaching implications on land use.

Displacement has also been associated with the concentration of demand for natural resources, thus contributing to severe and complex environmental consequences imncluding: deforestation in camp areas; devegetation in camps areas; unsustainable groundwater extraction in camps; uncontrolled urban slum growth; and the development of a relief economy that exacerbate demand for natural resources.

6.2 Climatic Change

Climate Change is one of the major threatening challenges to Sudan. Changes in climatic components such temperature, rain fall amount and variability and isohyets shift have various impacts on the production systems and livelihoods. Available evidence suggests that the climate of Sudan exhibits decreasing trends in the annual amount of rainfall and rise in temperature over time during the period 1915 – 2000, Fig below[38]. Analysis indicated a decrease in total annual rainfall with fluctuating distribution and dry periods towards the end of the season. Records in Sudan of annual average temperature for long period indicate progressive increase of temperature (Sudan Metrological Authority, 2008). The rise in temperature which started almost in 1965 – 1967 (Badi 2001) is an alarming challenge under dry land conditions[39]. In fact 80 % of the Nile basin is under dry lands conditions. The Figure below which shows the anomalies of the annual amount of rainfall from a long period average indicates

---

[35] *Darfur Development and Reconstruction Agency, 2016, Market and Trade Analysis Evaluation Report*

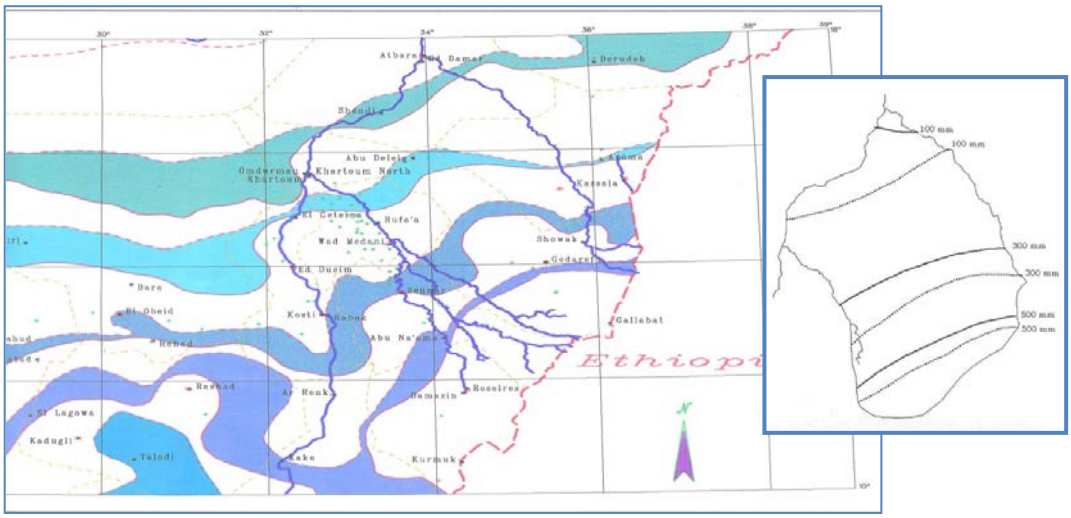
[36] *OSRO/SUD/203/JCA Final Report, FAO, 2012*

37 UNDP, Eastern Sudan Mapping: Partner Interventions, Development Indicators & Migration

38 H.Salih, Eltaib .S. Ganawa, A. F. Kheiralla. 2010. Using vehicle tracking system for hauling sugarcane. Presented at MRSS 6th International Remote Sensing and GIS conference and exhibition. Putra World Trade Centre, Kuala Lumpur, Malaysia, 28-29 April 2010.

[39] Ibid

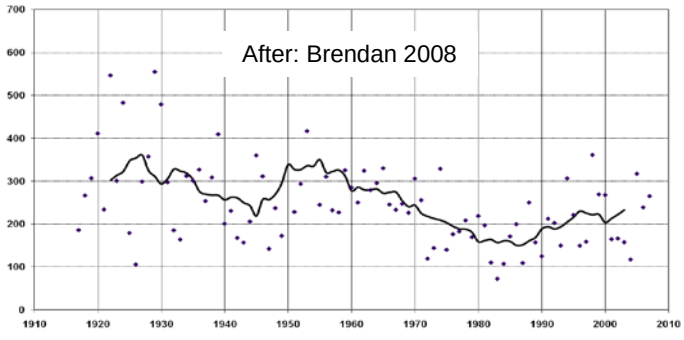
progressive decrease of rainfall. The long period average is represented by the zero line and the anomalies represented by the moving average over the period. Rainfall decline started almost in 1957 and 1967 at Damazin (high rainfall savannas) and Wad-Medani (semi-arid zone), respectively. Such a decrease in rainfall is an alarming challenge under dry land conditions.



R*ainfall variability over the period 1919 - 2008 in Wad Medani (left) and 1930 – 2008 in Damazin (right) (Source: Data compiled from Sudan Metrological Authority 2008)*

There is also support in the literature that rainfall in the Nile Basin indicates decreasing trends. Wing *et al*. (2008) states that there is decreasing seasonality in some key areas of the upper Nile in Ethiopia such as the southern Blue Nile area. Conway and Hulme (1993) supported the idea that except for Lake Victoria, all sub-basins of the Nile are experiencing slightly-to-strongly decreasing trends in precipitation. Sayed *et al* (2004) provided evidence that the Nile Basin has shown a slightly increasing trend in rainfall over the period 1905–1965 followed by a prolonged decline reaching its minimum in 1984 which is in agreement with figure below. Fig: Sift in isohyets map of Sudan, after FAO 1996 (left) and Elhag 2006 (right)

Isohyets as average over thirty years period for the period 1931 – 1960 and for 1961 – 1990 for the isohyets over the zones 100 – 200 up to 800 – 1000 shows isohyets shift across the major part of the Nile Basin throughout Sudan.



Evidence from rainfall records for El Fasher, North Darfur (figure right), shows a marked drop in the average annual rainfall, beginning with drought in 1972. More significantly, droughts have become more frequent: 16 of the 20 driest years recorded have occurred since 1972. Climate change models (P. K. Thornton et al 2006) also predict a

reduction in the length of the growing period of more than 20% between 2000 and 2020, with similar reductions across nearly all of Darfur by 2050 (Bromwich 2008[40]) .

Changes in temperature, decline in amount of precipitation and shift of isohyets have combined negative impacts on water and land resources as well as production systems. Bates *et al*. (2008) stated that the Nile Basin area could be vulnerable to water stress including reduced capacity of Hydropower generation and irrigation systems under climate change because of the limited water availability and the increasing demand for water from different sectors. Lakes levels have been observed to decline and annual average river flow and water supplies are projected to decrease by 10 – 30% particularly in dry tropical areas resulting in various impacts. Calculations from Rosaris reservoir watershed areas developed from two remote sensing images taken in 1987 and 2007 (Table 12) show remarkable shifts in land categories where the water area decreased from 14 % in 1987 to 13 % in 2007 and the forest area decreased from 29 % to 26 %. On the other hand the area of agriculture, scattered trees and bare land increased from 57 % in 1987 to 61 % in 2007 indicating continuous conversion of forests into agricultural land[41].

Table 12: Categories classification of Rosaris reservoir watershed areas from images 1987 and 2007

Classes	Area / ha 1987	percentage	Area / ha 2007	%
Water	23834.99	14 %	21154.42	13
Forest	47966.04	29 %	43148.16	26
scattered trees and shrubs	19953.73	12 %	31075.74	19
Agricultural land	51481.54	31 %	43927.56	26
Bare land	23422.28	14 %	27352.71	16
Total	166658.6	100 %	166658.6	100

Source: Ganawa, Eltaib (2011) Sugar Cane project assessment and Evaluation, 2011

6.3 Land use and LANDUSE change and Forestry (LULUCF):

Land use change has been a significant feature of Sudan's land use over the past few decades. The most conspicuous feature of this change is the remarkable increase in land under cultivation, from around 6 million feddan in 1970/71 to approximately 45 million feddan in 2014, excluding the uncultivated lands that are designated as agricultural land. During the same period animal population increased from approximately 40 million head to an estimated 105 million head resulting in heated competition over resources and eventually proliferation of conflicts. The expansion of agriculture is always at the expense of forests and range lands and eventually the scarcity and degradation of these resources.

[40] *Bromwich, Brendan, 2008 , Environmental degradation and conflict in Darfur: implications for peace and recovery, Humanitarian Exchange Magazine, ODI, Issue 39*

[41] *Ganawa, Eltaib (2011) Sugar Cane project assessment and Evaluation, 2011, 2nd International Conference on Engineering Professional Ethics & Education, Faculty of Engineering, International Islamic University Malaysia*

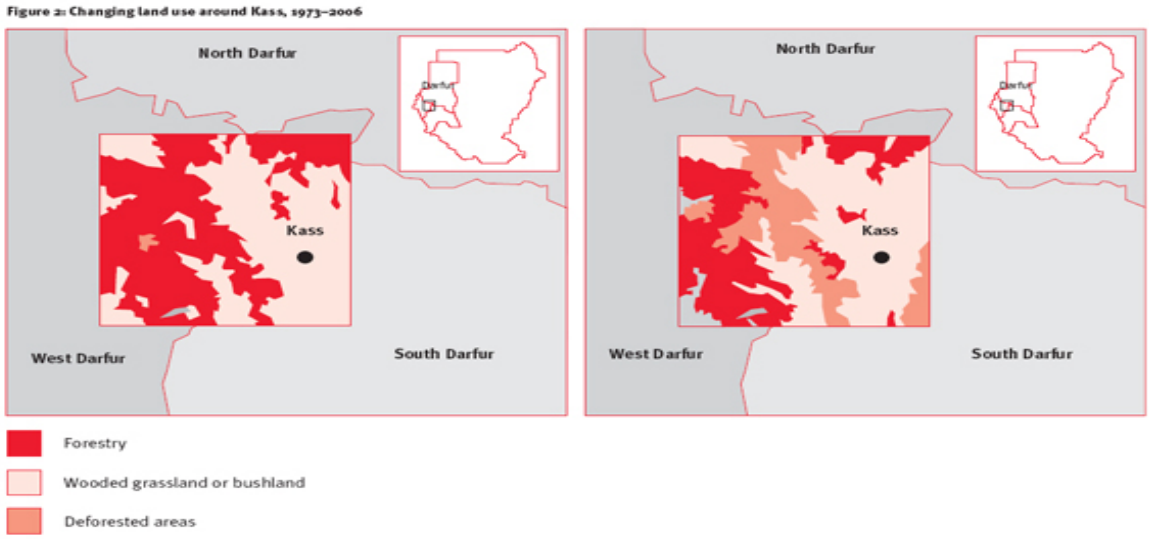
Available empirical evidence from around Sudan shows suggests enormous loss of forests and rangelands to agriculture. In Gedarif state the rapid expansion of the semi mechanized sector resulted in sharp reduction in the area of forests and range lands, from 78.5% in 1941 to 18.6% in 2002[42]. During the same period semi-mechanized farming expanded from 3,150 km^2 to 26,000 km^2 in 2002 (Table 15) reflecting radical land use transformation and concomitant severe pressure on the traditional farming and pastoral sector in the State that supports around 8 million head of animals.

Table 15: Transformation of land use in Gedaref State, 1941-2002

Type of use	Area 1941		Area 2002	
	Km2	%	Km2	%
Semi mechanized farming	3,150	8.7	26,000	72.2
Forest and rangeland	28,250	78.5	6,700	18.6
Hills and water courses	3,300	9.2	2,000	5.6
Wasteland (kerib)	1,300	3.6	1,300	3.6
Total	36,000	100.0	36,000	100.0

Source: Babikir, Mustafa (2011)

In South Darfur, the proportion of land use for rain-fed agriculture rises from 5.8 per cent in May 1973 to 15.4 per cent in November 2005. The combined percentages of forest and wooded grassland for the same dates are 70.9 per cent, to 49.4 per cent. According to data extracted from Bromwich 2008 the proportion of land covered by forest in Kass area of South Darfur (Fig) has fallen from 51% in 1973 to 36% in 2006 as a result of land use transformation



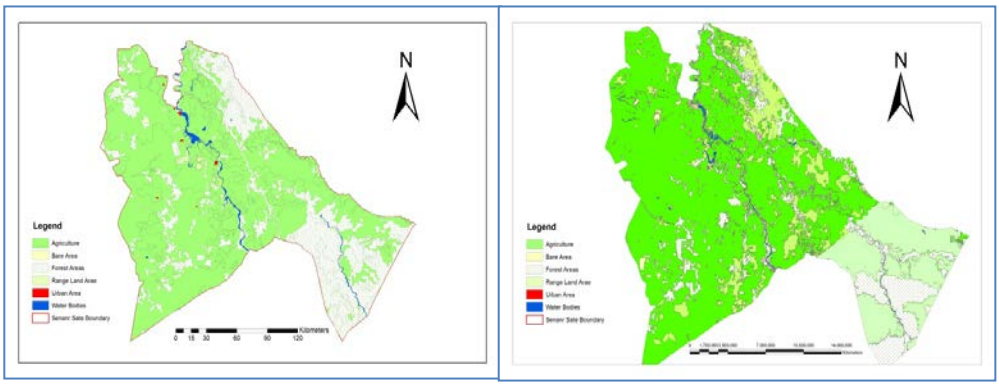
[42] *Babikir, Mustafa(2011) Mobile pastoralism and land grabbing in Sudan: impacts and responses, Paper presented to the International Conference on the Future of Pastoralism, organized by the Future Agricultures Consortium at the Institute of Development Studies, University of Sussex and Feinstein International Centre of Tufts University*

Data from Sinnar 2009 (Table 16) shows that rangelands dwindled to only 2.69% of the State's total area with agriculture, mostly in the semi mechanized sector, covering 62.1% of the State; forests land excluding the Dindir National Park covers only 1.8% indicating the enormous land transformation and concomitant severe pressure on the traditional farming and pastoral sectors in the State.

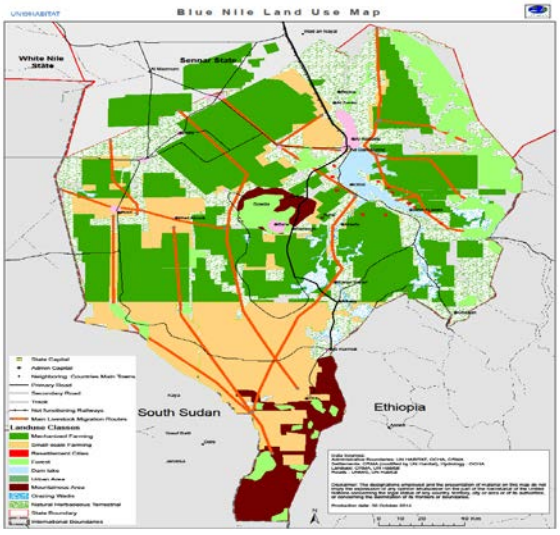
Table 16: Land use in Sinnar State, 2009

Use system	Area 000 fed	%
State area	9,700	100.0
Rainfed agriculture	5,500	56.7
Irrigated agriculture	525.6	5.4
Dindir National Park	3,240	33.4
Forests	174.0	1.8
Pastures	261.0	2.7

Source: Sinnar State Strategic Plan, 2009



Trend of land use and land cover in Sinnar State, Left : 2003 and Right 2015 (Source, FAO, 2015)



Land use in Blue Nile,2014: UNHABITAT

The analysis of Sudan Land Use Change and Forestry LUCF reveals that the most dominant systematic land use change processes were deforestation including conversion of forest land to mechanized and subsistence agriculture; forest degradation (conversion of woodland to bushland and conversion of Rangeland (bush/grassland) to cropland. All these resulted in a net reduction in forest cover from 76.4 million hectares (ha) in 1990 to 70.49 million ha in 2000 and 69.95 million ha in 2010 (30.5% to 28.1% and 27.9% of the country total area, respectively) (FRA, 2010). For the period 2000-2008 the estimated area of actual forest loss was 907,599 ha/year. causing a drastic change in forest carbon stocks and emissions from deforestation and forest degradation. Moreover, release of soil carbon due to the change in land use, such as clearing a forest to agriculture considered to be one of the major source of greenhouse gases

6.4 LAND USE AND GREEN HOUSE (GHG) EMISSION

Deforestation is one of the primary contributors to the greenhouse gas emissions that cause climate change, accounting for 12–17 percent of anthropogenic emissions globally and responsible for well over 90 percent of national emissions in many developing countries (IPCC, 2007, van der Werf et al. 2009).

Sudan case demonstrates that the cause of land-use change was insufficient and inadequate land-use planning and, consequently, poor land-use management. These factors combined with other factors such as high financial revenues from agricultural crops, Oil, Mining, rapid and high population growth, large immigration, and unclear land-tenure rules considered to be the main deforestation drivers.

Table 17 presents total GHG emissions and sinks for the year 2000. Total GHG emissions in 2000 were 77,650 GgCO2-equivalent (CO2e), which includes 57,611Gg from agriculture, 9,392 Gg from LUCF, 8,539Gg from energy; 2,015Gg from waste, and only 93Gg from industrial processes.

Table 17. Total GHG emissions in Sudan and South Sudan, 2000 (Gg)

GHG Sources & Sinks	CO_2e	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2	HFCs
Total National Emissions	**77,650**	14,201	2,153	59	112	2,892	188	1	6
1 Energy	8,539	6,090	95	1	80	2,020	176	0	0
2 Industrial Processes	93	93	0	0	0	0	12	1	6
3 Solvent & Other Product Use	0	0	0	0	0	0	0	0	0
4 Agriculture	57,611	0	1,923	56	17	353			
5 Land-Use Change & Forestry	9,392	8,018	59	0.4	15	520			
6 Waste	2,015	0	76	1					

Sources: Sudan's Second National Communications under the United Nations Framework Convention on Climate Change, 2013 (SNCR, 2013)

Agriculture-related activities accounted for the dominant portion of GHG emissions in 2000. Approximately 74% of all CO2e emissions are associated with enteric fermentation and manure management. LUCF accounts for about 12% of all GHG emissions, mostly from forest and grassland conversion. The combustion of fossil fuels in the energy sector is small accounting for only 11% of total

emissions. The remaining 3% of total emissions are mostly associated with solid and wastewater management activities as industrial processes account for less than 0.5% of all emissions (SNCR, 2013)

SNCR, 2013 indicated that, the trend in total GHG emissions for 1995, the year of the initial GHG inventory, and 2000. GHG emissions have increased by about 8%; from 72,014 Gg of carbon dioxide-equivalent (CO2e) in 1995 to 77,650 Gg CO2e in 2000. The major drivers for these changes in GHG emission levels were energy which increased by roughly 10% and agriculture which increased by roughly 27%.

Based on the Sudan's Second National Communications under the United Nations Framework Convention on Climate Change, 2013, total emission from land use change and forestry was estimated to be 9,393 Gg. This is mostly due to the deforestation and degradation of forests and rangelands associated with unsustainable biomass extraction in rural areas. Relative to overall Sudan's anthropogenic GHG emissions, the 9,392Gg CO2e represents about 12% of total CO2e emissions.

Regarding CO_2 removals by sinks, changes in forest and other woody biomass stocks that are under the management of the Forest National Corporation account for about 76% of all sequestered CO_2. The remaining 24% of all sequestered carbon is associated with the abandonment of agricultural lands.

Based on the dominant forest land use change patterns, the drivers and change in carbon stocks, it is so crucial to look for different options which could be pursued to implement a future national strategy which considers livelihood, biodiversity and climate change mitigation objectives. One of important option is to compensate land owners and users who would otherwise change their land use from high carbon stock to lower ones, for example, not clearing forests for agriculture. This, in principle, is the rationale underlying the so-called Reducing Emissions from Deforestation and Forest Degradation (REDD) mechanism which is aiming to develop mechanisms to make payments to developing countries for reducing emissions from deforestation and forest degradation and also for conservation and sustainable management of forests (REDD+) (relative to a reference level).

7. REDD+ AND SUSTAINABLE LANDUSE

In 2005, a discussion on deforestation was initiated within the United Nations Framework Convention on Climate Change (UNFCC) negotiations. From this discussion, the concept of reducing emissions from deforestation and forest degradation (REDD) emerged. The concept of REDD was later expanded to include conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks. The combination of REDD and these three additional activities is called REDD+.

The proposed REDD+ mechanism within the UNFCCC aiming at reduction of emissions from forests relative to a calculated reference level through provision of financial compensation and incentive to keep forests intact.

REDD+ is formally recognized in the United Nations Climate Change Framework in Paragraph 2:

"Parties are encouraged to take action to implement and support, including through results-based payments, the existing framework as set out in related guidance and decisions already agreed under the Convention for: policy approaches and positive incentives for activities relating to reducing emissions

from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

The concept of REDD+ continues within the UNFCCC where, the technical guidance for REDD+ was completed at the end of 2013. The guidance includes the setting of reference levels, adequate safeguard frameworks and approaches to monitoring, measuring, reporting and verification.

In addition to reducing Emissions from Deforestation and Degradation (REDD+) is REDD+ is expected to promote economic growth and reduce poverty. REDD+ mechanism is considered to be an income-generating activity that offsets opportunity costs of legal land-use change.

REDD+ fit well within current environmental and socioeconomic development strategies in Sudan. This is because the current forest and environmental policies aim to reduce deforestation, enhance sustainable forest management, biodiversity conservation and hence forest carbon stock.

Implementation of the REDD+ has however come with some challenges such as determination of a sustainable financing mechanism, establishment of a proper framework for measurement/ monitoring, reporting, and verification (MRV) and reference emission level as well as distribution mechanisms for benefits sharing under REDD+. Moreover, Drivers of deforestation and forest degradation such as expansion of agriculture, unsustainable wood extraction for energy and unclear land tenure considered to be the critical and costly challenges that ought to be addressed by the REDD+ in Sudan.For the past decades, too much of Sudan's economic growth comes at the expense of natural resource sustainability and relies heavily on forests as a main source of energy. Agriculture considered to be one of the main driver of deforestation. However, both agriculture and forestry can assist in expanding economic growth and increasing reliance on renewable resources. Agriculture and forestry can be building blocks for an economically and environmentally sustainable future because both are natural production systems based on photosynthesis and, when sustainably managed, both can provide a steady flow of readily adaptable products and services[43]

The work-stream on REDD+ and Sustainable Land Use focuses on provision of incentives and support to ensure that land resources are used in a way that simultaneously: (i) enables sustainable agricultural and economic development locally and globally (ii) ensures the health and stability of forest and other ecosystems and the continued provision of their services at the required scale, and (iii) reduces greenhouse gas emissions from deforestation and forest degradation[44].

In addition to REDD+ the international community addressed also the role played by land outside the forest in storing carbon and reducing emissions. Reducing Emissions from All Land Uses' pays specific attention to the interactions between forest carbon stocks, other carbon stocks affected by land use, the major drivers of land-use and forest change, and the livelihoods of people whose actions shape these changes[45]

[43] *AFO, Forests, forestry and forest products for a sustainable future*

[44] *http://www.unepfi.org/ecosystems/redd/*

[45] *AN ASSESSMENT OF OPPORTUNITIES FOR REDUCING EMISSIONS FROM ALL LAND USES,* ***VIETNAM PREPARING FOR REDD*** *FINAL NATIONAL REPORT*

A quarter of global emissions come from land use (agriculture, forestry and other land use). Besides storing carbon, tropical forests cover 7 per cent of the Earth but contain 50 per cent of global biodiversity, regulate water systems and support livelihoods of over a billion people. The biggest driver is agriculture, which is responsible for between 70 per cent and 80 per cent of deforestation. Mining, infrastructure, charcoal production and timber logging are other important drivers of deforestation and forest degradation. These seemingly conflicting issues – eradicating food insecurity, hunger and poverty on one side and forest and ecosystem conservation on the other – come together in the Sustainable Development Goals. It is clear that without a different way to use land — both for production and to protect ecosystems — it will be difficult, if not impossible, to meet some of these Sustainable Development Goals. The solution will have to include restoring and making use of the more than 2 billion hectares of degraded land and increasing agricultural production on existing land to stimulate rural economic development and reduce pressure to convert more forests[46].

It can be concluded that, land-use planning is an important tool to address the drivers of deforestation and forest degradation and land-use planning for REDD+ should be done at a landscape level with strong financial and political support from the government authorities. An integrated land-use-planning approach can be adopted to engage different stakeholders from various economic and social sectors and takes different objectives and activities in a landscape into account s as to achieve their goals with minimum conflict and enhanced benefits for the economy, and the environment.

8. CONCLUDING REMARKS

1. Owing to its ecological conditions (climatic and physiographic), and possibly to the undiscovered underneath resources, more than half (50.7%) of Sudan's total areas is void of human activities, except for the very recently started artisnal gold minimg in the Eastern Desert of the Northern and River Nile States. This reality defies the mindset of Sudan having an abundance of renewable natural resources while pinpoints the enormous challenges awaiting the present and future generations of Sudanese at all levels, from communities to the highest level of governance.

2. A remarkable feature of Sudan's land use is the apparenttly increasing demand for land in the agricultural sector, and particularly the semi mechanized farming and, but to a lesser extent the traditional sector that has become progressively market-oriented.

3. The context of land use in the country is also changing. There are emerging new demands from oil, gold minining and the domestic and regional agribusiness investors; the independence of the Republic of South Sudan has closed off many pastoral routes and resulted in the need to relocate a population of returnees from that country in the border states; growing populations of both people and livestock are increasing the pressure on land; and climate change is multiplying the pressure on land.

[46] https://www.unenvironment.org/explore-topics/forests/what-we-do/financing-sustainable-land-use

4. There is an observable tendency towards the movement and concentration of population and land use activities, from the drier northern parts of the country towards the comparatively natural resouce richer areas in the savanna belt towards the south.

5. Sudan's enewable land-based resources, namely forests and ranglands are progressively dwindling and shrinking under conditions of increasing demands. Climate change is multiplying the the problem.

6. Land uses in Sudan are very poorly organized and unsustainable and the potentialities of the country's land-based resources have not been translated into a broad-based socioeconomic development.

7. Sudan presently suffers severe problem of land degradation and irrational management of land. The most visible manifestations of the problem include declining land capability and productivity, soil erosion, degradation of forests and rangelands and general loss of biodiversity. The social consequences of land degradation are alarming including accelerated rates of rural poverty, high levels of rural-urban migration, and intensified competition and eventually conflict over land and natural resources. Land degradation has disastrously impacted food security and incomes of the rural population. In many cases women are made disproportionately worse off by kand degradation. Increasing scarcity of fuel wood and water adds to the workload on women and in conflict affected areas land degradation remains a major cause of violence against women. Land-related conflicts across Sudan have far reaching implications on land tenure regimes, access to resources and relations between social groups.

8. Land administration and governance in the country is at cross roads. The policy, legal and institutional framework to deal with land have been rendered inadequate to deal with tremendous changes posed by the present land use systems. in particular the multiple, parallel and weakly coordinated systems of land administration and governance that exist; the sectoral nature of land use policies; the critical legislative gaps in land tenure and natural resource management; and the eroded legitimacity and authority of traditional leadership (native administration) which is responsible for many aspects of land administration; have created an environment in which land uses are poorly organized; land is open to disputes, confusion over claims to land and natural resources is common, and in which conflicts proliferate and play out in a destructive manner. Indeed, land use issues have played a major role in sparking many of the local and regional conflicts in the country.

9. Diffuse and ill-defined land governance arrangements have also contributed to serious land degradation, characterised by extensive deforestation, as well as soil erosion, decline in biodiversity and increasing vulnerability to the effects of climate change. In addition, there is also increasing recognition that an ill-defined and weakly enforced governance regime has created a powerful disincentive to invest in land – both for all of those already involved in the agricultural sector and for potential new investors. And all of these factors – conflict, environmental degradation and economic disincentives – hurt the rural poor most of all.

10. There is wide recognition by land users, planners, decision and politicians that: (a) land is no longer a limitless resource: on the contrary, it is becoming a scarce resource that needs to be managed with care; and (b) that the current *status quo* of land use and natural resource

management is unsustainable, and that steps need to be taken to strengthen the governance arrangements for land if the rural sector is to deliver improved livelihoods and social justice, sustainable environmental management, and promote national economic growth and development. This urgently calls for a new framework for land governance, to address the problems of today and tomorrow.

11. Last, it is evident that it is not always the lack of policies that is the problem; rather it is the fact that implementation of policy – in many cases enforcement of regulations – is simply weak.

9. RECOMMENDATIONS

1. Recognizing the apparent institutional gap for comprehensive land administration and governance institutional reform founded on an effective institutional framework for land governance is needed.

2. To realize the proposed reform, the establishment of recognizable and legitimized super structure (Land Agency) for land administration, branched down to State and local levels seems urgent. The proposed Agency is conceived to bring the various actors together and mandated with the overall administration and coordination of land use-related issues. The Agency is anticipated to provide for the organization of land management and institutionalization of the decision making process; provide overall guidance and coordination, establish and oversees regulatory frameworks including law enforcement mechanisms, research and knowledge production and management; resource mobilization and the development and implementation of capacity development programmes (capacity building and follow-up unit). Recognizing, legitimating and securing the rights of small producers to land and natural resources as fundamental assets to the livelihoods will be an immediate responsibility and task of the Agency. To ensure the legitimacy, functionality and effectiveness of the Agency its establishment should be based on a rigorous, inclusive and representative consultation process that defines its vertical and horizontal relationships at state and federal levels.

3. A major challenge facing contemporary Sudan is the construction of a social environment in which the issue of land and land use could be dealt with peacefully and productively. In this respect there is an urgent need to engage people in dialogue and popular discussions to redefine the terms of debate over access and use of land while identifying mechanisms for negotiating the diverse rights and interests of the various social groups in lands, including the rights and interests of the government of Sudan.

4. There is an urgent need to focus popular attention on headline issues around land use and land degradation problem in particular as a major problem with damaging social consequenses that include, but not limited to conflict, rural poverty, heavy burden on women, intensification of climate change impacts and rapid rural-urban migration and eventually unsustainable urban growth. The different media channels are to be used for this campaign. However, a national conference intended to inform and arouse the attention of the public as well as planners, decision makers and politicians is an urgent task. Mobilization and engaging of researchers and research

institutions and civil society activists, including women groups, concerned with the issue of land and natural resource management will provide an important backup.

5. To inform, promote and sustain popular discourse over land governance and natural resource management issues, more research attention needs to be paid to how structural factors (policies and legislations, power relations, transition to market economy, oil, conflict, spread of arms, displacement and return...etc.) are built into poverty, local instability and distortions to prevalent land uses and the future trends of demands for land

6. Realizing the current status of information and the critical gaps in knowledge there is crucial need for multidisciplinary (social sciences and natural sciences) land research centre/institute attached to one of Sudan's universities.

7. Landscape approach in which the various land uses and interventions are planned together, with an emphasis on integrate land use planning is recommended to develop and implement land use plans at landscape scale, to integrate production and conservation

8. Agricultural intensification increases production per unit of land and can reduce the need for agricultural expansion if combined with effective land use planning and a better legal framework and its enforcement.

9. It is high time for Sudan to have in place its functional and operational national land use map that provides for the directives and regulation of land uses. Having the dynamic nature of Sudaneses environment the task is complex but deserves to be undertaken. In this regard it should be alluded that in some states (the three states of Eastern Sudan) the study of land use map had been completed (by Acsad in 2009) but had not been translated into programmatic actions. Currently another land use study is going on in Sinnar States funded bythe Ifad co-funded project " Supporting the Traditiona-Rainfed Small-Scale Producers" in collaboration with the State Ministry of Agriculture and which is anticipated to be completed by mid 2017. These initaives provide an important learning experience for the development of the national land use plan. In this connection it should also be remarked that many of the States Governments, each led by its Investment Commission, are currently embarking in producing their investment maps. This endavour is anticipated to create more confusion, challenges and possibly more conflicts in the future. This stems from the fact that the investment map should be the outcome of detailed land use mapping.

10. BIBILIOGRAPHY

Armed conflict Location and Event and Data (ACLE D) Country Report, Sudan and South Sudan, January 2015

Ahmed, Abdelghaffar M.,1980, Planning and the neglect of pastoral nomads in Sudan, in Gunnar Halland (ed) Problems of Savanna development: The Sudan Case, Occasional Paper No. 19, pp: 39 – 54, Department of Social Anthropology, Bergen, Norway

Babikir, Mustafa(2011) ,Mobile pastoralism and land grabbing in Sudan: impacts and responses, Paper presented to the International Conference on the Future of Pastoralism, organized by the Future Agricultures Consortium at the Institute of Development Studies, University of Sussex and Feinstein International Centre of Tufts University

Behnke, Roy, Odessa Centre, 2013, the economics of pastoral livestock production and its contribution to the wider economy of Sudan, UNEP and Feinstein International Centre, Working Paper

Bromwich, Brendan, 2008 , Environmental degradation and conflict in Darfur: implications for peace and recovery, Humanitarian Exchange Magazine, ODI, Issue 39

Darfur Development and Reconstruction Agency, 2016, Market and Trade Analysis Evaluation Report

Government of Sudan, 2014, Agricultural series of the main crops, 1970/71- 2012-2012/13 Directorate of Agricultural Economics and Statistics

Egemi, Omer, 2014, Pastoralism as a sustainable livelihood system: policy review for Sudan, Technical Paper, Tufts University, Boston, USA

Egemi, Omer (1994) the political ecology of subsistence crisis in the Red Sea Hills, PhD Thesis, University of Bergen, Norway.

Elbadawi, Ibrahim (2005) “An MDG-based Strategy for Re-building the Post-conflict Sudanese Economy” a paper presented at the workshop on “Rebuilding Devastated Economies in the Middle East”, sponsored by the G.E. von Grunebaum Center for Near Eastern Studies, UCLA, February 3-5, 2005

FAO, Country Programming Framework for Sudan PLAN OF ACTION (2015-2019):

Resilient Livelihoods for Sustainable Agriculture, Food Security and Nutrition

FAO and UNEP (2012) Land cover map in Sudan, FAO, Sudan

Gafar, Abdalla, 2013, Report to Sudan LGA Land Governance Report

Ganawa, Eltaib (2011) Sugar Cane project assessment and Evaluation, 2011, 2nd International Conference on Engineering Professional Ethics & Education, Faculty of Engineering, International Islamic University Malaysia

Government of Sudan, 2015, Impact of traditional mining of gold on the social and economic life in Sudan and on the environment, Ministry of Finance and National Economy, General Directorate of International Cooperation,

Government of Sudan, 2010, I-PRSP, 2010, Ministry of Finance and National Economy, Khartoum

Government of Sudan: the Study of the Sustainable Development of the Semi Mechanized Farming Sector in Sudan, Prepared for the government of Sudan and Sponsored by World Bank, 2007

H.Salih, Eltaib .S. Ganawa, A. F. Kheiralla. 2010. Using vehicle tracking system for hauling sugarcane. Presented to MRSS 6th International Remote Sensing and GIS conference and exhibition, Putra World Trade Centre, Kuala Lumpur, Malaysia,.

IFAD, Land policy Report, SUSTAIN and BIRDP co-Financed Projects, 2014

Ijaimi, Abdelatif Ahmed, 2016, Increasing production and productivity in the Five Years Programme 2015-2019, Council of Ministers General Secretariat

International Displacement Monitoring Centre IDMC, 2016. web: www.internal-displacement.org//database

James, Laura M., 2015, Fields of Control: Oil and (In)security in Sudan and South Sudan, Small Arms Survey HSBA Working Paper No 40, 2015

Khoglai, Mustafa M, 1980, Sedentrization of the nomadic tribes in the Northern and Central Sudan, Ph.D. thesis, Department of Geography, University of Khartoum, Sudan

Mahran H.A., 1994, Development strategies in the agricultural sector of the Sudan: 197 0 – 1990, Cahiers Options Méditerranéennes; pp:157- 179

Mohamed Salih M. A, 1990, Government policy and options in pastoral development in the Sudan, Nomadic People, No. 25-27, pp 65-78

Pantuliano, Sara and Omer Egemi et al, Put out to pasture: War, oil and the decline of Misseriyya Humr pastoralism in Sudan, 2009

Sinnar State, 2009 Sinnar State strategic Plan, Strategic Planning Office

Sudan Interim Poverty Reduction Strategy Paper IPRSP, 2011, Ministry of Finance

Tesfaye Teklu, Joachim von Braun. Elsayed Zaki (1991) Drought and famine relationships in Sudan: Policy implications, International Food Policy Research Institute, Research Report 88

UNDP, Human Development Reports 2008 and 2015

UNDP, Eastern Sudan Mapping: Partner Interventions, Development Indicators & Migration

UNEP, Sudan Post Conflict Assessment, 2007

United Nations, 2012, Sudan-UN and partners Work Plan, 2012