Republic of Sudan

Sudan LDN Report

UNCCD National Focal Point
The LDN TSP National Working Group
General Secretariat of the National Council for Combating Desertification
Ministry of Environment, Natural Resources and Physical Development

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This report summarizes the key outcomes of the national efforts carried out in 2017 towards putting in practice the land degradation neutrality concept. It has been prepared with the support of the Land Degradation Neutrality Target Setting Programme (LDN TSP), a partnership initiative implemented by the Secretariat and the Global Mechanism of the UNCCD, with support of the following partners: France, Germany, Luxembourg, Republic of Korea, Spain, Trinidad and Tobago, Turkey, European Space Agency, Food and Agriculture Organization of the United Nations, Global Environment Facility, ISRIC – World Soil Information, International Union for Conservation of Nature, Joint Research Centre of the European Commission, Soil Leadership Academy, United Nations Development Programme, United Nations Environment Programme, World Resources Institute.

The views and content expressed in this document are solely those of the authors of this document and do not necessarily represent the views of the LDN TSP or any of its partners.

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Summary

This report summarizes the key outcomes of the national efforts carried out in 2017 towards putting in practice the land degradation neutrality (LDN) concept. The report is designed in four chapters and a conclusion.

The first chapter summarised the LDN scope of leveraging activities that help develop and mainstream LDN concepts and targets in policies and strategies. The chapter highlighted the investment programs that support the Sustainable Development Goals in general and sustainable land management in particular. This chapter shows that the accountable Sudanese organizations in government, private and civil society sectors are the main actors for voluntary LDN targets on the ground. In this chapter the members of the working group are listed, as well as the meetings of the working group.

In the second chapter the land cover classes with the negative trend associated with area in hectares and the relative drivers are tabulated, and the geographical location for each negative land degradation trend is identified. Furthermore, the LDN baseline, land degradation hotspots, as well as the SWOT analysis of the legal and institutional environment are presented.

Chapter three includes the national voluntary targets and the technical measures. In chapter four the ongoing projects in Sudan relative to LDN and funded by international organizations are listed. The transformative opportunities related to LDN hotspots are tabulated in Table 8 according to the land cover classes and the trend in each locality/State.

The LDN concept has now become familiar for the relative stakeholders and focal points in the respective States in Sudan. Field visits to the hotspots and awareness programmes for the local communities in the States will complete the picture of LDN in Sudan for a promising future.

National Voluntary LDN Targets

National targets:

- Inventory of renewable natural resources in the country (Inventory of forest resources - Survey of pastoral lands - Wetlands inventory - Inventory of wild animals);
- Reservation of 15% of the country to be registered by the government as renewable natural resource area (Complete forest reservation - Mapping, reservation and recording of pasture lands - Reservation of wildlife areas - Completion of the wetland reservation and registration of the requirements of the RAMSAR Convention);
- LDN is achieved by 2030 as compared to 2010 at national level (no net loss);
- Improve the implementation of land use sustainability and planning and evaluation in state agencies related to the land degradation neutrality (Provision of a national database - Raise institutional and individual capacities in planning, implementation and evaluation - Improve coordination mechanisms between the center and the states in all sectors - Development of a sustainable land management methodology - Develop an integrated land use sustainability plan).

Sub-national targets:

- Determine the productivity of pastoral land in each state and increase it to 2.5 tons / hectare;
- Develop a methodology for the sustainability of pastoral lands at the national level;
- Forest conservation and reforestation of 66 square kilometers of degraded forests in Kassala and Blue Nile states.

Specific targets:

- Improving the quality of pastures' soil and SOC;
- Improve production in rainfed agricultural areas (clay) to mean 10 Shawwal per feddan (and sand) 5 Shawwal per feddan;
- Increase the carbon stock in the soil by 30,5742 tons (Compensation of carbon losses by base year and add the same amount by forest farming in North, Nile, Khartoum, North Kordofan and North Darfur)
- Increasing the forest area according to the plan of the National Forestry Commission;
- Cultivation of trees and shrubs of high nutritional value in the pasture lands in the semi-desert and savannah-poor areas, especially in the area of 12563 km2;
- Raising the productivity of declining agricultural areas (15496 km 2) and cropland with early signs of decline (59719 km 2) and stable but stressed (32467 km2).

1- Leveraging LDN

Sudan is dominated by hyper-arid, arid, semi-arid and dry sub-humid ecosystems that are seriously affected by land degradation. In Sudan land degradation causes reduction of agricultural, forestry, rangeland and livestock production, resulting in socioeconomic and environmental deterioration and consequent degradation of the quality of life. In dryland ecosystems - as in Sudan - Land Degradation Neutrality (LDN) is essential for alleviating these negative effects. **Sudan submitted a request for the LDN TSP to develop voluntary targets in May 2017 after receiving an invitation from UNCCD secretary in Dec. 2016**.

Sudan, with an area of 181 million hectares (1.8 million square kilometres), is endowed with 61 million hectares of arable land, 14 million hectares of natural pasture and 21 million hectares of forests (only about 11.6% of the country). The rangelands of Sudan support about 101 million heads of cattle, sheep, goats, and camels, and a wide range of wildlife species. The main water resources in the country are the River Nile, water from seasonal rivers, ground water, and annual recharge from seasonal rainfall. These huge and diverse agricultural resources are envisaged, not only to meet the domestic needs for sustainable food security, employment opportunities, and foreign exchange earnings, but also to enable Sudan to contribute significantly to regional and international trade for food security.

Degradation is both a cause and consequence of poverty, which at the end of the day forces affected communities to seek their livelihoods from fragile resources and which causes endemic degradation. This is because of extended droughts, human mismanagement of cultivated, forest and range lands (cultivation of marginal sandy soil, tree and vegetation cutting for fuel and construction of huts, overgrazing and mining). As a result of high human and animal population growth rates of in the States affected by desertification in Sudan, accompanied with land use conflicts, the situation is getting worse. This vicious circle can only be broken with programs like LDN, with strategies to alleviate poverty in a sustainable way.

Economically, land degradation in Sudan depletes the natural resources, and negatively impacts gross domestic product (GDP). The economic and social costs of land degradation outside of the affected areas, including the influx of displaced peoples, refugees and loss of national food production, are very high and reflect a huge drain on economic resources.

The Government of Sudan has three main sectors: a Governance and Management sector, an Economic Sector and a Social and Cultural Development Sector. In the country plan 2017-2020, and for the first time in Sudan, the environment has been integrated as a pillar in the Economic Sector. The Economic Sector has now six pillars: finance; productivity; environment; external support; infrastructure and services.

An examination of Sudan's ecological zones and climate indicates that the majority of its land is quite vulnerable to changes in temperature and precipitation. Changes in temperature and rainfall patterns also represent a high risk to food security in Sudan's agro-pastoral-based economy. Changes in temperature and rainfall are likely to lead to desertification in some regions. The country's inherent vulnerability may best be captured by the fact that food security in Sudan is mainly determined by rainfall, particularly in rural areas, where 70% of the total population live. Changes in temperature and precipitation could cause precarious shifts in the distribution of these ecological zones, in the productive capacity of rain-fed agriculture, and hence in the security of the nation's food supply.

The Government made the SDGs a national priority through organization of national consultations that have covered the States, private sector and civil society organizations, providing opportunities for officials and non-States actors to appreciate and own the post-2015 Development Agenda. These activities have led to the preparation of a national consultation paper, and to the agreement on poverty, peace and security, education, and food security as fundamental challenges of concern for Sudan's future discourse on peace and development. Food security is highly correlated with the land degradation neutrality.

Sudan has implemented many projects and programs in the field of climate change and desertification, but the scale of implementation remains far below the actual needs of the country to address the problem of climate change. The country's plans and strategies that the State seeks to implement in the field of climate change are:

- **National Strategy for Adaptation to the Effects of Climate Change (NAPA)**
- **National Adaptation Plan (NAP)**
- **Intended Nationally Defined Contributions (INDCs)**
- **National Appropriate Mitigation Actions (NAMAs)**
- **REDD+ National Strategy**
- **National Action Plan for Desertification 2006**
- **Sudan Road map for NAP implementation - Consultant report 2001 GM**
- **An assessment of the Status of implementation of NAPs to combat desertification in IGAD Member States**

All these plans and strategies are integrated with the LDN program.

Table 1: Framework for National LDN Target Setting Leverage Plan

Leverage		Actions	Responsibilities
Why does LDN matter?			
1.	Creating multiple benefits	▪ Create synergy between the national action plan of the country and the LDN TSP	▪ LDN TSP working group, National Council for Combating Desertification, Ministry of Finance, Higher Council of Strategic Planning, National Council of Population.
		▪ Justify relevance of the LDN TSP to achievement of SDGs	▪ UNCCD, LDN TSP working group, National Council of Population.
		▪ Work closely throughout the implementation of the LDN TSP.	▪ LDN TSP working group, Ministry of Finance, UNCCD.
2.	Fostering policy coherence	▪ Review main sectoral policies to assess LDN coherence.	▪ LDN TSP working group, National Council for Combating Desertification
		▪ Ensure that the main sectors of agriculture, forestry, environment, etc., work closely throughout the implementation of the LDN TSP.	▪ LDN TSP working group
		▪ Integrate LDN into the national land use policy.	▪ LDN TSP working group
		▪ The National Focal Points of the three Rio conventions (UNCCD, UNFCCC and UNCBD) should work closely throughout the implementation of the LDN TSP.	▪ NFPs of the UNCCD, UNFCCC, UNCBD
3.	Advancing climate action	▪ Integrate LDN programs into the National Adaptation Plan (NAP), National Determined Contribution (NDC). ▪ The LDN TSP working group should work closely with the National Focal Point of the UNFCCC, especially with regard to the implementation of the NAP and preparing of NDC. ▪ Promote synergy in the implementation of the NAP and the NDC.	▪ LDN TSP working group, FP of UNFCCC ▪ LDN TSP working group, FP of UNFCCC ▪ LDN TSP working group, FP of UNFCCC

4.	Tapping financing opportunities	▪ The LDN TSP working group should utilize the opportunities to mobilize climate finance, private investments and national budgetary resources. ▪ Develop transformative LDN project proposals. ▪ Utilize funding from: (a) Green Climate Fund (b) The LDN Fund ▪ Integrate LDN into the national budget	▪ LDN TSP working group, FP of GCF, Ministry of Finance ▪ LDN TSP working group ▪ LDN TSP working group, FP of GCF, UNCCD ▪ LDN TSP working group, Ministry of Finance
WHAT to leverage?			
5.	National development programmes, priorities and objectives	▪ The LDN TSP working group should work closely with the government in the implementation of national development projects related to the seven priority intervention areas: (i) Natural resources management; (ii) Market access and trade; (iii) Livelihood support; (iv) Pastoral disaster risk management; (v) Research and knowledge management; (vi) Conflict resolution and peace building; and (vii) Coordination.	▪ LDN TSP working group
6.	Country commitments and engagements	▪ The LDN TSP working group should work closely, through the General Secretary of the National Council for Combating Desertification, with the council of Ministers in order to integrate the LDN programs in the National Action Plan ▪ The National Focal Point of the UNCCD and the LDN and the TSP working group should work closely with NFPs of the UNCBD and the UNFCCC especially in the implementation of the projects related to the biodiversity and the NDC, respectively.	▪ LDN TSP working group ▪ LDN TSP working group, FP of UNCCD
WHO to engage to create leverage?			
7.	Senior government	▪ All the following stakeholders should be involved in the LDN TSP working group: National Council for Combating Desertification - Ministry of Environment, Natural Resources & Physical Development - Ministry of Agriculture and Forestry - National Forest Corporation - Ministry of Animal Resources and Fisheries - Ministry of Water resources and Electricity - Ministry of Tourism, Antiquities & Wildlife - Minister of Federal Governance - Central Bureau of Statistics - Ministry of Finance and Economy Planning - Ministry of Welfare and Social Security (National Council of Population -	▪ LDN TSP working group

		SDG)- Ministry of Oil & Gas - Ministry of Minerals - Ministry of Education - Ministry of Higher Education and Scientific Research - Ministry of information (Media).	
8.	National coordination mechanisms	▪ LDN TSP working group should work closely with: Higher council for Environment and Natural Resources - National Council for Combating Desertification - National Team for the Implementation of the 2030 Agenda - National Drought & Desertification Control Unit (NDDCU), as coordination units.	▪ LDN TSP working group
9.	International development partners	▪ The LDN TSP working group should engage international development partners in order to include LDN in their new projects. (a) The United Nations Development Program (UNDP) (b) The Food and Agriculture Organization of the United Nations (FAO) (c) The World Bank (d) The European Union Delegation	▪ LDN TSP working group
10.	National non-governmental stakeholders	▪ The LDN TSP working group should engage several national NGOs working in the field of land degradation in Sudan. Specially those projects and activities at the local level, for example: Sudanese Environment Conservation Society, Environmentalist Society, Sudanese Society for combating Desertification, Sudanese Society for forest, etc. ▪ The LDN TSP working group should engage many Professional Associations and Professional Scientific Associations working in the field of land degradation at local level. ▪ The LDN TSP team should engage the private sector in Sudan.	▪ LDN TSP working group ▪ LDN TSP working group ▪ LDN TSP working group

LDN National Working Group

The LDN national working group was established by Ministerial Decree on 4th of June 2017 with representatives from relevant stakeholders, as presented in Table 2. The meetings of the working group are summarized in Figure 1.

Fig 1: Meetings of the National LDN Working Group

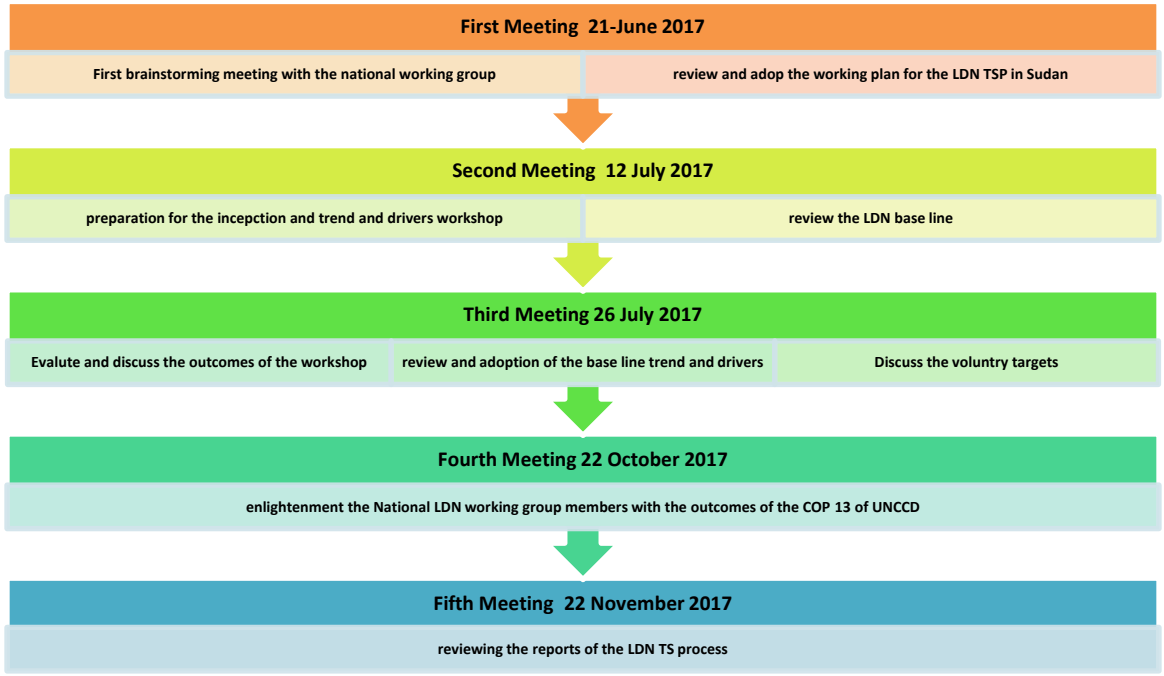


Table 2: LDN National Working Group

	Name of representative	Name of organisation
1	Dr. Abdelazim Mirghani Ibrahim, *president*	National Council for Combating Desertification
2	Dr. Hana Hamdaallah Mohamed, *member*	Ministry of Environment, Natural Resources & Physical Development (Climate Change)
3	Sannia Ali Rehan, *member*	Ministry of Agriculture and Forestry
4	Abdelhai Mohamed Sharif, *member*	National Forest Corporation
5	Abdelmunim Osman Hassan, *member*	Ministry of Animal Resources and Fisheries
6	ENG. Ibrahim Adam A. Balila, *member*	Ministry of Water resources and Electricity
7	Dean of Police/ Kahl M. Alamin, *member*	Ministry of Tourism, Antiquities & Wildlife
8	Siddig Hassan Frini, *member*	Minister of Federal Governance
9	Nada Khidir Alamin, *member*	Central Bureau of Statistics
10	Husam Hassan Ali, *member*	Ministry of Finance and Economy Planning
11	Amna Abuljookh, *member*	Ministry of Welfare and Social Security (National Council of Population-SDG)
12	Eng. Isam Ahmed Ali, *member*	Ministry of Oil & Gas
13	ENG. Ahmed Abulgasim Abdallah, *member*	Ministry of Minerals
14	Nazar Adbelgadir Ahmed, *member*	Ministry of Education
15	Dr. Sara Ahmed Mohamed Saad, *member*	Ministry of Higher Education and Scientific Research
16	Dr. Altayb Haj Ali, *member*	UNESCO chair for Desertification
17	Dr. Samai Siraj, *member*	Ministry of information (Media)
18	Mohamed Noor , *member*	Humanitarian Aid Commission
19	Prof. Jalaleldin Altayb, *member*	Sudanese Environment Conservation Society
20	Wafa Badawi Abdalla, *member*	General Federation of Sudanese Woman
21	Osama Taj Elsir, *member*	Sudanese Federation of Businessmen and Employers
22	Prf. Mamoun Dawelbait, *member*	Central Trading Company
23	Dr. Mona A. A. Dawelbait, *N Consultant*	Ministry of Environment, Natural Resources & Physical Development

2 - Assessing LDN in Sudan

Target 15.3 of the Sustainable Development Goals (SDGs) sets out a new global ambition: to achieve a land degradation neutral world by the year 2030. The recommended three indicators which are used as proxies to measure the land-based natural capital are:

- **land cover;**
- **land productivity (metric: net primary productivity);**
- **Carbon stocks above and below ground (metric: soil organic carbon (SOC) stock)**.

These indicators correspond to the UNCCD progress indicators and have been recommended as sub-indicators for the indicator 15.3.1, "Proportion of land that is degraded over total land area", adopted to measure progress towards SDG target 15.3.

According to the LDN National Committee (NC), they represent a **minimum set** and **the LDN NC agreed to add food insecurity and distribution of the population as sub-national indicators for a more accurate picture of land degradation.**

Land degradation is both a cause and consequence of poverty, which ultimately forces the affected communities to seek their livelihoods from fragile resources and causes endemic degradation. This is because of extended droughts, human mismanagement of cultivated land, and forests and rangelands (cultivation of marginal sandy soil, removal of tree and vegetation for fuel and construction of huts, overgrazing and mining). As a result of the high human and animal population growth rates in the States affected by desertification in Sudan, accompanied with land use conflicts, the situation is getting worse. This vicious circle can only be broken with programs such as LDN, with strategies of sustainable poverty alleviation.

2.1 Land degradation trends and drivers

- Degradation is generally considered to occur when:
  - land productivity shows a significant negative trend; or
  - SOC shows a significant negative trend; or
  - negative land cover change occurs; or
  - a negative change occurs in another nationally relevant indicator.

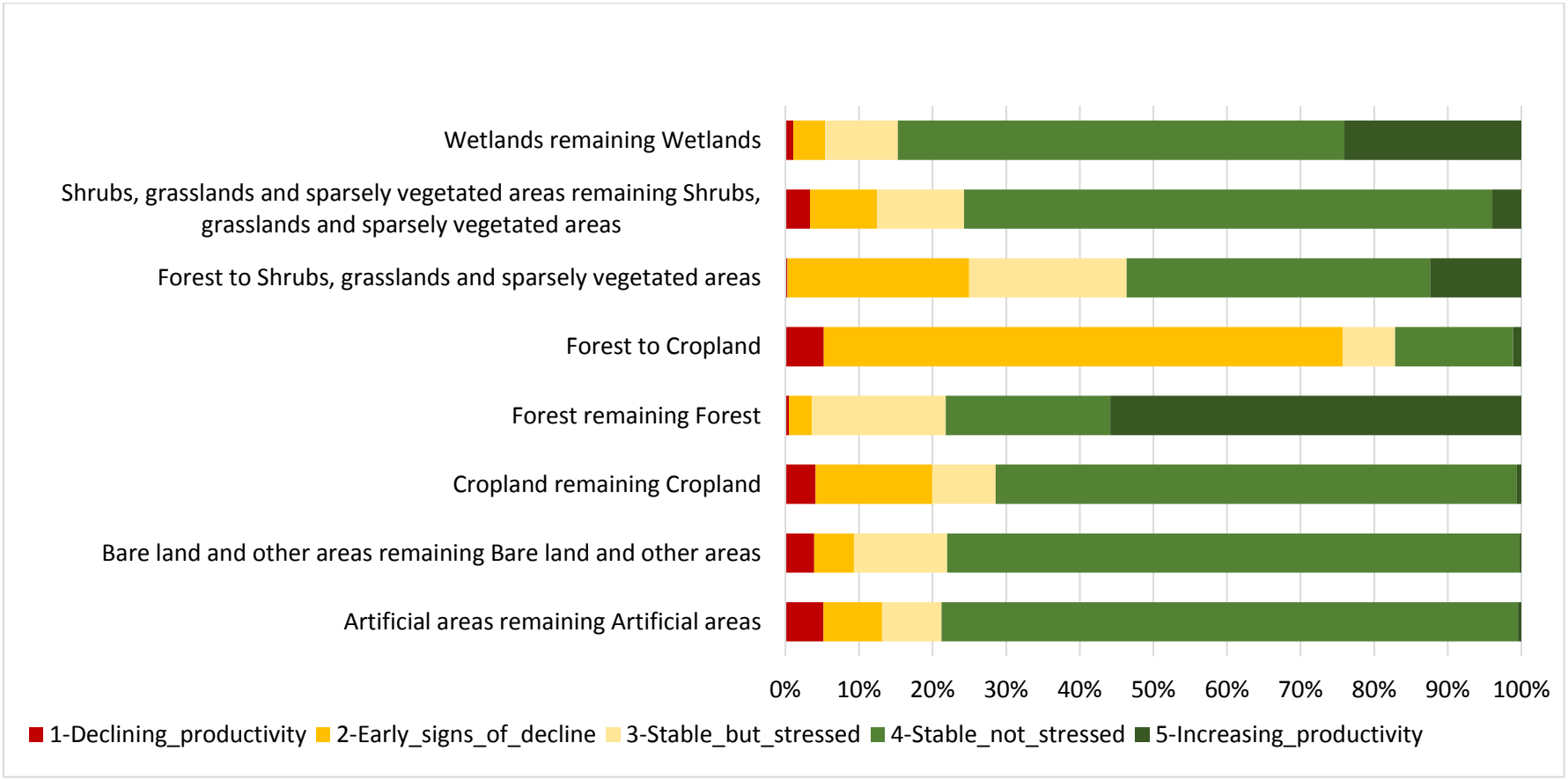
Table 3 describes the trends and key drivers for each land cover class through the analysis of the key indicators in terms of area affected (in hectares and in % of the national territory area), and the geographical areas. Figure 2 shows trends in net land productivity dynamics (Net LPD) according to land use/cover category from 2000 to 2010. These data were used alongside the map on acute food insecurity phases 2016 and the increase of population in these states from 2008 to 2013 with percentages from 10.8% to 15.3%, according to the population projections in these states (Table 5).

Table 3: Trends and areas affected by land degradation and corresponding key drivers

No	Land Use/Cover Category	Area Affected		Trend	Geographical location (State)	Driver
		Area in ha	Area in %			
1	Forest to crop land with declining productivity and showing early signs of decline	15900	0.01	Declining productivity	Gadarif - Blue Nile	Deforestation-Shifting Cultivation
2	Forests to cropland that is stable but stressed	1500	0.001	Stable but stressed	Gadarif - Blue Nile	Deforestation-Shifting Cultivation
3	Forest to shrubs, grasslands and sparsely vegetated areas with declining productivity and showing early signs of decline	41600	0.02	Declining productivity	Gadarif - Blue Nile- Sinnar- South Kordofan- West Kordofan - South Darfur	Deforestation
4	Forest to shrubs, grasslands and sparsely vegetated areas that is stable but stressed	35700	0.02	Stable but stressed	Gadarif - Blue Nile- Sinnar- South Kordofan- West Kordofan - South Darfur	Deforestation
5	Forests with declining productivity showing early signs of decline	52400	0.03	Declining productivity	Red Sea - Kassala- Gadarif - Blue Nile- Sinnar- White Nile - South Kordofan- West Kordofan - East Darfur -South Darfur	Deforestation
6	Forests that remain stable but stressed	265300	0.14	Stable but stressed	South Darfur	Deforestation
7	Shrubs, grasslands and sparsely vegetation with declining productivity and showing early signs of decline	4744500	2.57	Declining productivity	Red Sea - Kassala- River Nile - Gadarif - Blue Nile- Sinnar- Gazira - White Nile - North Kordofan - South Kordofan- West Kordofan - North Darfur -East Darfur - Central Darfur	Overgrazing
8	Shrubs, grasslands and sparsely vegetation that remain stable but stressed	4496300	2.43	Stable but stressed	Kassala- Gadarif - Blue Nile- Sinnar- Gazira -White Nile - North Kordofan - South Kordofan- West Kordofan - North Darfur -East Darfur - Central Darfur - South Darfur - East Darfur	Overgrazing
9	Cropland show declining productivity and early signs of decline	7518800	4.07	Declining productivity	Red Sea - Kassala- Gadarif - Blue Nile- Sinnar- Gazira - White Nile - West Kordofan - East Darfur - Central Darfur	Over Cultivation - Lack of Technology

10	Cropland that remain stable but stressed	3246700	1.76	Stable but stressed	Gadarif - East Darfur - West Darfur - Central Darfur - Gazira	Over Cultivation - Lack of Technology
11	Wetlands and water bodies showing declining productivity and early signs of decline	25000	0.01	Declining productivity	Red Sea- White Nile - Sinnar - South Kordofan - West Kordufan - River Nile - East Darfur - South Darfur	Overgrazing
12	Wetlands and water bodies that remain stable but stressed	45500	0.02	Stable but stressed	White Nile - South Kordofan - West Kordufan - East Darfur - South Darfur	Overgrazing
13	Artificial areas showing declining productivity and early signs of decline	22300	0.01	Declining productivity	Northern Sate - River Nile - Khartoum - Noth Kordufan - South Darfur - Kassala - Gadarif - Gazira - Blue Nile - Sinnar	Urbanization - inappropriate mining
14	Artificial areas that remain stable but stressed	13700	0.01	Stable but stressed	None	
15	Bare land and other areas showing declining productivity and early signs of decline	689500	0.37	Declining productivity	Northern State- River Nile - Red Sea - Kassala - Gadarif	Soil erosion
16	Bare land and other areas that remain stable but stressed	938600	0.51	Stable but stressed	Khartoum - North Darfur	Soil erosion
	Total	**22,153,300**	**11.98**			

Figure 2: Trends in Net Land Productivity Dynamics (Net LPD) according to Land Use/Cover Category from 2000 to 2010



2.1.1 Assessing in the field

In the working group (LDN NC) meeting for reviewing the interpretation of the data, and from the experience of the members in the working group, it was concluded that the land cover change from the forest to grass and shrubs and to cropland need to be assessed on the ground. There were different trends of land degradation identified according to the geographical location and the land cover class. The group of experts in the formal workshop discussed the status of land degradation and identified the following items, which should be taken into account during the assessment of land degradation on the ground during field visits:

Degradation in the grass and shrubs:

- Change the plant composition from palatable plants to non- palatable or toxic plants;
- Complete removal of plants;

Degradation in forest:

- Creeping of sand dunes on cities and farms;
- Poor productivity of the forest sector;
- Hurricanes;
- Disappearance of tree species and other appearance;

Degradation in cropland:

- Lack of production in the rain sector;
- Soil degradation;
- Emergence of some invasive plants;
- Creeping sand;

Degradation in wetland:

- Lack of wild life;
- Lack of fitness for growth and germination of trees and grasses;
- Soil hardening.

2.1.2. Identification of possible land degradation hotspots

As a result of the assessment of land degradation trends and drivers, geographical areas exposed to land degradation trends were identified as so-called LDN hotspots. Twenty five (25) different LDN hotspots were identified in Sudan and located in different ecological zones and exposed to different direct drivers of land degradation. Figures 3 and 6 show different hotspots in different land cover classes and different geographical locations. The hotspots were selected according to the declining land productivity in each land cover class. Food insecurity and increase of population were additional reasons to select the mentioned hotspots.

Further assessments in the selected areas - especially if they included protected areas - are required to fully understand the historical and current drivers behind observed land degradation dynamics using additional indicators approved by the LDN working group,

data sources, including field assessment and consultation visits. LDN hotspots may become a priority for action to achieve LDN through LDN transformative projects.

2.2 The LDN Baseline

The LDN indicators are computed primarily using **global** data sources and enhanced by national data sources, field surveys, assessments and ground measurements. The establishment of the LDN baseline in Sudan was supported in Sudan by the **GIS Unit in the Ministry of Environment, Natural Resources and Physical Development (MENRPD)** under the supervision of the LDN Country Consultant. The MENRPD is engaged in the LDN target setting process and is a part of the LDN national working group.

2.2.1 Validation of default data

Data derived from global (or regional) data sources are contextualised with information at the national and sub-national level, including a map on acute food insecurity phases (not shown) and population projections and distribution from the Sudan CENSUS 2008 (Table 5). The most common approach involves the use of site-based data to assess the consistency of the indicators derived from Earth observation and geo-spatial information.

The default data was discussed at LDN NC meetings. It was also discussed at a meeting of the data analysis team, who are members of the national working group. At both meetings it was noted that;

1. The country does not have reliable data on land cover, land productivity dynamics and soil organic carbon.
2. Further data are needed to assess LDN trends, complemented with ground observations/verification, as land degradation in Sudan seems to be acute.
3. It was recommended that further efforts be made by Central Statistical Bureau and other relevant stakeholders to collect and share data on land cover, land productivity dynamics and soil organic carbon, including multi-temporal high-resolution Google Earth images as verification data for tracking land cover patterns and their changes over time.
4. The LDN NC validated the default data with the above comments.

2.2.2 Validation of LDN baseline and targets

Sudan used the default data provided by the UNCCD Secretariat through the LDN Target Setting Programme (TSP) to set their LDN baseline, with some consideration of national data related to food insecurity and the distribution and projection of population from Sudan CENSUS 2008.

Under supervision of the country national consultant the default data was overlapped with the location map of the states and localities of Sudan to know the exact location for each class. Moreover, the land productivity dynamics (LPD) assessment was done using a map on the 2000 land cover as a baseline map to identify the classes of LPD for each land cover class.

The LDN baseline was technically validated by relevant stakeholders, including the LDN national working group and a national workshop. LDN targets were validated by the LDN national working group and endorsed by Government through the Minister of Environment, Natural Resources and Physical Development in July 2017.

Table 4: LDN baseline

Land Use/Cover Category	Area (2000)	Area (2010)	Net area change (2000-2010)	Net land productivity dynamics (NetLPD)** (sq. km)						Soil organic carbon (2000)**
	sq. km*	sq. km	sq. km	Declining	Early signs of decline	Stable but stressed	Stable not stressed	Increasing	No Data ***	ton/ha
Forest	16504	14625	-1878.7	66	458	2653	3261	8141	46	41.1
Shrubs, grasslands and sparsely vegetated areas	409862	411530	1668.2	12563	34883	44963	271789	15079	32255	21.6
Croplands	378258	378469	210.4	15469	59719	32467	266365	2290	2158	19.0
Wetlands	4674	4674	0	50	200	455	2802	1110	58	36.8
Artificial areas	2485	2485	0	87	136	137	1329	8	788	15.4
Bare land and other areas	1037060	1037060	0	2901	3995	9386	57570	172	963035	3.7
SOC average (ton/ha)										**11.2**
Percent of total land area				**2%**	**5%**	**5%**	**33%**	**1%**	**54%**	
Total (sq. km)	**1848843**	**1848843**	**0**	**31136**	**99390**	**90062**	**603115**	**26800**	**998340**	

Source: UNCCD Default Data

Table 5: Population projections in Sudan from Sudan CENSUS 2008

STATES	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2013-2008	% of change in 2013
Northern	701,451	724,073	746,538	768,968	791,370	813,742	836,056	858,289	880,417	902,398	924,185	945,737	967,005	112,291	16.01
Nahr lnile	1,126,295	1,151,105	1,176,154	1,201,488	1,227,113	1,253,026	1,279,208	1,305,654	1,332,351	1,359,274	1,386,400	1,413,700	1,441,140	126,731	11.25
Kassala	1,796,344	1,819,439	1,844,203	1,870,332	1,897,772	1,926,520	1,956,589	1,987,981	2,020,706	2,054,755	2,090,105	2,126,707	2,164,514	130,176	7.25
Red Sea	1,406,277	1,442,073	1,477,470	1,512,691	1,547,808	1,582,839	1,617,779	1,652,628	1,687,378	1,722,009	1,756,501	1,790,897	1,825,180	176,562	12.56
AL Gadarif	1,350,542	1,385,946	1,422,453	1,459,949	1,498,400	1,537,780	1,578,072	1,619,248	1,661,283	1,704,134	1,747,767	1,792,199	1,837,506	187,238	13.86
AL Gazeera	3,586,431	3,677,337	3,770,211	3,865,126	3,962,068	4,060,980	4,161,774	4,264,358	4,368,622	4,474,419	4,581,592	4,689,976	4,799,392	474,549	13.23
Khartoum	5,297,178	5,449,485	5,603,899	5,761,024	5,920,854	6,083,315	6,248,292	6,415,722	6,585,507	6,757,569	6,931,784	7,108,128	7,286,523	786,137	14.84
White Nile	1,737,460	1,778,086	1,820,023	1,863,133	1,907,363	1,952,675	1,999,036	2,046,405	2,094,736	2,143,995	2,194,151	2,245,187	2,297,076	215,215	12.39
Sinaar	1,288,771	1,319,476	1,351,209	1,383,908	1,417,583	1,452,207	1,487,743	1,524,161	1,561,429	1,599,510	1,638,364	1,677,963	1,718,259	163,436	12.68
Blue Nile	836,428	861,056	886,270	911,972	938,122	964,681	991,636	1,018,972	1,046,677	1,074,749	1,103,189	1,132,028	1,161,258	128,253	15.33
NorthKordofan	2,049,711	2,109,553	2,167,342	2,225,124	2,283,185	2,341,482	2,400,221	2,459,308	2,518,981	2,579,061	2,639,774	2,698,834	2,760,441	291,771	14.23
West Korofan	1,291,084	1,327,986	1,363,090	1,398,347	1,433,899	1,469,719	1,505,934	1,542,501	1,579,561	1,617,042	1,655,125	1,691,698	1,730,934	178,635	13.84
South Korofan	872,777	867,287	891,856	916,657	941,716	966,984	992,537	1,018,384	1,044,456	1,070,833	1,097,519	1,164,855	1,193,095	94,207	10.79
Central Darfor	556,651	571,814	587,263	602,998	619,027	635,354	651,978	668,888	686,036	703,465	721,177	739,154	757,408	78,703	14.14
East Darfor	1,242,450	1,266,229	1,291,019	1,316,753	1,343,520	1,371,436	1,400,629	1,431,183	1,463,180	1,496,675	1,531,692	1,568,062	1,605,653	128,986	10.38
North Darfor	2,125,400	2,176,712	2,228,956	2,282,308	2,336,904	2,392,876	2,450,310	2,509,317	2,569,953	2,632,260	2,696,253	2,761,796	2,828,746	267,476	12.58
South Darfor	2,929,770	2,983,590	3,039,677	3,097,928	3,158,449	3,221,424	3,286,961	3,355,213	3,426,305	3,500,363	3,577,491	3,657,603	3,740,612	291,654	9.95
West Darfor	759,036	778,853	798,913	819,267	839,966	861,030	882,462	904,282	926,421	948,928	971,811	995,019	1,018,581	101,994	13.44
Total	**30,954,056**	**31,690,100**	**32,466,546**	**33,257,973**	**34,065,119**	**34,888,070**	**35,727,217**	**36,582,494**	**37,453,999**	**38,341,439**	**39,244,880**	**40,199,543**	**41,133,323**	3,934,014	12.71

2.3 LDN institutional and legal environment

There are some examples to show the regulatory environment and the willingness to enforce related regulations:

- The Soil Conservation Committee was established in the 1940s and prepared a report in 1944 that concluded that soil degradation and desertification were mainly due to the misuse of land resources rather than as a result of climate change.
- Abdulla Khalil, former Prime Minister of Sudan from 1956 to 1958, while he was Minister of Agriculture, commented on Professor Stepping's (1952) book on desert encroachment in Sudan during his study of degraded vegetation. "
- The National Commission for Combating Drought and Desertification (72-1976) was established by presidential decree. The committee was chaired by the National Research Council and the Ministry of Agriculture. It was commissioned to prepare studies and solutions to the problems of desertification and drought. The Committee issued a report on the status of desertification in Sudan and project proposals to address the phenomenon (DECARP, 1976). The report was presented at the United Nations Conference on Desertification in Nairobi in 1977.
- The Ministry of Agriculture assigned a part-time coordinator to follow up desertification and land degradation control projects in 1979. In 1980 he was appointed as a full-time coordinator. In the same year the National Office for Combating Drought and Desertification was established under the supervision of the Undersecretary of Ministry of Agriculture and direct follow up of the Minister of State for Agriculture. The decision was to form a Permanent Council for Desertification, in which all relevant ministries and departments, as well as academic and research bodies, was mentioned.
- The Sudano-Sahelian Office (UNDP) provided technical and financial support in the early 1980s to the Office to Combat Desertification, which was designated as the Office for the Coordination of Desertification Programs.
- In 2009, the Combating Desertification Law, which provided for the establishment of a national council under the auspices of the President of the Republic, was promulgated with a legal personality, a succession and a general seal and the right to sue in its name. With the issuance of Presidential Decree No. 32 in 2015, the task of combating desertification became the responsibility of the Ministry of Environment, Natural Resources and Physical Development, and when the Presidential Decree No. 21 of 2017 was issued, the National Council for Combating Desertification was included in the Ministry of Environment, Natural Resources and Physical Development.

Policies:

- **Agricultural Policy:** Contains an approach for horizontal expansion in agricultural development for crop production to secure food, satisfy grain export and supply agricultural industries.
- **The Forest Policy** indicates the role of the different actors in the development, conservation and management of forest resources (1986-2006).
- **Range Policy:** Encouragement of private sector investments, intensification of productions and integration of agriculture and animal production.

- **Wildlife Policy:** Conservation and sustainable use of biological diversity in an integrated approach.
- **Water Policy:** Efficient use of water for agriculture, in addition to more utilization of ground water for irrigation.
- **Higher Council** of Environment and Natural Resources **(HCENR):** Development and coordination of policies and long term plans for environmental protection and sustainable development of natural resources.

Laws:

- **Combating Desertification Law**, 2009
- **Conservation of Environment Law**, 2017
- **Forests and Renewable Natural Resources Act**, 2002.
- **Wildlife and National Park Act**, 1986. A new wildlife draft legislation was prepared in 2013 to amend the 1986 legislation.
- **Range Act,** 2015
- **Water Resource Act,** 1995. The Ministry of Irrigation and Water Resources embraced most of the sub-sectors in the country.
- **Environmental Protection Act (EPA)** (2001 Act) harmonizes the different sectors' environmental laws.
- **Local Government Act,** 2003. The locality is entrusted, along with other functions, with agriculture, forestry, natural resources and animal wealth.

Table 6: SWOT analysis on the linkage between the legal and institutional environment in Sudan and the country's commitment to achieve LDN

STRENGTHS	WEAKNESSES
Legal 1- The existence of the combating desertification law. 2- Sudan's ratification and protection of the International Convention on Environmental Issues. 3- The Constitution of the Republic of the Sudan shall include provisions concerning the protection of the environment, the use of land and the establishment of a commission for it. 4- The existence of a legacy of environmental legislation and laws since 1900. **Institutional** 1- The activation of the UNCCD focal point of the Ministry of Environment, Natural Resources and Physical Development. 2- The existence of institutions, competent ministries and national councils and colleges, universities and	**Legal** 1- Non-enforcement of laws related to land degradation. **Institutional** 1- Poor coordination and integration in the implementation of activities and interests in the use of land, in addition to administrative and political intersections that may impede the implementation of laws and regulations that concern the protection of the environment. 2. Lack of follow-up and continuous monitoring of pasture issues. 3. Lack of attention to environmental issues at the local level. 4- Lack of awareness and guidance in the field of the environment. 5- Lack of analytical data that contribute to sound

research centres and civil society organizations concerned with protecting the environment and combating desertification. 3- The existence of specifications and criteria for the use of land in a scientific way and the Sudanese Organization for Standardization and Metrology.	decision-making.
OPPORTUNITIES	**THREATS**
Legal 1- International financial support that contributes to the implementation of projects, plans and programs related to the environment. 2. Availability of political will. 3. The interest of the private sector and civil society organizations through community responsibility. **Institutional** 1- The existence of a large number of studies and research in the field of desertification and land degradation. 2- The integration between the climate change projects and land degradation projects. 3- The National REDD+ Strategy in preparation. 4 - The presence of qualified and competent cadres.	**Legal** 1 - Land ownership, as most of the land used on the common. 2- Increasing mining concessions in identified land degradation hotspots. 3- Natural disasters such as drought, floods, erosion, desert encroachment, etc. 4- Horizontal agricultural expansion, especially agriculture in north line 13 (increase of population). 5- Increased pastoral load (increase in livestock numbers).

3 - Setting LDN targets

3.1 Voluntary LDN Targets

After national consultation, the national, sub-national and specific targets are as follows:

National targets:

- Inventory of renewable natural resources in the country (Inventory of forest resources - Survey of pastoral lands - Wetlands inventory - Inventory of wild animals);
- Reservation of 15% of the country to be registered by the government as renewable natural resource area (Complete forest reservation - Mapping, reservation and recording of pasture lands - Reservation of wildlife areas - Completion of the wetland reservation and registration of the requirements of the RAMSAR Convention);
- LDN is achieved by 2030 as compared to 2010 at national level (no net loss);
- Improve the implementation of land use sustainability and planning and evaluation in state agencies related to the land degradation neutrality (Provision of a national database - Raise institutional and individual capacities in planning, implementation and evaluation - Improve coordination mechanisms between the center and the states in all sectors - Development of a sustainable land management methodology - Develop an integrated land use sustainability plan).

Sub-national targets:

- Determine the productivity of pastoral land in each state and increase it to 2.5 tons / hectare;
- Develop a methodology for the sustainability of pastoral lands at the national level;
- Forest conservation and reforestation of 66 square kilometers of degraded forests in Kassala and Blue Nile states.

Specific targets:

- Improving the quality of pastures' soil and SOC;
- Improve production in rainfed agricultural areas (clay) to mean 10 Shawwal per feddan (and sand) 5 Shawwal per feddan;
- Increase the carbon stock in the soil by 30,5742 tons (Compensation of carbon losses by base year and add the same amount by forest farming in North, Nile, Khartoum, North Kordofan and North Darfur)
- Increasing the forest area according to the plan of the National Forestry Commission;
- Cultivation of trees and shrubs of high nutritional value in the pasture lands in the semi-desert and savannah-poor areas, especially in the area of 12563 km2;
- Raising the productivity of declining agricultural areas (15496 km 2) and cropland with early signs of decline (59719 km 2) and stable but stressed (32467 km2).

Measures:

- Protection, law enforcement and policy clearance in forest, agriculture and rangeland;
- Provision of forest, rangeland and agriculture inputs in all states (seedlings + seeds + mechanisms);
- Coordinate with national and local voluntary associations, networks and private sector to implement land degradation neutrality programs;
- Coordinate with research institutes to implement land degradation neutrality programs;
- Implementation of the article in the Forest Law of 2002 which is the cultivation of 5% of the irrigated projects and 10% in the rainfed projects to be forest;
- Allocation of sustainable management of pastoral lands at the national level;
- Open fire lines in areas with high plant density and frequent monsoon fires. Under the supervision and procedures of pasture administrations;
- Providing agricultural mechanization in the processing and processing of agricultural residues in high crop-intensive states where crop residues are available;
- Identifying all technical packages to increase productivity and issue a brochure and distribute it to all stakeholders;
- Identifying scientific methods - according to national adaptation plan - to increase productivity and disseminate it to all states;
- Identify gaps in institutional and individual capacities in the relative stakeholders to LDN;
- Collect and analyze the necessary RS space images in appropriate methodology to the ecosystems in Sudan;
- Linking land degradation data to the Central Statistical Organization;
- Link projects of land degradation neutrality with the National Plans for Sustainable Development;
- Raise capacity in planning, data collection and analysis, monitoring and reporting;
- Raise capacity in project management;
- Raising capacities in the field of writing projects and finance raising;
- Establishment of the national Land Commission;
- Complete Sudan land use map;
- Cultivation of 420 km square in the northern states, the Nile, Khartoum, North Kordofan and North Darfur;
- Identifying of all technical packages needed to increase carbon stocks and issue a handbook and distribute it to all stakeholders in the state.

Table 7: Measures identified for consideration by UNCCD National Focal Point and LDN working group

Negative trend	Area [sq. km]	Driver		Measure		
		Direct	Indirect		Area [sq. km]	Timeline
Negative Land Cover Change	210	Deforestation	Population pressure	Programmes and Projects	210	2030
Declining Land Productivity	12563	Overgrazing	Land tenure	Programmes and Projects	12563	2030
Declining Land Productivity	15469	Over exploitation of vegegation for domestic use	Povertry	Vegetative measures	15469	2030
Declining Land Productivity	66	Deforestation	Population pressure	Management measures	66	2030
Declining Land Productivity	50	Disturbance of water cycle	Population pressure	Management measures	50	2030
Early Stage of Land Productivity	458	Improper management of annual, perennial and scrub and tree crops	Governance and institutional settings	Programmes and Projects	458	2030
Early Stage of Land Productivity	34883	Improper soil management	Povertry	Management measures	34883	2030
Early Stage of Land Productivity	59719	Improper management of annual, perennial and scrub and tree crops	Land tenure	Vegetative measures	59719	2030
Early Stage of Land Productivity	200	Disturbance of water cycle	Povertry	Management measures	200	2030
Stable but Stressed (Land productivity)	90062	Improper management of annual, perennial and scrub and tree crops	Population pressure	Management measures	90062	2030
Soil Organic Carbon Loss	210	Deforestation	Povertry	Vegetative measures	210	2030

4 - Achieving LDN

4.1 Leverage already achieved

Ongoing projects related to LDN, funded by international organizations are:
1- Project on rehabilitation of the Gum Arabic belt (Kordufan - Darfur)
2- Rehabilitation of Grassland for Carbon Stock Project (North Kordufan)
3- Projects on incorporating tree belts in the River Nile and Northern States
4- Natural Resource Development Project - IFAD (Greater Kordofan)
5- Wadi Al-Kwa Project- UNEP (North Darfur).
6- Projects on Adaptation to climate change impacts
7- Sustainable Natural Resources Development Project (African Great Green Wall Project)
8- REDD+ Programme (under RPP)
9- The Drought Resilience and Sustainable Livelihoods Programme - Project (Gadarif, Kassala and White Nile)
10- Integrated Carbon Sequestration Project in Sudan

4.2 LDN transformative projects and programmes opportunities identified

As it has been shown in Table 3, all geographical areas and land use classes need to be maintained in order to have no net loss by 2030. Table 8 shows the project opportunities identified in the 25 LDN hotspots.

Table 8: Programmes opportunities identified in the 25 hotspots

Hot Spot	Land Use/Cover Category	Trend	Geographical location (State/ locality)	Driver	Intervention *
Hot spot 1	Forest to crop land with declining productivity and showing early signs of decline	Land Cover Change	Gadarif/ Localities: Algalabat Alshargia	Deforestation-Shifting Cultivation	Restoration of the forest; Reviewing State polices.
Hot spot 2	Forest to shrubs, grasslands and sparsely vegetated areas	Land Cover Change	Blue Nile/localities: Alrusairis- Gaisan- Alkurmuk	Deforestation	
Hot spot 3	Forest to Shrubs, grasslands and sparsely vegetated areas	Land Cover Change	South Darfur/ Localities: Buram	Deforestation	
Hot spot 4	Forests with declining productivity	Declining productivity	Red Sea / Localities: Tukar	Deforestation	
Hot spot 5	Forests with declining productivity	Declining productivity	Kassala / Localities: Rifi Shamal Altalta	Deforestation	
Hot spot 6	Forests with declining productivity	Declining productivity	Blu Nile / Localities: Joint point between Alrusairis-Aldamazin- Bawo	Deforestation	
Hot spot 7	Shrubs, grasslands and sparsely vegetation declining productivity and showing early signs of decline	Declining productivity	Kassala/ Localities: Rifi Kassala	Overgrazing	Improve the varieties of the shrubs and grass; Improve the technologies; Reviewing the state policies.
Hot spot 8	Shrubs, grasslands and sparsely vegetation declining productivity and showing early signs of decline	Declining productivity	Gadarif/ Localities: Albutana	Overgrazing	
Hot spot 9	Shrubs, grasslands and sparsely vegetation declining productivity and showing early signs of decline	Declining productivity	White Nile/ Localities: Aljabalain - Alsalam	Overgrazing	
Hot spot 10	Shrubs, grasslands and sparsely vegetation declining productivity and showing early signs of decline	Declining productivity	South Kordofan/ Localities: Abujebaiha- Alrashad	Overgrazing	
Hot spot 11	Shrubs, grasslands and sparsely vegetation declining productivity and showing early signs of decline	Declining productivity	North Kordofan/ Localities: Bara	Overgrazing	
Hot spot 12	Shrubs, grasslands and sparsely vegetation declining productivity and showing early signs of decline	Declining productivity	West Kordofan/ Localities: Alnihood	Overgrazing	
Hot spot 13	Shrubs, grasslands and sparsely vegetation declining productivity and showing early signs of decline	Declining productivity	Central Darfur/ Localities: Zalinjae	Overgrazing	
Hot spot 14	Shrubs, grasslands and sparsely vegetation declining productivity and	Declining productivity	North Darfur/ Localities: Kutum - Ambro	Overgrazing	

	showing early signs of decline				
Hot spot 15	Cropland showing declining productivity and early signs of decline	Declining productivity	Kassala/ Localities: Rifi Khashm Algirba	Over Cultivation - Lack of Technology	Improve soil fertility in crop land; Use of agro-forestry practices; Reviewing state policies.
Hot spot 16	Cropland showing declining productivity and early signs of decline	Declining productivity	Gadarif/ Localities: Gala' Alnahal - Madinat Algadarif - Alrahd - Algalabat Alshargia	Over Cultivation - Lack of Technology	
Hot spot 17	Cropland showing declining productivity and early signs of decline	Declining productivity	Sinnar/ Localities: Sinja- Abuhujar- Alsuki - Alrahad	Over Cultivation - Lack of Technology	
Hot spot 18	Cropland showing declining productivity and early signs of decline	Declining productivity	Blue Nile/ Localities: Altadamun - Alrusiris	Over Cultivation - Lack of Technology	
Hot spot 19	Cropland showing declining productivity and early signs of decline	Declining productivity	White Nile/ Localities: Aljabalain - Alsalam	Over Cultivation - Lack of Technology	
Hot spot 20	Cropland showing declining productivity and early signs of decline	Declining productivity	Central Darfur/ Localities: Aljinaina - Kirainik	Over Cultivation - Lack of Technology	
Hot spot 21	Wetlands and water bodies showing declining productivity and early signs of decline	Declining productivity	Red Sea/ Localities: Tukar - Ageeg	Overgrazing	Restoration of the wetland ecosystem; Reviewing the state policies.
Hot spot 22	Wetlands and water bodies showing declining productivity and early signs of decline	Declining productivity	West Kordufan/ Localities: Kailik	Overgrazing	
Hot spot 23	Artificial areas showing declining productivity and early signs of decline	Declining productivity	Kassala/Localities: Rifi Garb Kassla - Halfa Algadida	Urbanization - inappropriate mining	Restoration of the degraded land by mining; Reviewing state Policies.
Hot spot 24	Artificial areas showing declining productivity and early signs of decline	Declining productivity	North Kordufan/ Localities: Ummruaba - Shaikan- Bara	Urbanization - inappropriate mining	
Hot spot 25	Bare land and other areas showing declining productivity and early signs of decline	Declining productivity	Red Sea/ Localities: Ageeg	Soil erosion	Maintain of soil erosion using science and technologies.

*** The local communities are core partners in this intervention,**

5- Conclusion

The desert is gradually expanding in Sudan, where it threatens other areas of drylands as well as livelihoods. The problem of land degradation in Sudan is exacerbated by climate change, leading to land degradation, loss of agricultural land and reduced crop production. All this makes sustainable land management in the country a strategic approach to facilitate environmental protection and to achieve local and national goals in the country.

Analysis of the data shows that 12% of the country area was degraded, including areas in the eastern part of the country (Red Sea - Kassla - Gadarif - White Nile - Blue Nile - South Kordodan) and the western part of the country (West Darfur - Central Darfur - North Darfur), where intensive agriculture and rangeland production are common. These areas are also classified as areas with high population densities and growth (Table 3).

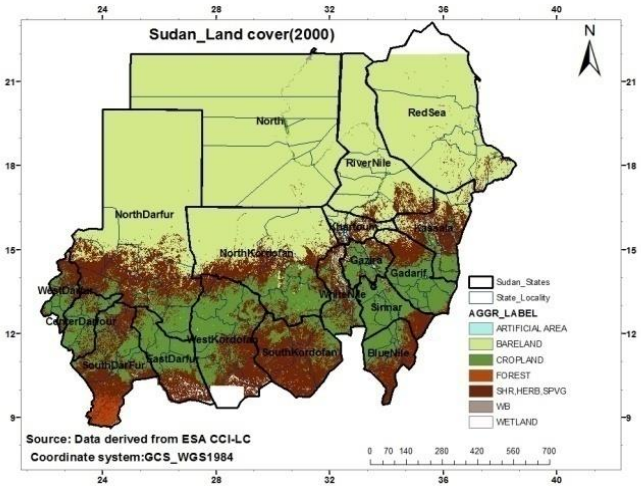
According to the LDN baseline table, there are some areas classified as stable but stressed which also require interventions in order to reduce the risk of land degradation by 2030. In the land cover change figure (Fig. 2), forest areas have been converted to either cropland or shrubs and grass land. This situation, in addition to restoration of the forest areas, requires state policies and close follow-up in the LDN implementation stages.

Sudan has a small proportion of wetlands, but it is very important to keep the ecosystem balanced. Degraded wetland areas are found in the Red Sea State and West Kordodan State, where there are very important seasonal streams used as sources of water for the local population and livestock. The degradation of these areas is caused by mining, erosion or inappropriate urbanization. The degraded bare land in the Red Sea State (Locality Ageeg) could be classified as degradation in a coastal zone.

The LDN target setting process for Sudan identified 25 hotspots in all land cover classes in different states and ecological zones. Program opportunities, including proposed measures, areas and timelines were also identified (Table 7) to address the land degradation challenges and work towards the achievement of LDN.

Annexes

Fig. 3a and 3b: land cover / land use 2000-2010 (source: ESA CCI-LC)



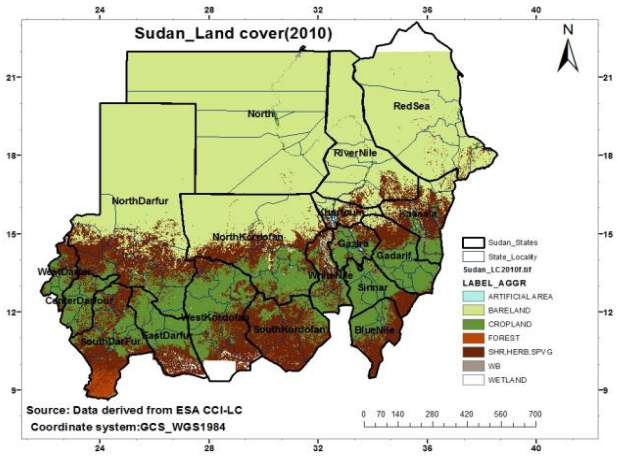


Fig. 4: Sudan land productivity dynamics (source: ESA CCI-LC)

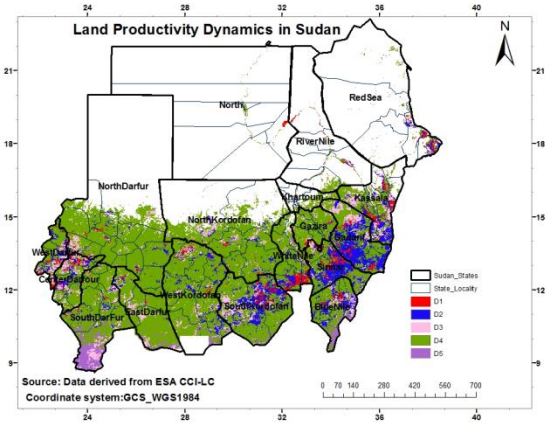
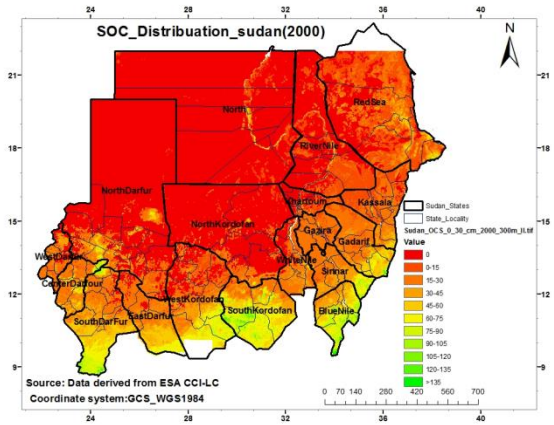


Fig. 5: Sudan soil organic carbon in 2000-2010 (source: ESA CCI-LC)



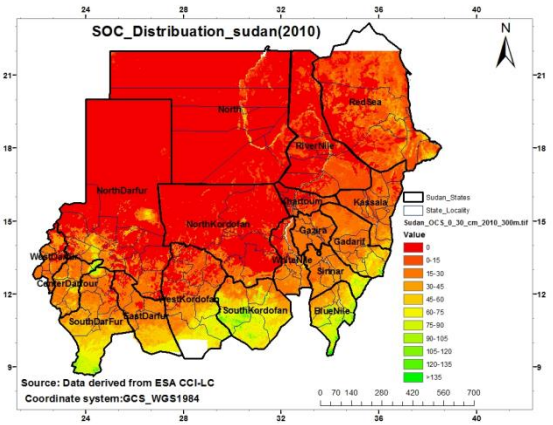
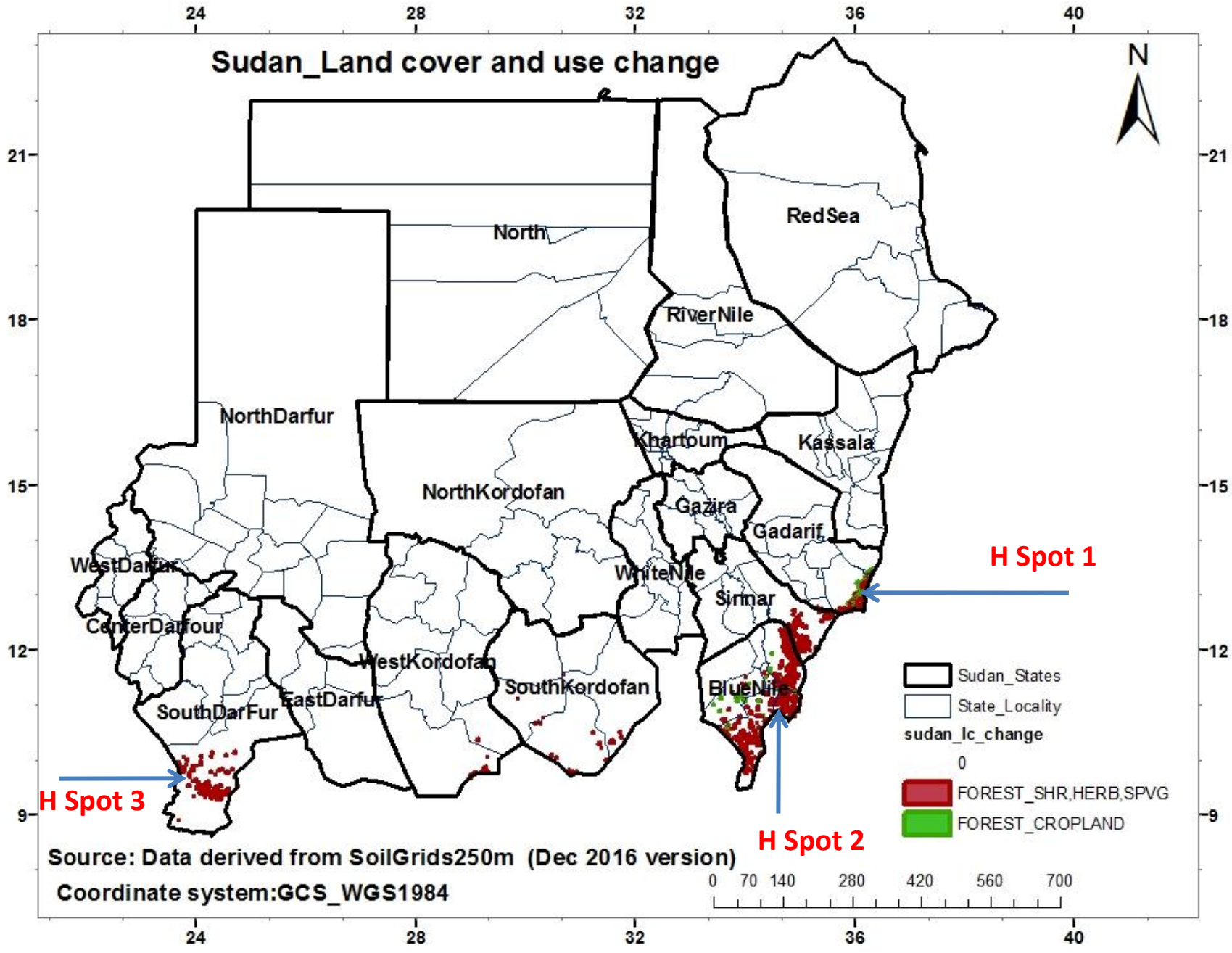
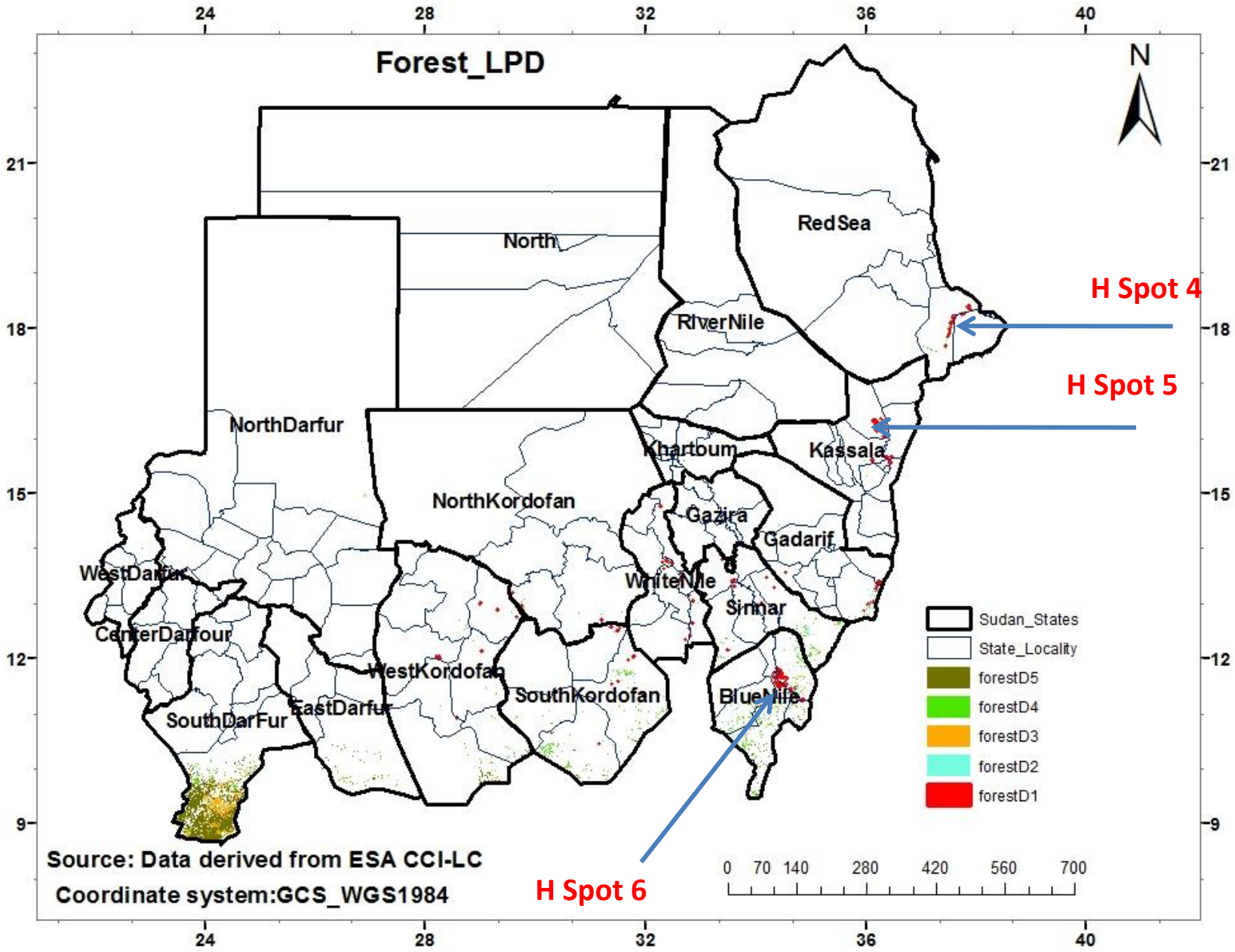


Fig 6: maps of the LPD for different land cover classes and hot spot locations




Forest_LPD
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NorthKordofan
Gazira
Gadarif
WestDarfur
WhiteNile
Sinnar
CenterDarfour
WestKordofan
SouthKordofan
BlueNile
SouthDarFur
EastDarfur
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H Spot 6
Sudan_States
State_Locality
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forestD3
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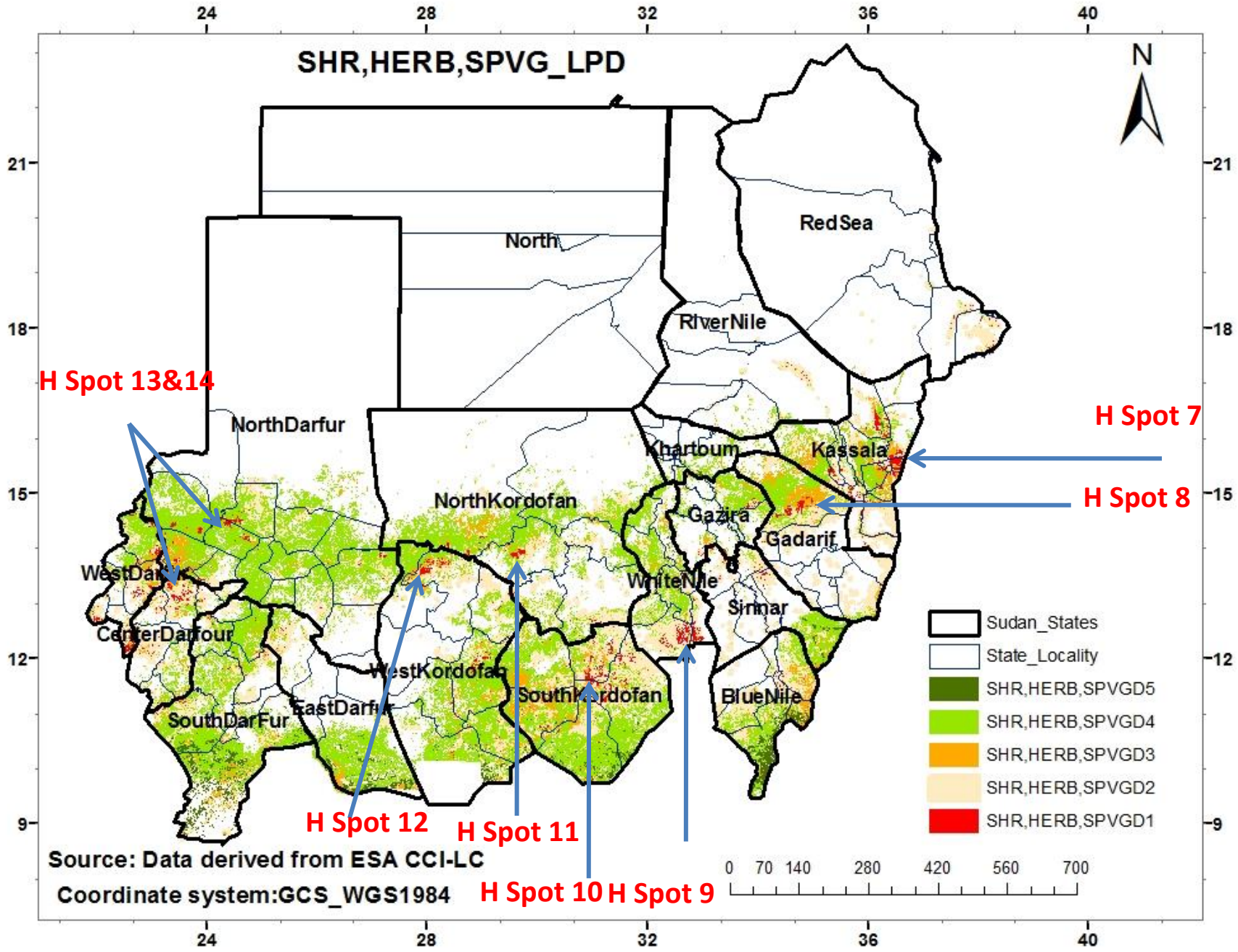
0 70 140 280 420 560 700
Source: Data derived from ESA CCI-LC
Coordinate system:GCS_WGS1984


SHR,HERB,SPVG_LPD
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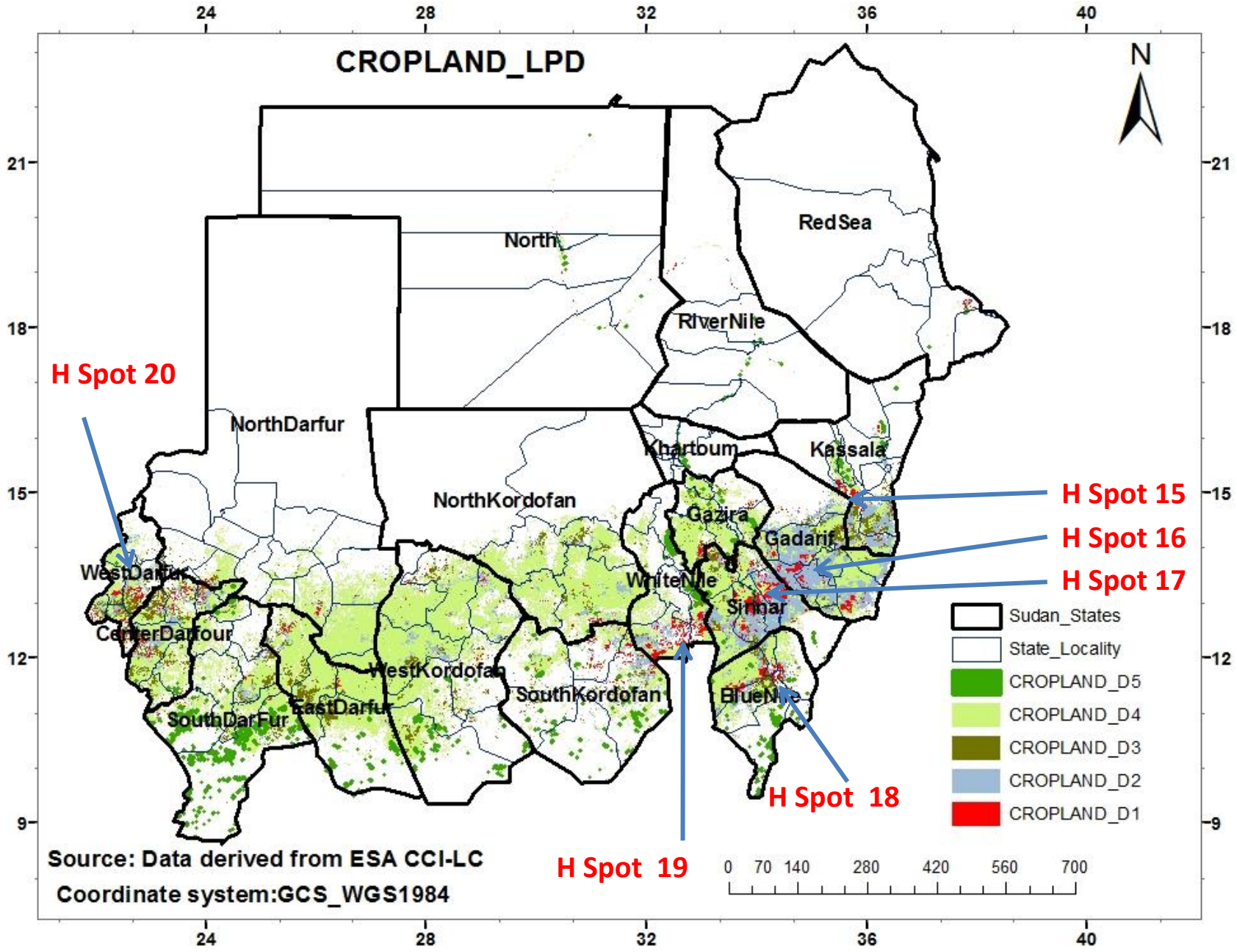
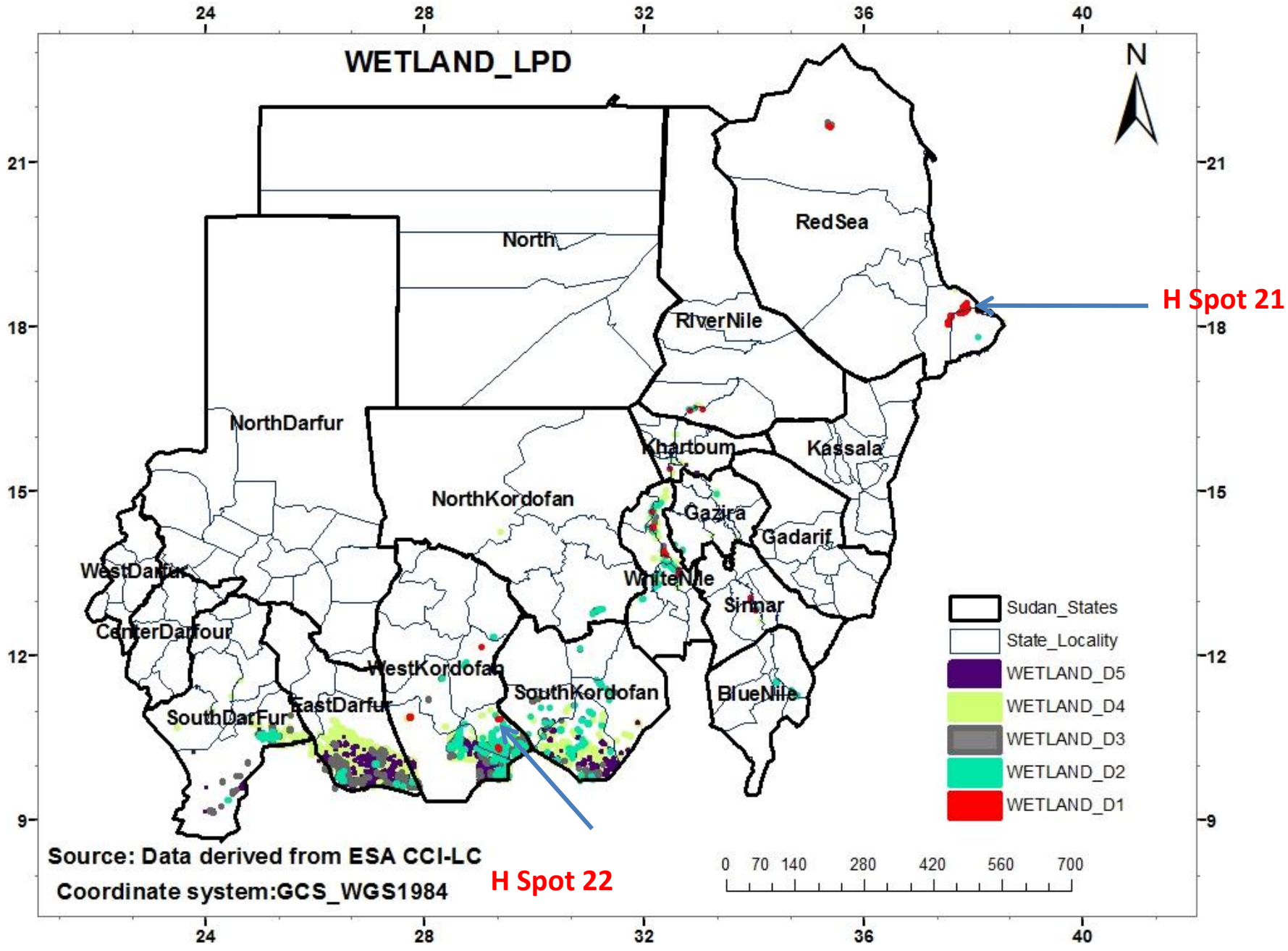
RedSea
RiverNile
NorthDarfur
Khartoum
Kassala
NorthKordofan
Gazira
Gadarif
WhiteNile
Sinnar
CenterDarfour
WestKordofan
SouthKordofan
BlueNile
SouthDarFur
EastDarfur
H Spot 13&14
H Spot 7
H Spot 8
H Spot 12
H Spot 11
H Spot 10
H Spot 9
Sudan_States
State_Locality
SHR,HERB,SPVGD5
SHR,HERB,SPVGD4
SHR,HERB,SPVGD3
SHR,HERB,SPVGD2
SHR,HERB,SPVGD1
0 70 140 280 420 560 700
Source: Data derived from ESA CCI-LC
Coordinate system:GCS_WGS1984


CROPLAND_LPD
N
24
28
32
36
40
21
18
15
12
9
North
RedSea
RiverNile
NorthDarfur
Khartoum
Kassala
NorthKordofan
Gazira
Gadarif
WestDarfur
WhiteNile
Sinnar
CenterDarfour
WestKordofan
SouthKordofan
BlueNile
SouthDarFur
EastDarfur
H Spot 20
H Spot 15
H Spot 16
H Spot 17
H Spot 18
H Spot 19
Sudan_States
State_Locality
CROPLAND_D5
CROPLAND_D4
CROPLAND_D3
CROPLAND_D2
CROPLAND_D1
0 70 140 280 420 560 700
Source: Data derived from ESA CCI-LC
Coordinate system:GCS_WGS1984


WETLAND_LPD
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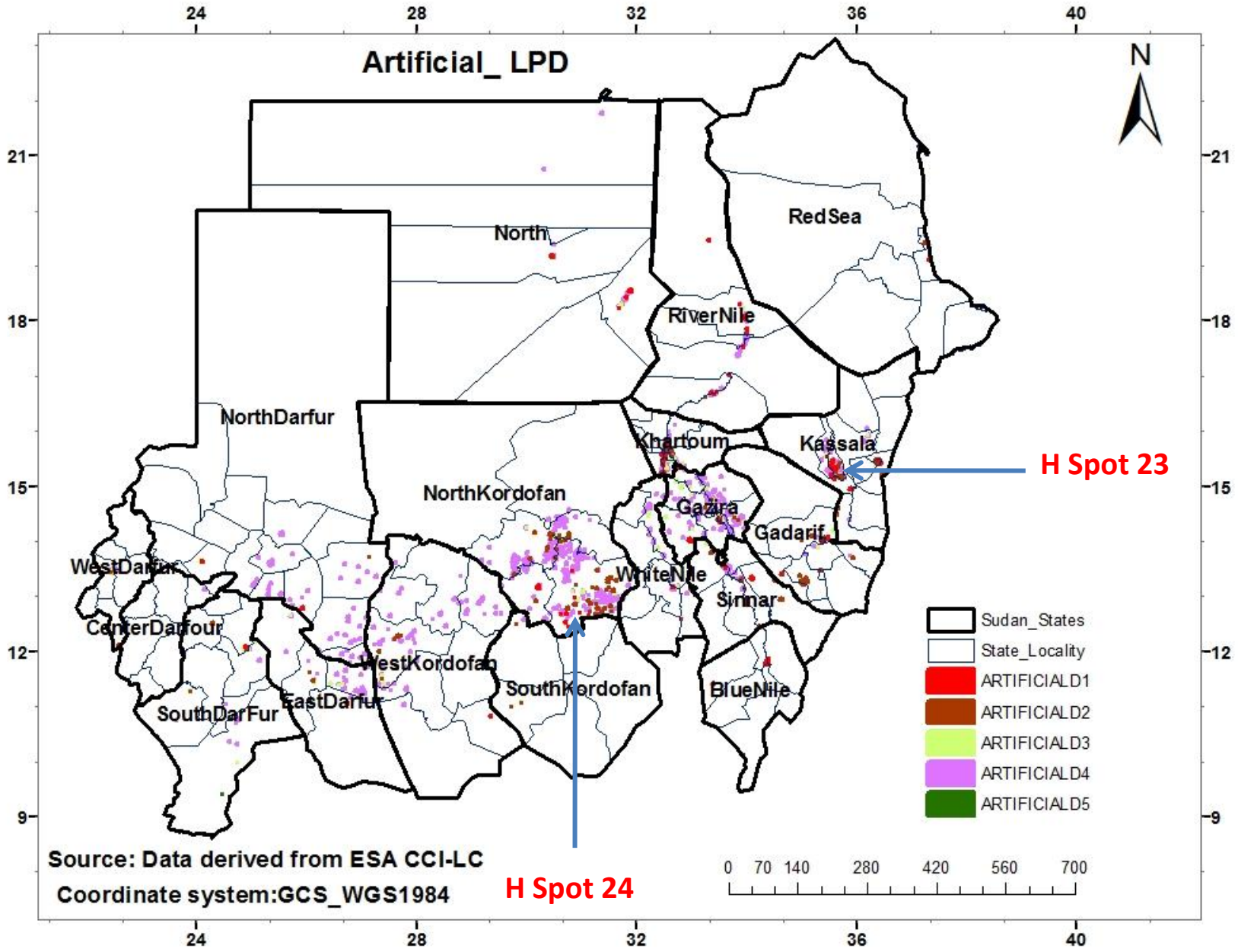
North
RedSea
RiverNile
NorthDarfur
Khartoum
Kassala
NorthKordofan
Gazira
Gadarif
WestDarfur
WhiteNile
Sinnar
CenterDarfour
WestKordofan
SouthKordofan
BlueNile
EastDarfur
SouthDarFur
Sudan_States
State_Locality
WETLAND_D5
WETLAND_D4
WETLAND_D3
WETLAND_D2
WETLAND_D1
H Spot 21
H Spot 22
Source: Data derived from ESA CCI-LC
Coordinate system:GCS_WGS1984
0 70 140 280 420 560 700


Artificial_ LPD
N
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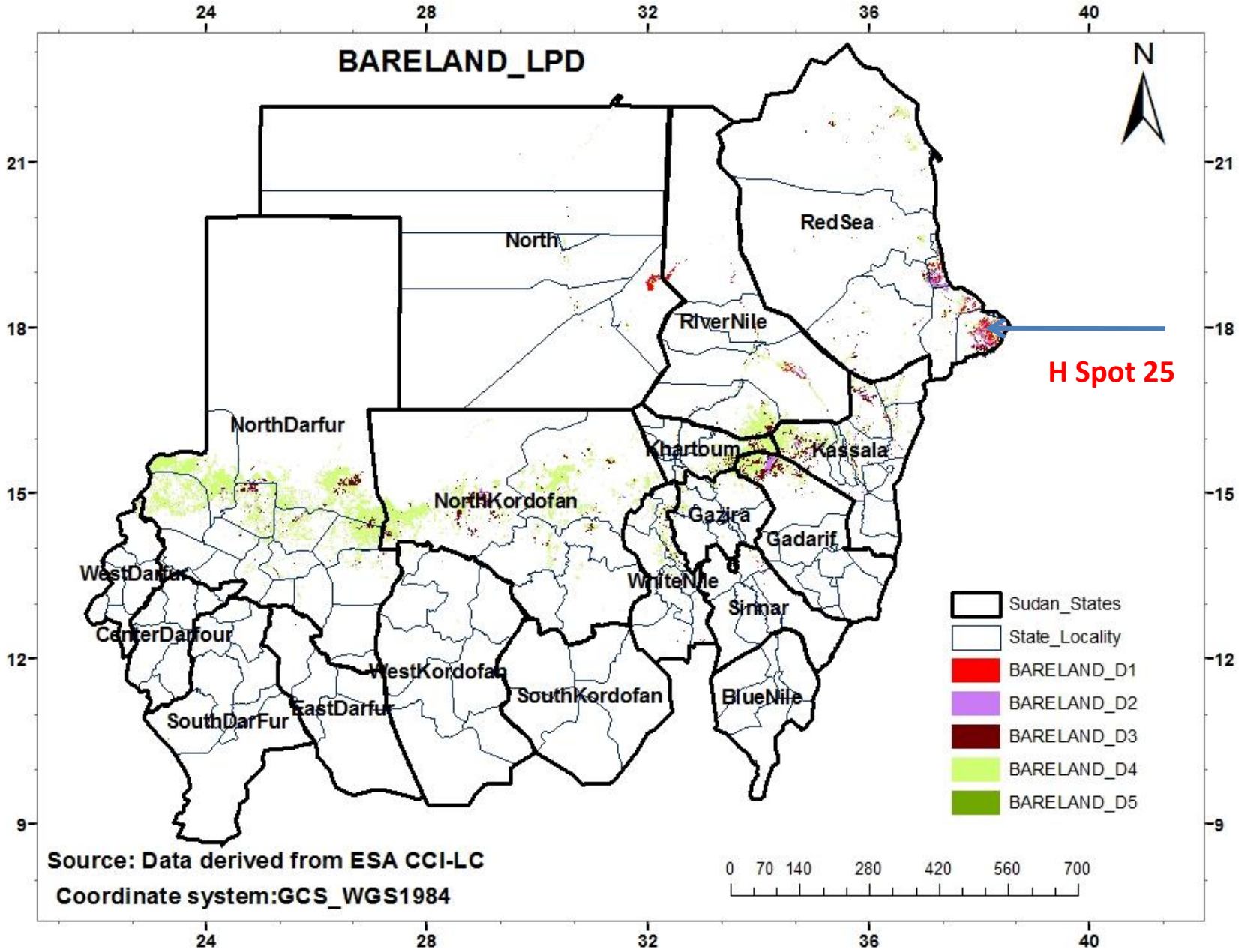
18
15
12
9
North
RedSea
RiverNile
NorthDarfur
Khartoum
Kassala
NorthKordofan
Gazira
Gadarif
WestDarfur
WhiteNile
Sinnar
CenterDarfour
WestKordofan
SouthKordofan
BlueNile
EastDarfur
SouthDarFur
H Spot 23
H Spot 24
Sudan_States
State_Locality
ARTIFICIALD1
ARTIFICIALD2
ARTIFICIALD3
ARTIFICIALD4
ARTIFICIALD5
0 70 140 280 420 560 700
Source: Data derived from ESA CCI-LC
Coordinate system:GCS_WGS1984


BARELAND_LPD
N
24
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18
15
12
9
North
RedSea
RiverNile
H Spot 25
NorthDarfur
Khartoum
Kassala
NorthKordofan
Gazira
Gadarif
WestDarfur
WhiteNile
Sinnar
CenterDarfour
WestKordofan
SouthKordofan
BlueNile
SouthDarFur
EastDarfur
Sudan_States
State_Locality
BARELAND_D1
BARELAND_D2
BARELAND_D3
BARELAND_D4
BARELAND_D5
Source: Data derived from ESA CCI-LC
Coordinate system:GCS_WGS1984
0 70 140 280 420 560 700