



SOUTH SUDAN TROPICAL FORESTS AND BIOLOGICAL DIVERSITY ASSESSMENT

PHASE 1: PRE-FIELD FAA 118/119 DESK ASSESSMENT



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Photo Credit: Charles Hernick, 2013

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LIST OF ACRONYMS

ADS	Automated Directives Systems
AfDB	African Development Bank
ASL	Above sea level
AWF	African Wildlife Foundation
BCM	Billion cubic meters
CAR	Central African Republic
CARE	Cooperative for Assistance and Relief Everywhere
CBD	Convention on Biological Diversity
CBNRM	Community-based natural resource management
CDCS	Country Development Cooperation Strategy
CETC	Central Equatoria Teak Company
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species
CPA	Comprehensive Peace Agreement
DFID	Department for International Development
DRC	Democratic Republic of Congo
EIRO	Environmental Impacts Risks and Opportunities
ETC	Equatoria Teak Company
ETOA	Environmental Threats and Opportunities Assessment
FAA	Foreign Assistance Act of the United States
FAO	Food and Agriculture Organization of the United Nations
FFI	Fauna & Flora International
FRA	Forest Resources Assessment
FSC	Forest Stewardship Council
GDP	Gross domestic product
GEF	Global Environment Facility
GEMS	Global Environmental Management Support
GHG	Greenhouse gas
GNI	Gross national income
GOSS	Government of the Republic of South Sudan
HA	Hectare
IBA	Important Bird Area
IDP	Internally displaced persons
INGO	International nongovernmental organization
IUCN	International Union for Conservation of Nature
LPG	Liquefied petroleum gas
MAARI	Ministry of Agriculture, Animal Resources and Irrigation
MAF	Ministry of Agriculture and Forestry
MARF	Ministry of Animal Resources and Fisheries
MDTF	Multi-donor Trust Fund
MWCT	Ministry of Wildlife Conservation and Tourism
MWRI	Ministry of Water Resources and Irrigation
NBHS	National Baseline Household Survey
NBS	National Bureau of Statistics
NGO	Non-governmental organization
NP	National Park
NRM	Natural resource management
NRMG	Natural Resource Management Group
NTFP	Non-timber forest product
PA	Protected area

PCEA	Post-Conflict Environmental Assessment
SEA	Strategic environmental assessment
SIFSIA	Sudan Institutional Capacity Programme: Food Security Information for Action
SSCCSE	Southern Sudan Centre for Census, Statistics and Evaluation
SSDP	South Sudan Development Plan
SSP	South Sudanese pound
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
USAID	United States Agency for International Development
WCS	Wildlife Conservation Society
WRAPP	Water for Recovery and Peace Program

INTRODUCTION

USAID regulations require that all country strategic plans include analyses of the actions that are needed to conserve tropical forests and biodiversity in the country and the extent to which current or proposed USAID actions will meet these needs. The purpose of this Phase 1: Pre-Field FAA 118/119 Desk Assessment is to provide the first part of the required analyses for the South Sudan program. When the political situation allows, it is anticipated that the second field-based phase of the FAA 118/119 Assessment will be implemented to complete the assessment. To ensure that United States Agency for International Development (USAID) programs are supportive of biodiversity conservation and tropical forests, the Foreign Assistance Act (FAA) of the United States in Sections 118 and 119, as amended, contains provisions that ensure that these issues are not overlooked. The provisions of the two sections state the following:

FAA Sec 118 (e): Country Analysis Requirements. Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of

- The actions necessary in that country to achieve conservation and sustainable management of tropical forests, and
- The extent to which the actions proposed for support by the Agency meet the needs thus identified.

FAA Sec 119 (d): Country Analysis Requirements. Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of

- The actions necessary in that country to conserve biological diversity, and
- The extent to which the actions proposed for support by the Agency meet the needs thus identified.

FAA Sections 118 and 119 are specific legal requirements of all USAID operating unit strategic plans.

Chapter 201 of the USAID Automated Directives Systems (ADS), which sets out USAID mandatory operational policies, implements this statutory requirement. ADS 201.3.4 establishes the process and mandatory inputs to USAID Country Development Cooperation Strategy (CDCS). The CDCS is generally a five-year strategy that is the mandatory basis for design of individual projects and programs. ADS 201.3.4., mandates that an “environmental analysis” satisfying the requirements of FAA 118 (e) and 119 (d), as above be completed in Phase 1 of the CDCS development (often called 118/119 analysis).

Best practice guidance for biodiversity and tropical forest analysis is provided by two reports: (1) *Best Practices for Biodiversity and Tropical Forest Assessments* (USAID, 2005a) and (2) *Tropical Forestry and Biodiversity (FAA 118 and 119) Analyses: Lessons Learned and Best Practices from Recent USAID Experience* (USAID, 2005b). As described, the FAA 118/119 Assessment consists of a combination of advance desk research and consultations with remote stakeholders and in-country field work and consultations.

In response to USAID/South Sudan strategic planning needs, a FAA 118/119 Assessment, including field components, was part of the Global Environmental Management Support (GEMS) program of environmental compliance and management support for USAID/South Sudan at the time of the current outbreak of political violence in South Sudan. The proposed assessment was to be the first for South Sudan as an independent nation; an FAA 118/119 Assessment was performed for Sudan in 2003 and updated in 2007 for Southern Sudan. Unfortunately, current conditions in South Sudan prohibit field work. This Assessment covers Phase 1, the remote desk-review portions, including a GIS analysis, of the FAA 118/119 Assessment. Phase 2, including FAA 118/119 field work, will be undertaken at a future date.

Phase 2 of the FAA 118/119 Assessment is expected to include the following:

- In-country stakeholder interviews and consultations;
- Site visits to better understand the current state of biodiversity and forests within the country;
- Updates to the policy and legislation sections;
- Development of priority actions and the analysis of the extent to which the actions meet the needs.

METHODOLOGY

The Phase 1 Pre-Field FAA 118/119 Desk Assessment was developed using the following methodology:

Step 1: Information Gathering and Identification of Stakeholders.

This first step required assembly of relevant documents on biodiversity and tropical forestry and potential threats to biodiversity in South Sudan. Potential stakeholders in the management of tropical forests and biodiversity were also identified and contacted (Annex B). However, only two of the contacted stakeholders responded to the questionnaire; it is assumed the current political unrest in the country hindered response to the inquiries. To gather information on the status of tropical forests and biodiversity conservation, a questionnaire was developed and sent out to the stakeholders (Annex C).

Step 2: Document Review and Remote Stakeholder Consultations

This step entailed review and analysis of all documents assembled in step 1 above. Areas of focus for the review were:

- Tropical forests and biological diversity of South Sudan, particularly current status and trends. This included available data and information on tropical forests and biodiversity at the ecosystem and species levels, including terrestrial, aquatic, and marine diversity;
- Ecosystems, species, and genetic resources that are threatened;
- Economic and social dependency on forests (i.e., ecosystem services) and ecological importance of forests and biodiversity;
- Status of forest certification programs and their impacts on forests;
- Donors and international organizations, both indigenous and external, that play a role in conserving biological diversity and tropical forests, and their principal programs.

Step 3: Preparation of Draft Report

Information on the above issues was reviewed and analyzed to prepare this draft report.

GENERAL DESCRIPTION OF THE REGION AND ECOSYSTEM, AND SPECIES DIVERSITY

Location

South Sudan has an area of 640,000 km² (GOSS and United Nations Development Programme (UNDP), 2011). The country is bordered by Ethiopia to the east, Kenya to the southeast, Uganda to the south, Democratic Republic of the Congo (DRC) to the southwest, Central African Republic (CAR) to the west, and Sudan to the North. It lies between latitudes 3° and 13° N and between longitudes 24° and 36° E (NBS, 2012).

South Sudan is divided into ten states (see Annex A, Map 2):

- Central Equatoria
- Eastern Equatoria
- Western Equatoria State
- Upper Nile
- Jonglei
- Warrap State
- Northern Bahr el Ghazal
- Western Bahr el Ghazal
- Unity
- Lake

Macroeconomic Setting

South Sudan is highly dependent on oil, which provides 98% of public sector revenue, almost all foreign exchange earnings, and 60% of the total gross domestic product (GDP) (GOSS, 2011). It is projected that oil will be the primary source of revenue over the next decade and will spur economic growth. The Government of the Republic of South Sudan (GOSS) realizes the vulnerability of overreliance on oil as the primary source of GDP due to variability in oil prices and the likely decline in the oil reserves after years of exploitation. For this reason, GOSS would like to diversify South Sudan's economy. According to the South Sudan Development Plan (SSDP) (2011-2013), agriculture and livestock provide the highest non-oil share of GDP. This, coupled with other factors such as an abundance of arable land with potential for irrigation, aquatic and forest resources, and a youthful and unskilled workforce, makes agriculture a priority sector for initial investment due to its potential for growth (GOSS, 2011).

According to the National Baseline Household Survey (NBHS) undertaken in 2009, 78% of households in South Sudan depend on crop farming and animal husbandry as the primary source of livelihoods and 53% of the working population is engaged in unpaid family labor (National Bureau of Statistics (NBS), 2012).

The overall objective of the GOSS as per the SSDP is “to ensure that by 2014 South Sudan is a united and peaceful new nation, building strong foundations for good governance, economic prosperity and enhanced quality of life for all,” to be achieved through core building blocks over the plan period:

- Improved governance;
- Rapid rural transformation to improve livelihoods and expand employment opportunities;
- Improved and expanded education and health services; and
- Deepened peace building and improved security (GOSS, 2011).

Socioeconomic Indicators

Population

The total population of South Sudan as recorded in the 2008 Sudan Fifth National Population and Housing Census was 8,260,490¹ (GOSS and UNDP, 2011). During the war, about four million people were displaced internally or externally (AfDB, 2013) and many of them are returning from the diaspora – East Africa, Sudan, and elsewhere. Estimates of the number of returnees differ: UNDP (2009) estimates one million have returned while the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) estimates that two million have returned from the signing of the Comprehensive Peace Agreement (CPA) in 2005 to September 2012 (UNOCHA, 2013). It is estimated that the 2013 population of South Sudan was 11,090,104. Return of people to South Sudan or, for internally displaced persons (IDPs), to the areas from which they came, is placing strain on natural resources.

South Sudan's fertility rate is estimated at 6.2 %, which is higher than the sub-Saharan average of 5 % (AfDB, 2013). The population of South Sudan is projected to increase at a rate of 2.2 % (GOSS and UNDP, 2011). Population density is quite variable from one state to the other, but on the whole, the average population density varies from four persons/km² in Western Bahr El Ghazal state to a high of 26 persons/km² in Central Equatoria state (the capital city Juba is located in this state). Northern Bahr el Ghazal has the highest percentage of rural population (92%) while Western Bahr el Ghazal has the lowest with 57% (NBS, 2012). African Development Bank (AfDB) (2013) has projected that the population of South Sudan will be 14 million by 2020 with an urban population of 3.66 million (26%). Currently, the urban population stands at 20% of the population. This is a lower percentage than other countries, however, the urban population is increasing at a faster rate than typical; it grew at an average of 15% per year between 2007 and 2011 (AfDB, 2013). Increases in population and the underlying demographics have direct implications for forests and woodlands and biodiversity conservation as land is cleared for agriculture and other uses. Rapid rates of increase put a strain on social services and infrastructure. This very rapid increase in the urban population stems primarily from three sources:

- The very large number of returnees to the country that take up residence in urban areas;
- A substantial number of IDPs who are also located in urban camps; and
- Voluntary movement of rural residents to urban centers to escape violence in their rural communities (AfDB, 2013).

Poverty

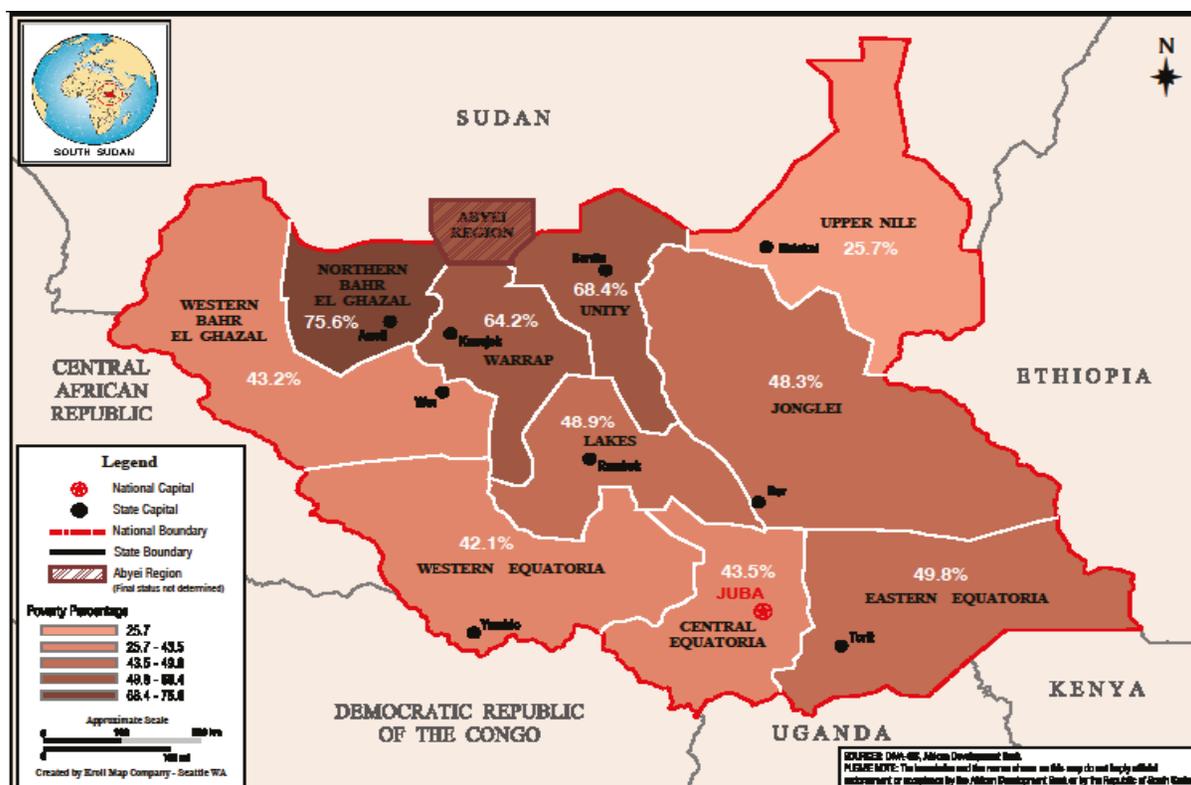
South Sudan is a poor country with a gross national income (GNI)² per capita of \$1,050, compared to \$5,851 for low income countries (AfDB, 2013). The national incidence of poverty (percent of population) is 50.6%. While this is lower in the urban centers (24.4%) it is slightly higher in the rural areas (55.4 %) due to the more limited opportunities for the rural poor (AfDB, 2013). Over half of the population lives below the poverty line, with average levels of consumption of \$31.60 per month (less than \$1 per day). Poverty rates also vary between states from Bahr El Ghazal (42.1%) with the lowest to Northern Bahr El Ghazal, Unity, and Warrap with the highest rates (over 60%) (AfDB, 2013). Food accounts for 79% of the average household incomes

¹ It has been stated by several authors that this population was an underestimate of the actual population intended to influence the referendum results. The authors of the South Sudan Infrastructure Plan estimated the 2011 midyear population at 10.05 million, while UNDP, 2011 indicate the population is 12 million.

² GNI is equal to GDP plus income from South Sudanese citizens earned abroad minus income of foreigners earned in South Sudan (GOSS, 2011).

while 47% of the population is under nourished. All other social indicators for South Sudan highlight the poverty levels in the country (see Table 1).

Map 1. Poverty Distribution in South Sudan (% per Population)



Source: AfDB, 2013. South Sudan Infrastructure Action Plan

Table 1. Selected Socio-economic Indicators for South Sudan

INDICATOR	SOUTH SUDAN	LOW INCOME COUNTRIES	LOWER MIDDLE INCOME COUNTRIES	SUB SAHARAN AFRICA
Population (millions)	8,615	2,352	2,475	743
GNI per capita (\$)	1,050	5,851	923	746
Population density (persons/km ²)	13	83	63	31
Incidence of poverty (% of population)				
National average	50.6			41.1
Urban average	24.4			
Rural average	55.4			
Demographic indicators				
Total fertility (births per woman)	6.2	3.6	2.1	5.3
Crude birth rate (per 1, 000 people)	46	29	16	40
Crude death rate (per 1,000 people)	11	10	7	17

INDICATOR	SOUTH SUDAN	LOW INCOME COUNTRIES	LOWER MIDDLE INCOME COUNTRIES	SUB SAHARAN AFRICA
Life expectancy at birth (years)	59	59	71	47
Education				
Adult literacy rate (% of 15 years plus)				
Female	16	50	93	53
Male	40	71	85	70
Net primary enrollment ratio (%)	48	78	93	66
Ratio of girls to boys in primary school (%)	59	87	99	86
Students per teacher	52	42	42	48
Health status				
Under five mortality rate (per 1,000 people)	135	114	39	163
Infant mortality rate (per 1,000 people)	102	75	31	96
Underweight children under 5 years (%)	34	13		30
Maternal mortality rate (per 100,000 live births)	2 054	684	163	921

Source: AfDB, 2013.

Climate

The climate of South Sudan is quite varied and is influenced by altitude, which ranges from 600 to 3,000 m above sea level (IRG, 2007). Most of the country has a sub-humid climate, with Western Equatorial and the highland parts of Eastern Equatorial receiving rainfall of between 1,200 to 2,200 mm of rainfall annually. The lowland areas of Eastern Equatoria, Jonglei, Upper Nile, and Bahr el Ghazal receive 700 to 1,300 mm of rainfall annually (IRG, 2007; Lomuro, 2012). The equatorial belt and parts of the Ironstone plateau have two wet seasons: April to July (primary wet season) and August to December (IRG, 2007; Brown and Sidahmed, 2009; AfDB, 2013). The rest of the country tends to have a long wet season that starts in May and ends in October/November. The southeastern tip of Eastern Equatoria receives the least rainfall, about 200 mm annually. Temperatures in South Sudan are high countrywide; they are generally above 25°C and rise to above 35°C, especially during the dry season, which lasts from January to April. Areas such as Malakal have been reported temperatures of up to 42°C during the dry season (GOSS and UNDP, 2011).

Livelihoods are to a large extent influenced by climate; agriculture and pastoralism are the primary livelihood activities for many. Pastoralists (e.g., Dinka, Nuer, Shilluk) migrate with their livestock during the hot dry season to more permanent water sources (such as the toic), which serve as dry season grazing pasture. At the onset of the rainy season in June, the pastoralists and livestock return to the uplands, where water and pasture are available (IRG, 2007; GOSS and UNDP, 2011). Migrating wildlife species follow the same pattern: moving to the toic during the dry season and dispersing in the wet season when water and lush green pastures are more readily available everywhere.

The wetter regions of Western, Central and Eastern Equatorial states form the Greenbelt, which has a very high potential for agriculture.

Agroecological Zones

Greenbelt Zone: This is a high potential area for agriculture with good soils and rainfall throughout the year, except to the southeast in Eastern Equatorial state, which receives very little rainfall. The Greenbelt occupies much of the equatorial region and has two rainy seasons. Households in this zone, especially to the southwest, rely almost exclusively on agriculture for their livelihoods and surplus production is common.

Arid Zone: The zone is located at the southeastern tip of the country and receives an average precipitation of less than 400mm annually. The soils are shallow and pastoralism is the main livelihood activity. Seasonal migrations of people and their livestock in search of water and pasture are common.

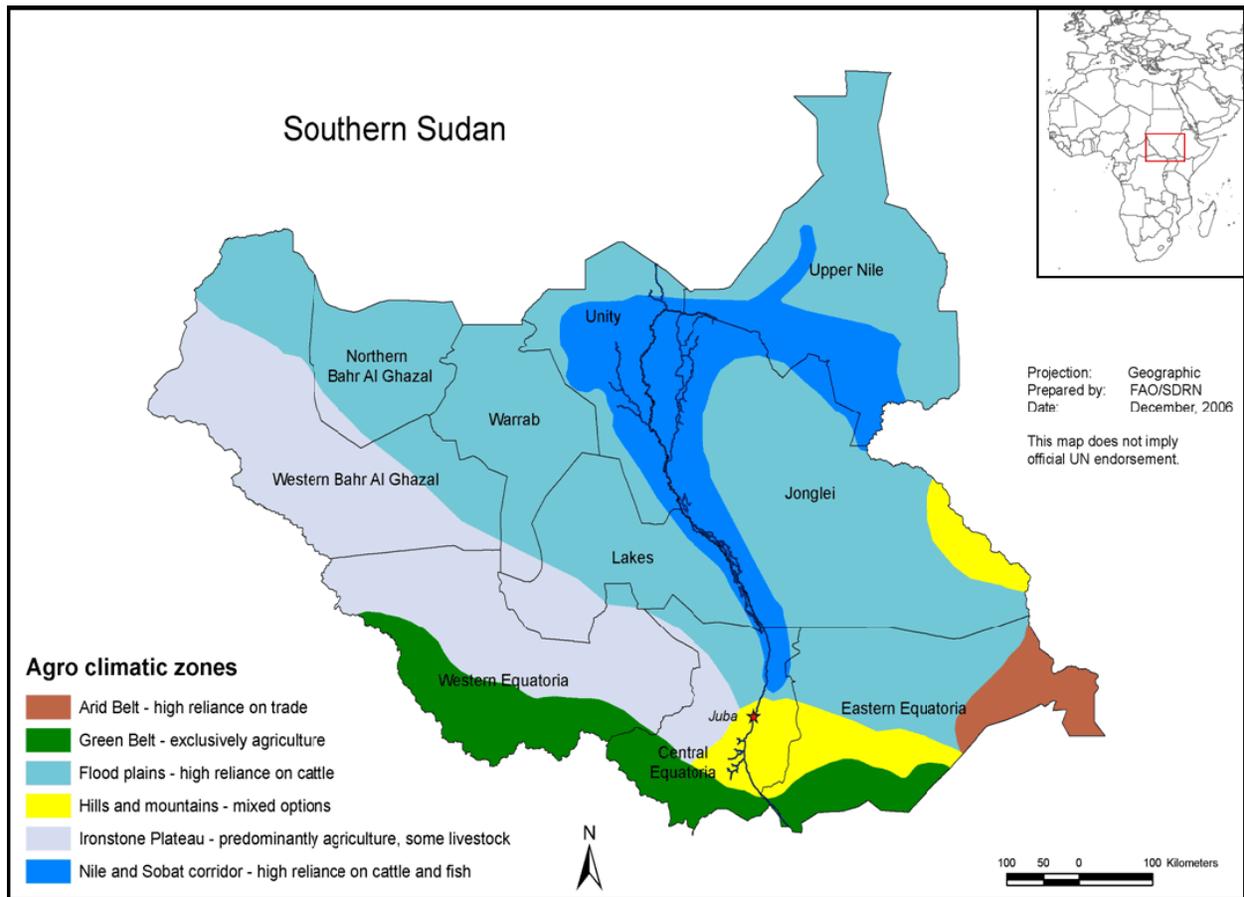
The Hills and Mountains Zone: The main livelihood activity in this zone is a combination of agriculture and pastoralism. In difficult years when crops fail, the local people rely on cattle, trade, and root crops.

Western and Eastern Flood Plain Zones: In the Western Flood Plain Zone, livestock and agriculture, supplemented by fish and wild foods, are the main food sources. The Eastern Flood Plain Zone is similar, but with an additional option of game hunting.

Ironstone Plateau Zone: Households in this zone are heavily dependent on crop production. The zone borders the Greenbelt and the local communities are able to access food surpluses from there.

Nile and Sobat Rivers Zone: There is limited crop production in this zone, which is largely occupied by wetlands. Pastoralism and fishing are the main livelihood activities; however, wild foods are important for sustaining livelihoods.

Map 2. Agro-Climatic Zones of South Sudan



Source: USAID, Program Description for the Food, Agribusiness, and Rural Markets (FARM) Program in South Sudan

Water and Wetland Resources

South Sudan's water resources include rivers and wetlands. The major rivers are the Nile River, which originates from the East African highlands; the Bahr el Ghazal³ with its catchment in the Congo highlands; and the Sobat River with its catchment in Ethiopia. The three rivers meet to form the White Nile near Malakal (Riak, undated). Both the Sobat River and the Bahr el Ghazal catchments have a strong seasonal character influenced by the prevailing climatic conditions, as opposed to the Nile River that originates from various climatic zones and whose hydrological dynamics are also stabilized by the lake systems in East Africa (Mohamed et al., 2004, Mohamed et al., 2005; Sutcliffe & Parks, 1989 in IRG, 2007).

Permanent wetlands cover about 5 % of the total land area of South Sudan (United Nations Environment Programme (UNEP), 2007), but a much larger area is covered by seasonally flooded wetlands. Estimates from spatial analysis during this Pre-Field Desk Assessment indicate the wetlands area of South Sudan is approximately one million hectares. Wetland areas of South Sudan are shown in Annex A, Map 7. The White Nile contributes about 11.5 billion cubic meters (BCM), or about 14 %, of the total flow of the Nile River, which is 84 BCM.

³ The Bahr el Ghazal starts as the Bahr el Arab, originating in the border areas between South Sudan and the CAR. It is fed by a number of tributaries key among them being the Lol, Yei, Jur, Tonj and Naam rivers. The Jur and Bahr el Arab merge to form Bahr el Ghazal, which joins the White Nile a few kilometers after Lake No.

The Sudd wetland area is infested with the water hyacinth (*Eichornia crassipes*), an invasive plant species common within the Nile River ecosystem. It forms a mat-like fringe along river channels and lakes and impedes fishing and navigation activities (UNEP, 2007; Riak, undated).

Description of Ecosystems and Biological Diversity

South Sudan has a broad diversity of habitats that include lowland forests in Eastern and Western Equatoria, afro-montane forests, high altitude plateaus, wooded savanna, Savanna grasslands, wetlands, and floods plains (UNDP, 2009). The diverse habitats are occupied by a wide range of plant, avian, and mammalian species.

In terms of ecosystems and biological diversity, South Sudan is credited with having the following:

- One of the world's most spectacular animal migrations, thought to rival the migration of the wildebeest in the Masai Mara/Serengeti ecosystem in East Africa;
- The Sudd wetland, considered the largest tropical wetland in Africa and possibly the world;
- The largest intact savannas in Africa (UNDP, 2009).

The principal ecosystems of South Sudan are described below:

Montane Forests

These are found on the mountains (Imatong, Dongotona, Acholis, Didinga and Jebel Gumbiri) to the southeast in Eastern Equatoria state. The montane forests of South Sudan are part of the Eastern Afro-montane ecosystem, which is categorized as one of Africa's biodiversity hotspots (Moukaddem, 2011), and they cover 0.4% of the total land area of South Sudan (Africa Forest Forum, 2011). Rainfall increases with altitude to an average of about 2,500 mm annually at an altitude of 2,500 m above sea level (ASL) (Jackson, undated). These forests are rich with endemic plants, animals, and birdlife (Jackson, undated). However, this ecosystem is highly deforested due to extraction of timber and encroachment for agriculture (UNEP, 2007; Moukaddem, 2011). The Dongotona, for example, lost two-thirds of its forest cover from 1986 to 2011; it is likely to be cleared of all vegetation by 2020 (Moukaddem, 2011).

Common tree species in the montane forests are *Podocarpus milanjianus*, *Juniperus procera* (pencil cedar), *Croton*, *Macaranga*, *Albizia*, and *Arundinalia alpina* (bamboo), among others. Common animal species include the Blue duiker and the bushbuck (UNEP, 2007; Jackson, undated; IRG, 2007).

Lowland Forest

These represent the northernmost extension of the Congo basin forests and are rich in forest biodiversity (plant and animal). In South Sudan, the area is confined to a few scattered small areas in the southwest near the CAR, the DRC, the Ugandan borders and the foothills of the Imatong Mountains. The area receives rainfall averaging 1,600 mm. Other locations with this type of forests are found in small patches on the Aloma Plateau near Yei, the Azza Forest in Maridi County and the Yambio area, and some areas at the foothills of the Imatong Mountains (Talanga, Labone, Loti) (Caldecott and Miles in IRG, 2007). Several forest species of mammals have been known to occur in the region, but their status has to be confirmed. It is suspected that elephants migrate from the CAR and DRC into these forests. Other species likely to be found in the lowland forests are the eastern chimpanzees, the bongo (an ungulate) (*Boocercus eurycerus*), African forest buffalo (*Syncerus caffer nanus*), and the giant forest hog (*Hylochoerus meinertzhageni*) (IRG, 2007). The status of these species has not been verified to date.

Woodland Savannah

These constitute the largest ecological region in South Sudan and are divided into two regions, namely, the low rainfall woodland savannah, which is mainly found in Upper Nile State, and the high rainfall savannah woodlands. Low rainfall savannah covers about 2.9% of the total land area of the country while the high rainfall savannah occupies 52.6% (African Forest Forum, 2011). Common large mammals of the woodland savannah include the elephant (*Loxodonta africana* and *Loxodonta cyclotis*), hippopotamus (*Hippopotamus amphibious*), waterbuck (*Kobus defasa*), bushbuck, oribi, duiker, Uganda kob (*Kobu skob*), warthog (*Phacocoerus ethiopicus*), hartebeest (*Alcelaphus sp.*), giant eland (*Tragelaphus derbianus*), buffalo (*Syncerus caffer*), and various species of primates. A rich diversity of avifauna, reptiles, amphibians, and invertebrates are also found here. Protected areas (PAs) in the woodland savannahs are Southern, Nimule, and Lantoto National Parks (NPs), and Ashana, Chelkou, Boro, Juba, and Numatina Game Reserves (UNDP, 2009). Table 2 shows the ecological classification of woodland savannahs in South Sudan.

Table 2. Ecological classification of Forests and Woodlands in South Sudan (2011)

	LOW RAINFALL SAVANNAH	HIGH RAINFALL SAVANNAH	MONTANE	SPECIAL AREAS	FLOOD REGION	TOTAL
Land area (km ²)	17,900	325,800	2,600	37,500	235,900	619,700
% of total land area	2.9	52.6	0.4	6.1	38.0	100
Classification	Arid/Semi-arid	Sub-humid		Humid		-
%age by classification	2.9	53.0		44.1		100

Source: Africa Forest Forum, 2011.

Note: The size of each category was extrapolated by super imposing the map of Harrison and Jackson's 1958 "Ecological Classification of the Vegetation of Sudan" on the maps of the two countries (Abdel Nour, 2011 in GOSS and UNDP, 2011).

Semi-desert

Semi-desert areas are located in the extreme southeast of the country and around the Ilemi Triangle in Eastern Equatoria state (IRG, 2007; UNEP, 2007). Low rainfall, averaging 300 to 500 mm annually, favors the growth of patches of short open grasslands with acacia bush land. Ground cover is generally poor, depending on annual rainfall, which is unpredictable. The area is an extension of the northeastern Kenya semi-arid zone and shares much of the fauna and flora from that region. Wildlife found in this region includes oryx (*Oryx beisa*), Grant's gazelle (*Gazella grantii*), and dikdik (*Madoqua kirkii*). No PAs in this ecoregion have been designated for protection; however, the presence of the oryx, an endangered species, has been confirmed in recent surveys by WCS.

The Sudd Wetland

Located on the lower reaches of Bahr el Jebel (name given to the White Nile as it moves to the north) in South Sudan, the Sudd is one of the largest tropical wetlands in the world and covers approximately 57,000 km². However, the actual size of the wetland varies based on the river flows from its catchment and rainfall (Riak, undated, IRG, 2007). The Sudd wetland is fed by additional rivers that originate from the Nile-Congo divide (Riak, undated). The largest areas of the Sudd are found along the Bahr el Ghazal, where the Bahr el Jebel and Bahr el Zeraf in Upper Nile and Jonglei come together. The southernmost limit of the permanent wetland in the Sudd is Bor town, which is also the wettest.

The Sudd wetland is composed of various ecosystems, ranging from open waters and submerged vegetation, floating fringe vegetation, seasonally inundated woodlands, rain-fed and river-fed grasslands, and floodplain scrubland (Riak, undated, IRG, 2007). About 50 % of the 2.9 BCM of water that flows into the Sudd wetland is lost through evaporation (Riak, undated).

The central core of the Sudd swamps is dominated by papyrus sedge (*Cyperus papyrus*), which is bordered by cattails (*Typha dominguensis*), the dominant vegetation that covers about 75% of the total swamp. The Sudd is an important habitat for biodiversity and was declared a Ramsar site on June 5, 1996. The Sudd is also listed as an Important Bird Area (IBA) by Birdlife International with over 470 documented species.

Important plant species in the Sudd include the papyrus sedge (*Cyperus papyrus*), hippo grass (*Vossia cuspidate*), and cattails (*Typha spp*) located in the permanent swamps that surround the deep open waters. These are important habitats for the endangered Shoebill stork and are found near the middle of the wetland. *Echinochloa stagnina*, *E. pyramidalis*, and *Oryza longistaminata* surround the seasonally flooded grasslands. At the edge of the wetland is the grass species, *Hyparrhenia ruffa*. Although about 350 plant species have been identified in the Sudd region, only one endemic plant species has been recorded, the swamp grass (*Suddia sagitifolia*) belonging to the genus Poaceae. The papyrus sedge (*Cyperus papyrus*), which is threatened elsewhere by pollution and flood control, flourishes in the pristine Sudd wetlands (Riak, undated; IRG, 2007).

Current Status of Biodiversity Resources

South Sudan is rich in biodiverse ecosystems, as enumerated in the various ecosystems above. Aerial counts undertaken by the Wildlife Conservation Society (WCS) in 2007, following the transects of an aerial survey undertaken in the 1980's, revealed that about 1.2 million white-eared kob, Mongalla gazelle and tiang migrate between the Boma NP and Bandingilo NP and towards the Nile River every year in a migration said to rival the wildebeest migration between Serengeti in Tanzania and the Masai Mara in Kenya. Recorded species include elephants, ostriches, lions, leopards, hippos, and buffalos; and sightings of oryx, thought to be extinct, were documented (Zimmer, 2007). While wildlife in general appears to be thriving, particularly in areas that were inaccessible during the war (e.g., the Boma/Jonglei landscape), significant drops and local extinctions of certain species have been reported. For example, the Southern NP used to have an estimated population of 60,000 buffaloes and Boma NP used to have about 20,000 zebras, but none of those species were recorded in their respective NPs during the 2007 surveys. (See Annex A, Map 7: National Parks and Protected Areas).

GOSS and UNDP (2011) also indicate that during their surveys for the Environmental Impacts, Risks and Opportunities (EIRO) Assessment, few mammals were encountered in habitats considered ideal for wildlife along the Nile River in Upper Nile state. However, in Northern Bahr el Ghazal, the local game guards reported occasional sightings of gazelles and two lions with a cub near Ashana game reserve (GOSS and UNDP, 2011). While poaching is common, it seems to have disproportionately affected non-migratory species because they are an easier target (Zimmer, 2007). In another survey done by Fauna & Flora International (FFI) in 2007, 400 elephants were seen in the Sudd. Other species seen during this survey were the Nile Lechwe and a few buffalo (Per. Com, Lamprey, 2007 in IRG, 2007).

Lowland forests are suspected to harbor forest animal species such as the bongo, the giant forest hog, chimpanzee, red river hog, and the forest elephant (UNDP, 2009). However, the existence of these species in the lowland forests will need to be verified in Phase 2 of this FAA 118/119 Assessment.

Much of the data on wildlife populations is either outdated or simply unavailable. However, wildlife surveys from the 1980s and 2007 indicate a decline in almost all species surveyed (Table 3).

Table 3. Comparison of Wildlife Populations in Surveyed Areas of South Sudan (1980s' and 2007)

SPECIES	PREVIOUSLY DOCUMENTED POPULATION	POPULATION SIGHTED (2007)	COMMENTS
Elephant (<i>Loxodonta africana</i>)	-	6,000	Elephant surveys need to be undertaken within the elephant range to confirm their numbers (see Annex 1, Map 5).
Nubian Giraffe (<i>Giraffe camelopardalis camelopardalis</i>)	1979-80: 9,028 (Boma NP); 1981: 1,325 within, 770 outside (Southern NP); 1981: 3,429 (Shambe N. Reserve)	<450	Surveys undertaken in several PAs indicated high numbers of giraffes ⁴ . A viable population may still exist. In 2007, giraffes were sighted during the survey flights over Bandigilo NP, but none were seen during aerial surveys
Buffalo (<i>Syncerus caffer</i>)	1981: Southern NP 60,000	10,000	Surveys within the species range need to be undertaken to confirm numbers
Mongalla gazelle (<i>Eudorcas albotata</i>)	-	250,000	Population has been declining
Antelope (<i>Tiang damaliscus lunatus</i>)	-	160,000	Population has been declining
Reedbuck (<i>Redunca redunca</i>)	-	13,000	Population to be confirmed
White-eared kob (<i>Kobus kob leucotis</i>)	900,000 before civil war broke out again in 1983	800,000	Population has been declining and is at risk of being hunted especially during the migration
Buffalo (<i>Syncerus caffer</i>)	1981: 60,000 (Southern NP)	None	Species has been decimated and is at risk of local extinction in South Sudan
Nile Lechwe (<i>Kobus megaceros</i>)	No earlier figures recorded	4,300	Population has been recorded as being on the decline
Zebras	1982: 20,000 (Boma NP)	None seen	Species is under threat of local extinction
Rhinoceros (<i>Diceros Bicornis</i>)	-	Status unknown	Surveys need to be done in the lowland forest that are their habitats to confirm species exists
Eastern Chimpanzee	-	Status unknown	Status is unknown. Surveys need to be done in the lowland forest to confirm species exists
Beisa Oryx (<i>Oryx beisa</i>)	Earlier census figures not available	Confirmed presence (eastern Equatoria)	Surveys to establish the number of the Oryx and if this is a viable population

Source: Various reports (Marais et al., 2012; GOSS and UNDP, 2011; IRG, 2007; UNDP, 2009)

⁴ It is not clear whether this is the Nubian giraffe (*Giraffe camelopardalis camelopardalis*) or other (sub) species (Marais et al., 2012). Three sub species have been known to exist although some may have become locally extinct.

The status of forest and woodlands biodiversity is directly related to deforestation and forest degradation. This is more evident in the montane and lowland forests that are rich in biodiversity but occupy a very small area of the country. An analysis of forest cover change was undertaken as part of this Phase 1:Pre-Field Desk Assessment using the Global Forest Cover Change dataset at a spatial resolution of 30m, degraded to 500m for use in the current analysis. The original forest cover change analysis was performed on thousands of images from the USGS Landsat program, acquired between 2000 and 2012. The analysis indicates that South Sudan has lost approximately 14,000 hectares of forest cover between 2000 and 2012, out of a total of about 17 million hectares, which is an indication of stable forest cover (See Annex A, Map 8). The calculated forest cover loss is much lower than has been provided by previous assessments. However, the analysis – when performed at a local scale – reveals forest cover loss has been focused around Yei, Bor, Bentiu, and Mushra Game Reserve (See Annex A, Maps 8a-8d).

Forest and Biodiversity Values

Hydrological Value

Several rivers, including the White Nile, drain into the Sudd wetland bringing with them 29 BCM of water annually; water that is rich in inorganic particles, nutrients and salt ions. Since wetlands act as filters, the Sudd filters and purifies the water thus improving on the water quality. The wetland also regulates flooding by acting as a giant sponge that absorbs excess water during periods of high water yield. The Sudd area loses about 51% of the water via evaporation that enters it from Bahr el Jebel and almost all the water of Bahr el Ghazal through evaporation, which feeds into the hydrological cycle as rainfall. Forests are also catchments for the many rivers that provide water for domestic, wildlife and livestock and they also help regulate the water cycle.

Socioeconomic Value

The Sudd and other wetlands constitute the principal source of water (domestic and livestock) for communities (Dinka, Nuer and Shilluk) who are mainly pastoral groups that live around it. The Sudd and flooded grasslands (*toic*) are an important resource for these pastoralists who depend on the regular flooding regime to regenerate pastures; thus providing dry season grazing for livestock, the major livelihood activity for many of the pastoral communities in the region. During the dry season, these communities move together with their livestock from their permanent settlements on the highlands to the intermediate lands (*toic*) at the beginning of the dry season to graze their animals. They return to the highlands in May-June when the rainy season starts (GOSS and UNDP, 2011; Riak, undated).

In addition, the Sudd supports a fisheries industry that not only adds to the nutritional needs of these communities, but is an economic activity. The Sudd is an important breeding area for the Nile ecosystem fish species and is the largest potential source of freshwater fish in South Sudan. Fish species of economic importance are: the Nile perch (*Lates niloticus*), Bagrid catfishes (*Bagrus bayad* and *B. docmac*), the Nile tilapia (*Oreochromis niloticus*), carp (*Labeo spp*), Binny carp (*Barbus binny*), elephant-snout fish (*Mormyrus spp*), stubs, (*Distichodus spp*), tigerfish, *Hydrocyon spp* and characins (*Alestes spp*) (Riak, undated; IRG, 2007, Lumoro, 2012). There is inadequate data on actual production of fish; however, it is estimated to be approximately 100,000 to 300,000 tons annually on a sustained basis (Lomuro, 2012).

Biodiversity Value

Mammalian Fauna

South Sudan has one of the largest antelope migrations in the world (the white eared kob, tiang and Mongalla gazelle), which has an invaluable biodiversity value globally. In addition, the Sudd wetlands, rich in biodiversity are also found in South Sudan. They support a wide diversity of wildlife species that include the threatened hippopotamus (*Hippotamus amphibius*), the near-threatened sitatunga (*Tragelaphus spekei*), the

endemic Nile lechwe (*Kobus megaceros*), and globally endangered species such as the elephant (*Loxodonta africana*) and leopard (*Panthera pardus*). It is also used as a dry season refuge by the huge migratory species populations of the white-eared kob (*Kobus kob leucotis*), endemic to South Sudan and the tiang, (*Damaliscus lunatus tiang*). Others include the Mongalla gazelle, the Nile crocodile (*Crocodylus niloticus*) considered the largest wild population in the world, supported by the large size and remoteness of the Sudd; the African rock python (*Python sebae*), other species of snakes and amphibians (Riak, undated). The Nile Lechwe population is estimated to be 4,300 (UNDP, 2009, Riak, undated).

Avifauna Biodiversity

South Sudan is rich in birdlife with close to 800 species recorded. Over 470 bird species have been recorded in the Sudd region alone, thus distinguishing it as an IBA by BirdLife International (UNEP, 2007). It also supports over 20,000 water birds throughout the year, and is a wintering ground for migratory birds from Europe. The Sudd floodplains support the largest population of the shoebill stork (*Balaenice psrex*) in Africa, with an estimated population of 5,000 (GOSS and UNDP, 2011; Riak, undated). Other species include the white stork (*Ciconia ciconia*), black tern (*Chlidonias nigra*), and saddle billed stork (*Ephippiorhynchus senegalensis*). Threatened and endangered species supported by the Sudd include: the white pelican (*Pelecanus onocrotalus*), which uses the Sudd as a wintering site, and the black-crowned crane (*Balearica pavonina*) designated as “vulnerable” by IUCN is also found in the Sudd. Howel *et al*, 1985 in IRG, 2007 state that the Sudd wetland supports about 300,000 open billed storks (*Anastomus lamelligerus*), 100,000 cattle egret (*Bubulcus ibis*), 100,000 spur-wing goose (*Plectropterus gambensis*), and more than 20,000 black crowned crane (*Balearica pavonina*). About 1.7 million glossy ibis (*Plegadis falcinellus*) are found in the Sudd (Riak, undated).

Fisheries

The Sudd, described as an inland delta (Brown & Sidahmed, 2009) has a diversity of habitats and is rich in nutrients that make it ideal for aquatic life including fisheries. It is thought to host the largest fresh water fish populations in South Sudan (Lomuro, 2012). This is estimated to be in the range of 100,000 to 300,000 metric tons per year, based on a combined water surface area of 90,000 km² of the River Nile (AfDB, 2013). Over 100 species of fish that include 31 siluroids, 16 characoids, 14 cyprinoids, 11 mormyrids, eight cichlids and seven cyprinodontids have been recorded in the Sudd alone (Riak, undated; IRG, 2007). In the Sudd are eight dwarf fish species of the Nile that are endemic to the Sudd wetland. These include: *Cromeria nilotica*, *Nannaethiops unitaeniatus*, *Barbus stigmatopygus*, *Chelaethiops bibie*, *Andersonia leptura*, *Aplocheilichthys loati*, *Epiplatys marnoi* and *Electris nanus*. Others such as *Clarias*, *Polypterus* and *Protopterus spp*, found in the Sudd are amphibious and they aestivate in the mud during the dry season. An annual fish called *Nothobranchus* that spends the dry season in the egg stage is found in the drier reaches of the Sudd (Riak, undated). Fourteen percent of households living in the Sudd region along the Nile and its tributaries have fishing as a livelihood activity (NBS, 2012 in AfDB, 2013). The fisheries industry supports livelihoods of some of the Nilotic groups especially those who do not own cattle. The NHB survey indicates that potential for commercial fisheries is high, but is yet to be exploited fully (Lomuro, 2012; GOSS and UNDP, 2011; AfDB, 2013).

Flora

South Sudan has a variety of habitats rich in plant life. These include the montane forests, woodlands and wooded grasslands. Over 350 species of plants have been recorded in the Sudd region alone, common among them being sedges and grasses found in other African wetlands (UNEP, 2007). Only one endemic plant species, *Suddia sagitifolia*, is found in the Sudd. *Suddia* is a rare genus belonging to the Poaceae family. In addition, *Cyperus papyrus*, *Vossia cuspidate*, and *Typha spp*. that are important habitats for the endangered Shoebill stork are found in the permanent swamps that surround the open deep waters. (*Cyperus papyrus*) has been reported as being locally threatened in other wetlands in south Sudan by pollution and flood control (GOSS and UNDP, 2011; Riak, Undated). The montane forests are also a biodiversity hotspot and have a diversity unrivalled elsewhere in the country (Jackson, undated). The woodlands of South Sudan are also rich in high value timber trees such as mahogany.

Tourism

The biodiversity resources of South Sudan and in particular the migration of the white-eared Kob and other accompanying species have great potential for the development of tourism in the country. The Sudd wetland is a unique phenomenon that enhances the eco-tourism potential of the country. The concentration of a large mammalian biomass (10,000 kg/km²) in the seasonal floodplain in the Sudd provides excellent opportunities for traditional hunting and tourism, if developed.

Woodlands Important for Livelihoods

Besides producing timber and other wood products, forests provide other benefits such as wild berries and fruits that are consumed as food. These were useful during the civil war when food was scarce, but can also be useful during periods of droughts. Forests also provide fibre, shade, construction materials for housing and cattle sheds; and spiritual benefits. They are also a habitat for bees needed for pollination of plants and soil fertilization.

Carbon Sequestration

The vast forest and woodland resources in South Sudan provide for carbon sequestration, an important function in reducing greenhouse gases (GHG). At this time, data were not available on the carbon sequestration rates of the forest and woodland resources of South Sudan.

POLICY AND INSTITUTIONAL FRAMEWORKS

[Due to the uncertainty given the current political instability in South Sudan, the Policy and Institutional Frameworks section will be developed in Phase 2 of the South Sudan 118/119 assessment.]

LEGISLATION

[To be developed in Phase 2 of the 118/119 Assessment]

INSTITUTIONS

[To be developed in Phase 2 of the 118/119 Assessment]

BILATERAL, OTHER DONORS, AND INTERNATIONAL ORGANIZATIONS

International donors and agencies have played an important role in many of the environmental initiatives in South Sudan. In particular, the USAID and the World Bank have funded projects related to conservation and natural resources management in South Sudan.

The following is a list of current and recent biodiversity-related projects undertaken by NGOs or financed by donors, including USAID.

Table 4. Development Partners and Other Important Actors in Environment/Natural Resources Management in South Sudan

DEVELOPMENT PARTNER/DONOR	PROJECT ACTIVITY	IMPLEMENTING PARTNER/ORGANIZATION	AREA OF OPERATION
Department for International Development (DFID) /UNEP	Environmental management: Juba clean and green project <ul style="list-style-type: none"> • Community management of natural resources • Solid waste management • Environmental governance 	GOSS, Ministry of Agriculture and Forestry (MAF), Cooperative and Rural development	Juba capital city
UNDP	<ul style="list-style-type: none"> • Provide broad policy and technical support to urban area governments 	Ministry of Finance and Economic Planning, Ministry of Housing and Physical Planning	Urban area
USAID	<ul style="list-style-type: none"> • Supporting endangered species conservation in south Sudan through aerial and ground wildlife census • Re-establish flagship of south Sudan natural heritage. • Ant-poaching training and wildlife monitoring • Provision of equipment and infrastructure development • Identify key migration corridor and Promote trans boundary conservation link between Ethiopia and northern Kenya 	WCS, GOSS, Ministry of Wildlife Conservation and Tourism (MWCT) & FFI	NPs and game reserves and dispersal areas
World Bank	<ul style="list-style-type: none"> • Establish socio environmental • Safeguard mechanism to review development activities. 	GOSS, Multi-donor Task Force (MDTF)	In the entire country

DEVELOPMENT PARTNER/DONOR	PROJECT ACTIVITY	IMPLEMENTING PARTNER/ORGANIZATION	AREA OF OPERATION
USAID/Global Environmental Facility (GEF)	Funding a large conservation project in biodiversity conservation The project is based on the Landscape Approach, which involves looking beyond the boundaries of PAs to look at entire landscapes harboring wildlife populations as units to be managed.	MWCT	Central Equatoria, Eastern Equatoria and Jonglei States
African Wildlife Foundation (AWF)	Strengthening management of PA planning	AWF	Nimule NP & Imatong Forest Reserve
IFAW	Supported stakeholder workshops to provide input into Southern Sudan's wildlife policy.	GOSS, MWCT	NPs and game reserves and other conservation areas.
Cooperative for Assistance and Relief Everywhere (CARE) International	Implementing agriculture, primary health care, sleeping sickness and rural road rehabilitation project	Ministry of Agriculture, Animal Resources and Irrigation (MAARI), MAF, Ministry of Health, Ministry of Roads and Bridges, Ministry of Physical Infrastructure	Counties of Tambura (Western Equatoria), Bor (Jonglei), and Wau (Bahr Al Ghazal)
European Union	Rural Development and Infrastructure/cross-cutting themes are environment	Sudan Institutional Capacity Programme: Food Security Information for Action (SIFSIA), Rice Scheme, livestock and fisheries projects.	Bahr Al Ghazal
United Nations Environment Programme (UNEP)	<ul style="list-style-type: none"> • Conducted a Post-Conflict Environmental Assessment (PCEA) • Provided supplies, such as computers and phones to the Ministry of Wildlife Conservation and Tourism (MWCT) • Support the MWCT's Environmental Information Center 	MWCT	Juba

DEVELOPMENT PARTNER/DONOR	PROJECT ACTIVITY	IMPLEMENTING PARTNER/ORGANIZATION	AREA OF OPERATION
The Nile Basin Initiative	Develop and implement a shared vision “to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources	Ministry of Water Resources and Irrigation (MWRI), MAARI, MAF	Ten Nile Basin countries
Food and Agriculture Organization of the United Nations (FAO)/UNDP	Fisheries Training Project	Ministry of Animal Resources and Fisheries (MARF)	Malakal
Pact/Sudan (an implementing agency that gets funding at times from USAID)	<ul style="list-style-type: none"> • Providing clean and safe water to people in different localities in South Sudan and building the capacity of stakeholders in water management through the Water for Recovery and Peace Program (WRAPP) • The project involves gender empowerment, environmental awareness, improved livelihoods and public health. They also had a natural resource management (NRM) project 	Community-based organizations, civil society organizations, peace committees, international nongovernmental organizations (INGOs) and women and youth groups,	Greater Upper Nile, Greater Bahr el Ghazal and Eastern Equatoria.
Natural Resource Management Group (NRMG) (not a donor but a coordinating group Ministries in the Environment/NRM Sector)	Ensure holistic and integrated management of South Sudan’s natural resources for Sustainable development. The NRMG is currently formed of seven government ministries and the South Sudan Land Commission	MAF; Ministry of Energy and Mining; MARF; Cooperatives and Rural Development; Environment; MWCT; MWRI; Housing and Physical Planning and the South Sudan Land Commission.	
The Environment Cluster Group (not a donor)	Assist the Ministry of Environment in identifying and addressing significant environmental issues in South Sudan. Also improve on coordination function of the Ministry.	Development partners including United Nations (UN) agencies and non-governmental organizations (NGOs)	

Source: Various reports

STATUS AND MANAGEMENT OF PROTECTED AREAS AND ENDANGERED SPECIES

PROTECTED AREAS

The protected area (PA) system of South Sudan covers about 10.4% of the terrestrial areas of the country, which is higher than the African average estimated at 9% (UNDP, 2009). According to the UNDP (2009), the primary function of establishing the PA network was to conserve populations of wildlife and big game rather than ecosystems or major ecological functions such as migrations. Although the system is not inclusive of all the important habitats in the country, a wide range of critical habitats/ecosystems are included in the network (see map of PA network in Annex A, Map 4). Fourteen of these PAs are located in woodland and tree savanna habitats; three are in lowland forests, and one in wetlands.

In total, the PA network has five NPs and 14 game reserves.⁵ Four of the PAs (Southern, Boma, Bandingilo and Zeraf) make up 80 % of the entire PA system (UNDP, 2009).

The PA system has a high diversity of animals, habitats, and birdlife and the numbers they harbor are also significant. While some of the PAs are still intact, as observed in recent surveys such as in Bandingilo NP, in others, such as in Ashana Game reserve, limited sightings of wildlife species and high levels of woodlands degradation has been observed (GOSS and UNDP, 2011). Management of most of the PAs is largely nonexistent or very limited with inadequate personnel, administrative infrastructure such as offices, accommodation for personnel, road network/tourism circuit roads and finances' (Seme, 2014, personal communication). However, since 2007, management has slightly improved in some PAs such as Boma, Badingilo and Nimule NPs. With funding from USAID through WCS and the Ministry of Wildlife Conservation and Tourism (MWCT), some management activity has been restored in Bandingilo and Boma NPs.

Thirteen of the PAs (Ashana, Boro, Chelkou, Zeraf/Fanyikang, Juba, Kidepo, Meshra, Mbarizunga, Mongalla, Numatina, Shambe, Bore Kapatuos and Bandingaru) fall under IUCN Category (VI) whose main aim is to protect habitats but also allow sustainable use of natural resources in parts of the PA. Five of the PAs (Boma, Nimule, Southern, Bandingilo, Lantoto) are in Category (II), which confers on them NP status and aims to conserve large natural or near natural ecological process and species that provide a foundation for other activities such as cultural, spiritual, educational, scientific and tourism opportunities. Only one PA (Bengangai) is in category (IV), set aside mainly to protect particular species or habitats (see Table 5 and Table 6).

Plans are underway to expand the PA network to include the montane forests, some of the corridors for the migratory white eared kob/tiang as well as expand Bandingilo NP to encompass Juba Game reserve. Zeraf Game reserve is also proposed for expansion southwards (UNDP, 2009).

⁵ UNDP Project Document gives a figure of six NP s and 13 game reserves. The area of the PA still remains the same. There is need to reconcile the status, whether NP or game reserves in Phase 2.

Table 5. Description of Protected Areas according to IUCN Classification

CLASSIFICATION	DESCRIPTION
I (a) Strict Nature Reserve	Strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphic features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.
I(b) Wilderness Area	Usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.
II National Park	Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities.
III Natural Monument or Feature	Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities.
IV Habitat/Species Management Area	Aim to protect particular species or habitats and management reflects this priority. Many Category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.
V Protected Landscape/Seascape	An area where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.
VI Protected Area with Sustainable use of Natural Resources	Conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.

Source: www.iucncategory

Table 6. Status and Size of Protected Areas in South Sudan

NAME AND YEAR PROTECTED	CONSERVATION STATUS WITH IUCN CATEGORY	HABITAT	AREA IN (KM ²)	STATE
Ashana (1939)	Game reserve (VI)	Woodland and tree savanna	900	Northern Bahr el Ghazal
Bandingilo* (1986)	National park (II)	Grassland and woodland savanna	16,500 (recently proposed >18,000)	Central & Eastern Equatoria

NAME AND YEAR PROTECTED	CONSERVATION STATUS WITH IUCN CATEGORY	HABITAT	AREA IN (KM ²)	STATE
Bengangai (1939)	Game reserve (IV)	Lowland forest, woodland and open glades	170	Western Equatoria
Boma* (1986)	National park (II)	Woodland savanna, grassland and riverine woodland	20,000	Jonglei, E
Boro*	Game reserve (VI)	Woodland and tree savanna	1,500	Western Bahr el Ghazal
Chelkou (1939)	Game reserve (VI)	Woodland and tree savanna	5,500	Western & southern Bahr Gel Ghazal
Zeraf (which also incorporates Fanyikang GR, 1939)	Game reserve (VI)	Wetlands, toich grassland, wooded savanna and floodplains	8,000	Jonglei, Upper Nile, Unity
Juba (1939)	Game reserve (VI)	Woodland and wooded savanna	200	Central Equatoria
Kidepo (1975)	Game reserve (VI)	Woodland and wooded savanna	1,200	Eastern Equatoria
Lantoto*	National park (II)	Woodland, forest and open glades	760	Central Equatoria
Meshra*	Game reserve (VI)	Woodland, wooded savanna	4,500	Warrap, Lakes
Mbarizunga (1939)	Game reserve (VI)	Lowland forest, woodland and open glades	10	Western Equatoria
Mongalla (1939, now incorporated into Bandingilo NP)	Game reserve (VI)	Woodland savanna, grassland and floodplains	75	Central Equatoria
Nimule (1954)	National park (II)	Wooded savanna, Nile River	200	Eastern & Central Equatoria
Numatina (1939)	Game reserve (VI)	Woodland and wooded savanna	2,100	Western Bahr el Ghazal
Shambe (1985)	Game reserve (VI)	Woodland and wooded savanna, grassland and floodplains	620	Lakes

NAME AND YEAR PROTECTED	CONSERVATION STATUS WITH IUCN CATEGORY	HABITAT	AREA IN (KM ²)	STATE
Southern (1939)	National park (II)	Woodland and wooded savanna, bush land, small grasslands, riverine woodland, inselbergs	22,000	Lakes, Warrap, Western Equatoria, Western Bahr el Ghazal
Bire Kapatuos (1939)	Game reserve (VI)	Lowland forest, woodland and open glades	5	Western Equatoria
Badingaru (1939) (Incorporated into Bandingilo NP)	Game reserve (VI)	Grassland, woodland and wooded savanna	805	Central & Eastern Equatoria

Source: IUCN, 2009 in UNDP, 2009.

* These areas were all named at the central level by the GOSS as PAs under the 1986 Wildlife Act and confirmed by the Wildlife Conservation and National Parks Act of 2003, but they have yet to be clearly gazetted and their boundaries demarcated.

ENDANGERED SPECIES, THREATENED, AND RARE SPECIES

South Sudan is home to several species of mammals, birds and plants that are endangered, threatened, or rare (summarized in Table 7).

Table 7. Endangered, Threatened, and Rare Species in South Sudan

NAME	STATUS	NAME	STATUS
Elephant (<i>Loxodonta africana</i>)	Vulnerable	Shoebill stork (<i>Balaeniceps rex</i>)	Vulnerable
Mongalla gazelle (<i>Gazella rufifrons albonotata</i>)	Vulnerable	Black-crowned crane (<i>Balearica pavonina</i>)	Vulnerable
<i>Panthera pardus</i>	Near Threatened	Beisa Oryx (<i>oryx Beisa</i>)	Near Threatened
Eastern Chimpanzee	Endangered	Rhinoceros (<i>Diceros bicornis</i>)	Critically Endangered
Wild dog (<i>Lycaon pictus</i>)	Endangered	<i>Giraffe camelopardalis</i>	Threatened
<i>Hippopotamus amphibius</i>	Vulnerable		

Source: IUCN Redlist

South Sudan is home to many endemic species of plants and animals. These include the Nile lechwe (*Kobus megaceros*) and eight dwarf species of fish (*Cromeria nilotica*, *Nannaethiops unitaeniatus*, *Barbus stigmatopygus*, *Chelaethiops bibie*, *Andersonia leptura*, *Aplocheilichthys loati*, *Epiplatys marnoi* and *Electris nanus*). Several plant species

are endemic in the afro-montane forests and some may not even have been identified yet (Jackson, undated). The Sudd wetland is home to one endemic plant species: *Suddia sagittifolia* (Riak, undated).

CONVENTIONS/INTERNATIONAL TREATIES RATIFIED IN SOUTH SUDAN

To date, the country has ratified three environmental/biodiversity conventions (see Table 8). Further investigation of South Sudan's interest and involvement in ratifying additional conventions will be undertaken during Phase 2 of this assessment. Additional conventions and treaties that South Sudan may want to consider ratifying include:

- Convention on International Trade in Threatened and Endangered Species of Wild Fauna and Flora, (CITES) (1973)
- The Convention on Biological Diversity CBD)
- The United Nations Framework Convention on Climate Change (1993)
- UN Convention to Combat Desertification (1995)
- Convention on Migratory Species (CMS)

Table 8. Conventions Ratified by South Sudan

INTERNATIONAL CONVENTIONS CONVENTIONS/TREATIES	STATUS IN SOUTH SUDAN	URL SEARCHES
Ramsar Convention (Convention on Wetlands of International Importance)	Ratified	10/10/2013 www.ramsar.org
Montreal Protocol on Substances that Deplete the Ozone Layer	Ratified	23/01/2012 www.ozone.unep.org
Convention on Biological Diversity (CBD)	Ratified	18/05/2014

STATUS AND MANAGEMENT OF FOREST RESOURCES

The Africa Forest Forum (2011) indicates that the southern areas of the country – especially Western Bahr El Ghazal, Northern Bahr El Ghazal, and Western and Central Equatoria – have vast areas of closed to open tree woody vegetation. The State of Forests Resources report for 2005 and 2010 found significant areas of forests and woodlands (see Annex A, Map 8). It is estimated that natural forests and woodlands cover a total of 207,422 km² or about 33 % of the total land area of South Sudan (AfDB, 2013).

Table 9. Cover of Forests and Other Woodlots Vegetation in South Sudan Region and Annual Loss of Forest Cover

AREA	FOREST (HA*)	OTHER WOODLAND (HA)	ANNUAL LOSS(HA)	ANNUAL %AGE LOSS
Bahr el Ghazal	14,048,291	4,829,122	113,958	0.6
Upper Nile	15,165,707	6,333,033	76,192	0.35
Equatoria	14,256,099	3,356,184	87,480	0.50

Source: GOSS and UNDP, 2011

* Hectare (ha)

Forests in this case are defined as land spanning more than 0.5 hectares with trees higher than 5 m and a canopy cover of more than 10 %, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use

Other Wooded Lands: Land not classified as “forest”, spanning more than 0.5 hectares, with trees higher than 5 m and a canopy cover of 5 to 10 %, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 %. It does not include land that is predominantly under agricultural or urban land use (GOSS and UNDP, 2011).

Table 10. Gazetted Forest Reserves

	FEDDANS*	HA		FEDDANS*	HA
Central Equatoria Forest Reserves			Upper Nile, Jonglei and Unity States Forest Reserves		
Mongalla	1,134	459	Zar-zur C.R	3,874	1,568
Girikidi	20,680	8,368	Tawfigia	2,365	957
Kadule	335	136	Atar C.R	238	96
Lulubo North	10,768	4,357	Sobat (A)	156	63
Lulubo South (Lokitiri)	10,200	4,127	Sobat (B)	3,224	1,305
Jebel Korok (Juba)	250	101	Sobat (C)	4,170	1,687
Kajo keji	4,660	1,886	Malakal West	250	101
Kagelu	2,305	933	Khor-wol	12,800	5,179
Korobe	5,055	2,045	Renk C.R	234	95
Loka West	54,078	21,881	Abu Khries	3,356	1,358
Momory	220	89	Ahmed Agaha	1,242	503
Kajiko South	13,340	5,398	Kodok C.R	123	50
Kajiko North	11,678	4,725	Wad Akona	627	254
Green Belt Yei	312	126	Goz-Rom	234	95
Rajaf East	10	4	Khor Tumbak	22,500	9,104
Total	135,025	54,634	Diel	254	103
Eastern Equatoria Forest Reserves			Khash Khash		
Torit town	655	265	Nsgdiar PR	27,100	10,965
Katire teak	31	13	Bir	59,499	24,075
Imeila	3,150	1,275	Bong PR	7,748	3,135
Imatong/Gilo	304,207	123,090	Total	154,874	62,666
Vukadi	75	30	Western Bahr el Ghazal Forest Reserves		
Kereppi	500	202	Nyin-Akok	8,485	3,433
Parjok	56	23	Khor-Grinty	8,285	3,352
Lorwa	176	71	Tonj No.1	3,225	1,305
Shakole	2,447	990	Kuajena	10,869	4,398
Magwi	16	6	Khor-Abong	11,888	4,810
Palwar	182	74	Nyalero	17,300	7,000
Total	311,495	126,038	Dokorong	4,100	1,659

	FEDDANS*	HA		FEDDANS*	HA
Western Equatoria Forest Reserves			Namatina	610,236	246,916
Asanza.C.	497	201	Gette	5,289	2,140
Yabongo.C	843	341	Ngohalima & Akanda	10,645	4,307
Yatta.C.	19,500	7,890	Wau town	2,970	1,202
Nzara	10,020	4,054	Pongo Nuer	3,200	1,295
Magada	5,564	2,251	Gette extension	4,800	1,942
Yabua	10,189	4,123	Total	701,292	283,760
Mbari-zunga	19,900	8,052	Lakes		
Simbi	17,700	7,162	Karich	13,350	5,402
Ringasi	6,700	2,711	Pacong	4,930	1,995
Nangondi		0	Palual	14,185	5,740
Marangu	13,550	5,483	Rumbek town	2,195	888
Azza	1,763	713	Cumcok & Mayen Atot	1,250	506
Zaria	41,774	16,903	Malek	8,200	3,318
Embe	8,270	3,346	Total	44,110	17,848
Maridi town	395	160	Northern Bahr el Gazal Forest Reserves		
Zumbi	14,774	5,978	Nyala	32,000	12,948
Bangangai		0	Pongo Aweil	32,000	12,948
Riwa- 1		0	Total	64,000	25,896
Riwa- 2		0			
Total	171,439	69,368			
Grand Total Feddans = 1,582,235			Grand Total Hectares = 640,211		

Source: Forest National Corporation, 1999 in ETOA, 2007. * One feddan is equivalent to 1.038 acres or 0.42 ha.

In Table 10 above, updated data was not available and will be investigated in Phase 2 of the FAA 118/119 Assessment.

TYPES OF FORESTS

Forests are categorized as savannah woodlands, which cover most of the country, and montane forests, found in localized areas (IRG, 2007; Africa Forest Forum, 2011). Savannah woodland is sub-divided into two categories: low rainfall savannahs covering a small part of the country in the northern part of Upper Nile state and high rainfall savannahs covering most of the rest of the country. High rainfall savannah covers most of South Sudan with the exception of the floodplain around the Nile River and the montane region.

Montane Forests

These are found on the Imatong Mountains, Jebel Gumbiri, Dongotona and the Acholis in the southeastern parts of the country in Eastern Equatoria state. The highest peak on the mountains is Mt Kinyetti at an altitude of 3,187m ASL on the Imatong. Besides being classified as one of the biodiversity hotspots in Africa, it is also the largest continuous closed canopy forest in South Sudan (Moukaddem, 2011; Jackson, undated). Jackson (undated) observes that there is a great variation in vegetation cover within short distances in the

Imatong Mountains, which is not comparable to anywhere else in the region. The montane forests (Imatong, Dindinga and Dongotona) contain *Podocarpus milanjanus*, the only source of coniferous timber in the country. The less difficult terrain in the Imatong Mountains make the Podocarpus stands the easiest to exploit (Jackson, undated). Vegetation zones follow a gradient up the mountain. The *Podocarpus* belt starts at an altitude of 5,500 ft ASL but at this altitude, there is more of the African Olive (*Olea hochstetteri*) and *Syzygium*. The proportion of *Podocarpus* increases at higher elevations and at about 9,000 ft, it forms almost pure stands in sheltered places and then tapers into stunted *Podocarpus* belt mixed with *Dombeya*. This is followed by a belt of large bamboo (30 ft high by 3 in thick) *Arundinaria alpina* (Jackson, undated). The bamboo trees are very large in size and can be good for commercial purposes. Near the top of Mt Kinyeti in the Imatong Mountains, temperate plants such as violets (*Viola abyssinica steud.*), Lady's mantle (*Alchemilla sp.*), anemones (*Anemone thompsonia*) and forget-me-not (*Myosotis spp*) are found (Jackson, Undated) .

In the Imatong Mountains, local farming communities continued to move up the slopes opening up land for cultivation and reaching an altitude of 2,300 m (7,500 ft) ASL. This has created a problem of soil erosion as forests are cleared for agriculture.

Extraction of timber, especially the high value *Podocarpus*, at the higher altitudes and mahogany at the lower elevations is leading to serious deforestation. Encroachment for agriculture is also another major threat at the lower altitudes in the lowland forest zone. The Dongotona for example lost two-thirds of its forest cover between 1986 to 2011 and is likely to be cleared of all vegetation by 2020 (Moukaddem, 2011). Analysis of satellite imagery from 1973 to 2010 revealed that this vegetation type is rapidly disappearing in the Imatong Mountains; Dongotona and Didinga will also be affected the same way.

Savannah Woodland

These are mainly found in equatorial, Upper Nile and Bahr el Ghazal where rainfall ranges from 900-1,300 mm. Species recorded in this forest type in Western Bahr el Ghazal in 1984 included Vuba (*Isoberlinia doka*), mahogany (*Khaya senegalensis*), Bu (*Daniellia oliveri*), Pai (*Afzelia africana*), Abu suruj (*Prosopis africana*), Abu Suruj Dakar (*Amblygonocarpus andogensia*), Abino (*Burkea Africana*), Darot (*Terminalia avicinnoides*) and Abu Habil (*Lannea kerstingii*) Poulin and Ltee, 1984 in IRG, 2007). In 2007 during the field assessment for the Environmental Threats and Opportunities Assessment (ETOA), the natural forests in Western Bahr el Ghazal were reported to be intact (they were not affected by the civil war) while mahogany was being harvested in Northern Bahr el Ghazal (IRG, 2007)

Savannah Woodland Recently Derived from Rain Forest

This sub-type is much localized and occurs in higher rainfall areas (>1300mm) along the Congo border and some small patches of rainforest in other areas. These are high rainfall forests (i.e., rainforests) that have undergone a phase shift due to human-influenced degradation over the years. The dominant species are *Celtis zenkeri*, *Chrysophyllum albidum*, *Mildbraediendron excelsum* and *Holoptelea grandis* (Ibrahim and Badi, 2006). Other common species are *Terminalia glaucescens*, *Albizia zygia*, *Combretum binderianum*, *Bridelia scleroneuroides*, and *Dombeya quinqueseta* (Ibrahim and Badi, 2006 in IRG, 2007).

ECONOMIC IMPORTANCE OF FORESTS

Forests provide numerous ecosystem services, including watershed protection, water quality, and prevention of erosion. Forest resources in South Sudan are also important economically for both timber and non-timber forest products (NTFP), the benefits of which are described below. While the current political situation within South Sudan is not amenable to tourism, the abundant forest and associated biodiversity could be an important source for development for nature-based tourism.

Watershed Conservation/Sustainable Water Supplies

The forest resources in South Sudan occur mainly in the high rainfall woodland savannah zone and the montane forests of Didinga and Imatong Mountains. They are catchments for the many rivers that are a source of water in the country. Forests protect land against erosion and the secondary impacts of sedimentation of water courses/reservoirs; reduce risk of flooding downstream by slowing down surface run off; and allow for more water percolation to the ground thus making it possible for ground water recharge. South Sudan's surface water sources include perennial rivers, lakes and wetland areas, as well as seasonal pools and ponds, rivers; and these are important to the economy of the country in that they support agriculture, energy, construction, as well as wildlife and tourism. They also prevent occurrence of disasters such as floods.

Timber

South Sudan's forests are sources for high-grade timber, including teak, mahogany and ebony (AfDB, 2013). Currently, commercial exploitation is limited to teak (from plantation forests) and mahogany natural forests (Specht et al., 2009). Teak plantations are found in the more humid parts of the country. Most of them lack proper management and were badly harvested during the war (UNEP, 2007). Globally, there is a high demand for premium-quality timber, such as the types found in South Sudan. Timber and logging companies have been in operation for several years, and have caused significant damage to the forests by operating without management plans in logging concessions that were obtained during or after the war, when there was no regulatory framework in place.

However, investment in the forestry sector in terms of improved management and establishment of new plantations is needed for the sectors full potential to be realized. Large stands of mahogany are currently found in the natural woodlands both reserved and un reserved. Systems for sustainable management and enhanced protection will be necessary to avoid overharvesting.

Potential for Tourism Development

South Sudan forests are biologically diverse system representing some of the richest biological area on earth. They are also habitats for wildlife including some of the mega fauna diversity such as elephants. They therefore have potential for eco-tourism development.

Non-Timber Forest Products

The gum Arabica belt in South Sudan runs across from Eastern Equatoria, Central Equatoria, North Bahrel Ghazal, Warrap, Unity, Jonglei to Upper Nile States. Despite the significance of gum in the livelihoods of people living in the gum belt, there has been only insignificant investment in the gum sector. South Sudanese have not been able to benefit from this natural resource apart from traditional uses of the gum, like chewing. In a few cases, gum collectors sell their harvests at very low prices to middlemen who then sell to traders in

neighboring countries. Potential for commercializing gum Arabica through Public Private Cooperation exists and can benefit many local communities (Specht et al., 2009).

The shea tree (*Vitellaria nilotica*) is a deciduous savanna hardwood growing naturally and abundantly within the savannah woodland belt of South Sudan. In some counties such as Yei, the tree grows in abundance to the extent of being the dominant tree species (South Sudan Forest Working Group, 2004). The country has a potential to produce 100,000 metric tons of shea nut per year, but only 10,000 metric tons are produced, with the bulk of the harvest consumed locally. It is estimated that only 0.2 % of the product is exported even though there is a growing international demand for shea butter. The tree species found in South Sudan is the mainly found in northern Uganda and South Sudan whose product is better than the *Vitellaria paradoxa*. The Shea nut produces premium oil for use in cosmetics, soap, detergents, pharmaceuticals and candles, confectionery and as cooking oil. Shea butter is becoming increasingly popular especially in France and the United States. Chocolate and confectionery products account for 95 % of shea butter demand, with only 5 % currently used for cosmetics and pharmaceuticals (Fintrac, 1999). The wood of the shea nut tree is hard, heavy, and resistant to termites, and is used in building construction and the manufacture of mortars, craft goods, and charcoal.

Honey

The vast woodlands of South Sudan are ideal for honey production with many of the local communities keeping traditional hives. There is great potential for production of honey both for the domestic and external markets. Currently honey is a source of income for rural communities, however, the quantity and quality of honey produced and sold are not documented.

STATUS AND MANAGEMENT STRUCTURE

The Food and Agriculture Organization of the United Nations (FAO) 2010 Forest Resources Assessment (FRA) listed Sudan as having the ninth largest forest cover at 70 million hectares. Fifty percent of the forests and woodlands area found in Sudan before South Sudan achieved independence is now found in South Sudan (Africa Forest Forum, 2011; FOA, 2010). At that time, the FRA indicated that Sudan showed a significant decline in the forest cover as compared to the period between 1990 and 2000. The current annual loss of forests and other wooded land in South Sudan is estimated at 277,630 hectares annually (GOSS and UNDP, 2011). The same report also projects that if the population of South Sudan continues to increase at a rate of 2.2% per annum, and forest loss continues at the same rate experienced from 2000 to 2005, there will be no forests remaining in a hundred years. The spatial analysis performed as part of this Phase 1 Pre-Field FAA 118/119 Desk Assessment estimated a loss of approximately 14,000 ha from 2000-2012, based on Landsat imagery. There is a large discrepancy between the estimates by GOSS and UNDP and the analysis in this report.

National and foreign demand for tree products determines the rate of deforestation, which is expected to increase proportionately. In the absence of effective policing, protection and management, the rate could be extremely high. In South Sudan, factors that drive demand for forest resources are i) need for construction materials especially by the returnees after the signing of the CPA and independence, ii) fuel wood and charcoal particularly in the urban centers, iii) a good market for the charcoal in the neighboring countries of Kenya, Uganda and Sudan, and iv) improved infrastructure that opens forest areas and makes it easy to access markets. Table 11 summarizes the area of forests and other vegetation types as well as the annual loss of forest cover.

Table 11. Forest Land in South Sudan

LAND USE CATEGORY	AREA (1,000 HA)	SHARE (%)
Forest Reserves	640	3.1
Forest Plantations	23	0.1
Other forested area	20,079	96.8
Total	20,742	100

Source: AfDB 2013. South Sudan Infrastructure Action Plan

In summary, shifts in forested land have been caused, in part, by conversion of forests to open forests and to wooded grasslands, and conversion of forests to agricultural lands (UNEP, 2007). Forest reserves cover 3 % of the total forested area while commercial forests cover only 0.1 % of the forested area (AfDB, 2013).

With limited areas under commercial forestry, demand on timber/wood products from natural forests will be high. The government must therefore make concerted efforts to increase area under plantation forests. Local communities also do not participate in forest management and reforestation; however plans are underway to develop such mechanism (Ogwaro, 2011).

PLANTATION FORESTS

South Sudan has a total of 188,000 hectare (ha) of forests plantations (African Forest Forum, 2011). Production of timber in South Sudan has been haphazard, small-scale and unauthorized (Verjee, 2013). The teak plantations were initially planted in 1919 in Kagelu in Central Equatoria and later in other parts of Equatorial and Bahr Al Ghazal regions. Between 2004 and 2007, a total of 18 teak plantations were mapped (13 in 2004 and five in 2007). However, during the war, these forests were seriously exploited without adequate measures to regulate the process leading to degradation. Lack of management during the years of the civil war also meant that silvicultural practices were not undertaken even where the forests were not exploited. These forests are therefore not of any commercial timber value and it is recommended that they be clear felled and replanted afresh.

Species such as Sunt (*Acacia Nilotica*) were established under irrigation while teak, pine and eucalyptus were established in the high rainfall area. Currently, there are 15,000 ha of mature plantations mainly of *Afzelia africana*, *Cedrella tona*, Sunt (*Acacia nilotica*) and *Eucalyptus spp*s; 6,500 ha of mature teak (*Tectona grandis*); and 600 ha of softwood plantations, mainly pine (*Pinus petula*, *Pinus radiate*), cypress (*Cupressus lusitanica*) (Ogwaro, 2011).

Table 12. Distribution of the Various Plantation Types in South Sudan

PLANTATION TYPE	AREAS WHERE GROWN
Sunt (<i>Acacia niloticus</i>)	Along the Banks of the Nile
Mahogany (<i>Khaya senegalensis</i> & <i>Khaya grandiflora</i>)	Greater Bahr el Ghazal
<i>Eucalyptus Spps</i>	Spread throughout all the states in the south
Teak (<i>Tectona grandis</i>)	Central equatorial and Northern Bahr El Ghazal

Source: Africa Forest Forum, 2011. Forest Plantations and Woodlands in Sudan

The Ministry responsible for forest management has not yet established a clear system for granting forest concessions (Ogwaro, 2011), which makes the process haphazard and prone to misuse, leading to over exploitation. Even in the absence of a clear policy on how to grant concessions and management plans for

the affected forests, some concessions have already been granted. Clear policies on criteria for award of concessions can help better manage the forest for both conservation and production.

Verjee (2013) indicates so long as the construction boom continues in Juba and the need for GOSS to generate revenue from its teak plantations, pressure will be high on the plantations, especially those in Central Equatoria. Despite this, there is an urgent need for GOSS to strengthen its capacity in the management of existing plantations for sustainability purposes, otherwise, the plantations may be lost soon. Table 13 below shows the existing plantation forests and their sizes.

Table 13. Estimates of Area in Forest Plantation

FOREST PLANTATIONS (MAPPED*)	CURRENT BEST ESTIMATE OF TEAK (HA)	FOREST PLANTATIONS (NOT YET MAPPED**)	AREA OF PLANTATION (HA)
Nangondi	492	Ngohalima & Akanda	2,825
Yaboa (Nzara)	701	Nyini Akok	1,457
Mbarizanga	386	Khor Grinty	1,449
Yabongo	233	Gette	1,376
Asanza	234	Khor Abong (Busere)	764
Yatta	357	Tonj No.1	1,305
Zaria	181	Dokorong	1,327
Ringasi	35	Nyalero	1,327
Magaba	23	Kuajina	1,327
Marangu	24	Namatina	1,327
Bangangai	36	Kpanza	202
Embe	111	Pongo Nuer	554
Kegulu	1,204	Pongo Aweil	554
Loka	1,972	Total	15,796
Yei Council Teak	158		
Mommory	238		
Kajiko North	977		
Korobe Hill	318		
Total	7,680		

Source: IRG, 2007.

* Mapped by Southern Sudan Agriculture Revitalization Program or by Equatoria Teak Company or both.

** Data from FD statistics not confirmed

Note: The information in Table 13 above will need to be updated during the Phase 2 of the FAA 118/119 Assessment based on mapping studies that have been completed since 2007.

FOREST CERTIFICATION SCHEMES

Forest certification has not yet become a norm in South Sudan. The major concessionary in South Sudan has been the Equatoria Teak Company Limited (ETC). ETC has a 32-year, renewable concession on a total area of 18,640 hectares (186.4 km²) (including 1,319 hectares of teak, and 170 hectares of cassia) for five land blocks near Nzara, Western Equatoria. The concessions were granted in 2006 by the Ministry of Agriculture and Forestry (MAF) with the approval of the GOSS Council of Ministers. Another company with concessions in Lainya and Yei River counties is Central Equatoria Teak Company (CETC). Due to changes of

ownership since 2006, both these concessions are now currently owned by the Same Company, Maris Capital. There has been doubt if the 32-year concession was awarded competitively as well as if the benefits to GOSS and the people of Sudan are commensurate. ETC was temporarily granted certification for its concessions in South Sudan. Verjee, 2013 writes that ETC claimed in its website that its teak was certified by the Forest Stewardship Council (FSC), the industry leading certification body for ethically and sustainably harvested timber and related products. However, there seems to have been a controversy with regard to this certification, which has since been revoked although the website continued to indicate otherwise for some time.

In the absence of a certification scheme for the high value timber found in South Sudan, there is a high likelihood that illegal logging will escalate. GOSS, through MAF, needs to urgently put in place sound policies and regulations on the exploitation of forest resources, in addition to ensuring timber harvested from the south is certified.

MAJOR THREATS TO TROPICAL FORESTS AND BIODIVERSITY CONSERVATION

GENERAL

The analysis of threats in this section is based on a desk review. Additional information will be collected in the field-based portion of the analysis (Phase 2).

Lack of Integration of Conservation into Development Planning

GOSS is eager to encourage economic development in the country. Priority developments are in infrastructure (roads, power generation projects/dams, ports and harbors, and housing); and the agriculture sector for purposes of ensuring food security and production for the export market. Agriculture using unsustainable practices can lead to catchment degradation, which is a threat to aquatic resources (UNEP, 2007). In the absence of proper planning that takes into consideration environment and natural resources, many of these development activities are likely to harm forests and biodiversity resources in general. Some of the resources likely to be affected are wetlands/water resources; protected areas and forest reserves; wildlife corridors and dispersal areas.

Expanding Infrastructure

GOSS, as per the current South Sudan Development Plan (2011-2013), is committed to expanding roads and other infrastructure such as railways and harbors for purposes of improving communications and access to services (GOSS, 2011). Some of the activities to be undertaken over the 2011-2013 period as per the SSDP are development of 700 km of trunk roads, 1000 km of roads linking major towns and expanding feeder roads. While this is positive, it has an inherent risk for biodiversity conservation. Better access to areas previously inaccessible often leads to more exploitation of resources (forests, wildlife, fisheries). During the years of the war, this occurred in some parts of South Sudan such as in Southern NP resulting in near and/or local extinction of certain wildlife species, for example the African buffaloes were exploited (GOSS and UNDP, 2011). Similarly, forests in Central Equatoria and Bahr el Ghazal have been seriously exploited since the 1980 (IRG, 2007; GOSS and UNDP, 2011). Opening up roads/communications, especially in a country with weak institutional and legislative framework for ensuring protection and monitoring of wildlife and forest resources will increase the risk to biodiversity and forest resources.

This then calls for the government to strengthen the institutions responsible for the management and protected of these resources.

Climate Change

Although no specific climate change scenarios exist for South Sudan, the expectation is that the country is vulnerable to climate change, based on predicted changes elsewhere in the region (UNEP, 2007; GOSS and UNDP, 2011). Factors that can accelerate climate change such as deforestation, forest/woodland degradation, over grazing and conversion of land to agriculture are also on the rise. Anticipated impacts of climate change are increased water scarcity, accelerated desertification and soil erosion processes, decreased productivity (a 20 % drop in crop yields is predicted), damage caused by more extreme climate events such as droughts and floods, increased health related illnesses, and higher risk of pest and disease outbreaks (UNEP, 2007; GOSS and UNDP, 2011). Droughts and floods are already common in South Sudan. The NBHS, 2009 indicates that 62 % of the rural population was subject to shocks arising from droughts and floods. Climate change can lead to changes in habitats as well as in species composition and numbers.

Weak Institutional Framework for the Protection of Tropical Forests and Biodiversity Resources

The parties responsible for management of tropical forests and biodiversity in South Sudan –MAF and MWCT – are largely ineffective due to lack of technical and resource capacity and presence on the ground. In the PAs, there is lack of office infrastructure, communications, and road networks for management and tourist circuits. The staff's capacity needs to be built through training, but operating budgets have been low. Other parties that play a critical role in ensuring the conservation of these resources – Ministry of Environment, Ministry of Water Resources and Irrigation (MWRI), Ministry of Livestock Development (for fisheries management) – face the same constraints that limit effectiveness.

Limited Livelihood Options and High Poverty Levels

IDPs and returnees find themselves with limited options for survival, which forces them to over exploit natural resources such as forests/woodlands and wildlife. Main activities undertaken for sustenance of livelihoods that have adverse impacts on forests and biodiversity are charcoal burning, hunting game meat and making earth fired bricks. Charcoal and brick making operations consume high volumes of wood, a direct causes deforestation and/or forest degradation.

DIRECT THREATS TO TROPICAL FORESTS

Clearing Land for Cultivation

Currently, agriculture employs about 67% of the population (Brown & Sidahmed, 2009). While the total land area that is currently under cultivation is low⁶, the GOSS plans to expand and intensify agriculture in order to meet the food needs of the country as well as to grow crops for export (GOSS, 2011). The SSDP indicates that about 60% of the imports of South Sudan from Uganda and Kenya are food items, which shows the high dependency of the country on food imports and its vulnerability (GOSS, 2011). The cultivated area (including irrigated) is projected to increase significantly over the next 20 years. Currently, only 1% (32,000 ha) of the cultivated area is under irrigated agriculture and this is set to increase up to 400,000 ha by 2020 (AfDB, 2013). According to the plan, half of this increase will be undertaken by small scale farmers with the

⁶ It is estimated that less than 4.5% of the total land area of South Sudan is periodically under cultivation. AfDB puts this figure as 2.7 million hectares in 2010 and this is expected to rise to four million by 2020. The SSDP, 2011 puts land currently under cultivation to 4% of the total potential agricultural land.

remainder going to medium- and large-scale commercial farming (AfDB, 2013). Mechanization of agriculture which is more degrading to the environment since most of the tree cover is removed during the process (Deng, 2011 in GOSS and UNDP, 2011).

Regions where significant agricultural activities are ongoing include Upper Nile State, Central and Western Equatoria States (Juba, Terekeka and Yambio counties) where clearing of dense forests for maize production and biofuels has already occurred (Deng, 2011 in GOSS and UNDP, 2011). Increases in the cultivated area will come from bringing areas currently covered by forest, shrubs and grass under cultivation (AfDB, 2013). Table 14 summarizes the projected areas for cultivation and irrigation.

Table 14. Indicative Plan for Cropland Development

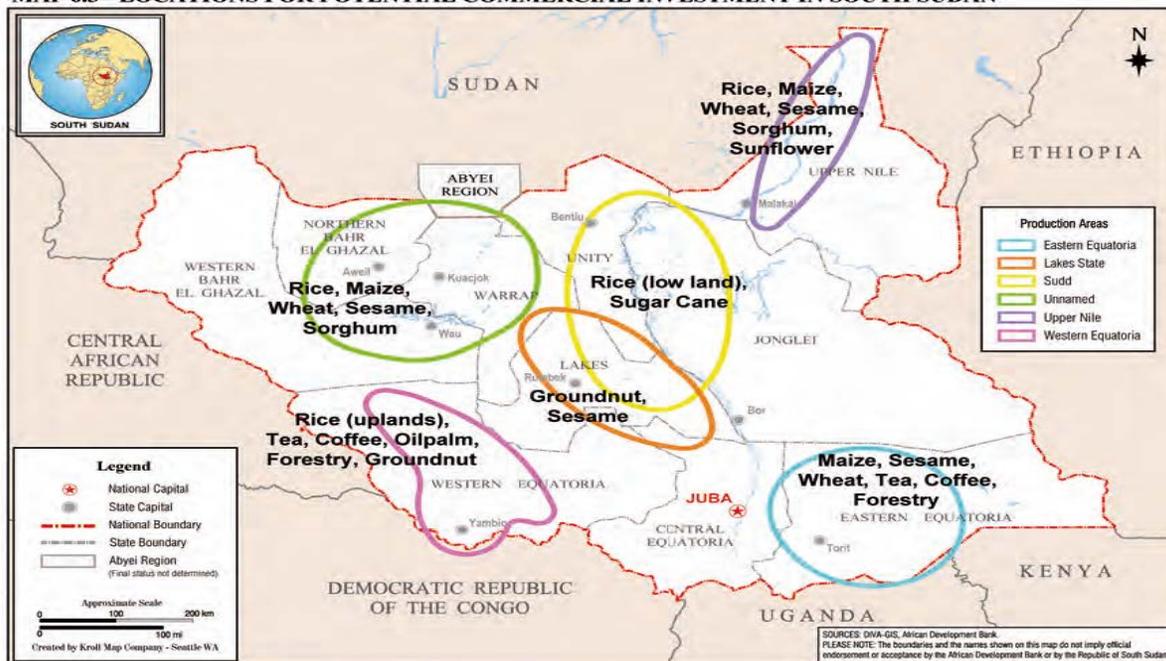
INDICATOR	ESTIMATES (1,000 HA)			PROJECTION (1,000 HA)				INDICATIVE (1,000 HA)
	2010	2011	2012	2013	2014	2015	2020	
Harvested area								
Cereals	921	500	939	986	1,060	1,166	1,880	2,800
Other crops	79	80	81	84	100	154	620	1,900
Total	1,000	580	1,020	1,070	1,160	1,320	2,500	4,700
Cultivated land under rotation	1,681	2,114	1,726	1,684	1,675	1,671	1,500	1,570
Cultivated area	2,681	2,694	2,746	2,754	2,835	2,991	4,000	6,270
Memo items:								
Irrigated area (ha)	32,000	19,000	37,000	53,000	86,000	132,000	400,000	1,000,000
Cultivated as % total land area	4.2	4.2	4.3	4.3	4.4	4.6	6.2	9.7
Harvested as % of cultivated	37.3	21.5	37.1	38.8	40.9	44.1	62.5	75.0
Irrigated area as % total harvested	3.2	3.3	3.6	5.0	7.4	10.0	16.0	21.3

Source: AfDB, 2013.

Table 14 demonstrates the significant increases of land put under cultivation over the next 20 years. The plan integrates crop rotation, which allows for retention of soil nutrients. However, agriculture in many other parts of Africa has been associated with significant adverse environmental impacts such as forest, land, and water quality degradation due to use of unsustainable land use practices. In addition, shifting cultivation and use of fires to open up land are common practice in the country and they are also likely to have adverse impacts on forests and biodiversity.

Some of the proposed agricultural developments will be on areas that are very important for Biodiversity conservation such as the Sudd wetlands (see Map 3). Irrigated agriculture is planned all along the Nile and its tributaries. Over abstraction of water could have adverse impacts on aquatic biodiversity as well as degrade the quality of water for domestic consumption. Western and Eastern Equatoria, areas with important forest biodiversity, are also mapped for agricultural development. All these calls for careful planning to ensure such developments are not located in critical areas for biodiversity conservation. In addition, management of such development schemes must be done sustainably to mitigate secondary impacts of the implementation phase.

Map 3. Potential Areas for Investment in Agriculture in South Sudan



Source: AfDB, 2013.

Return of Internally Displaced Persons and Refugees

The 2011 SSDP indicates that about four million people were internally or externally displaced during the Sudanese civil war. Since the signing of the CPA in 2005 and the declaration of independence in 2011, there has been an influx of people coming back to the country. An estimated one million people were expected to return from the Sudan as independence approached. Such a large influx of people creates demand for natural resources, including timber and poles for construction, fuel wood and charcoal (charcoal is the major source of energy for cooking in the urban centers). These threats are analyzed in the section below.

Construction Materials (Timber and Poles)

Timber and poles are a major input during construction activities. With the return of refugees to South Sudan and relocation of IDPs to their original lands, demand for construction material (housing, commercial centers, social amenities such as schools clinics, churches and other facilities) is high. For timber, higher quality wood of larger older trees such as the African copaiaba balsam tree (*Daniellia oliveri*) and the African mahogany (*Khaya senegalensis*) is exploited. Depending on location, local woodland resources are exploited to provide poles for construction of tukuls. The amount of forests and woodland resources exploited to serve this need is dependent on the number of people who need to construct and settlement patterns. Exploitation of large numbers of trees at a go alters the forest/woodland structure and biodiversity (GOSS and UNDP, 2011).

Fuel Wood and Charcoal Burning

Wood fuel and charcoal are the primary sources of energy for cooking in South Sudan. Overall, 86% of the population use fuelwood for energy with only 10% using charcoal (NBS, 2012). However, 44% of the population uses charcoal for cooking in urban centers. Fuel wood is also the primary source of lighting in the rural areas (35%), while 15% of the population uses grasses for lighting (NBS, 2012). The figures in Table 15 below indicate that Central Equatoria, Western Bahr El Ghazal and Upper Nile have the highest use of

charcoal due to the relatively higher urban populations. As the urban population increases all over the country, the demand for charcoal will also grow.

Table 15. Breakdown of Energy Sources for Cooking by State

STATE	FIREWOOD	CHARCOAL	GRASS	OTHERS	TOTAL
Warrap	97	2	1	0	100
Western Equatoria	96	4	0	0	100
Eastern Equatoria	94	6	0	0	100
Lakes	93	5	1	1	100
Northern Bahr Al Ghazal	93	4	2	1	100
Jonglei	92	3	4	0	100
Unity	83	8	9	0	100
Central Equatoria	72	25	2	1	100
Western Bahr Al Ghazal	68	32	0	0	100
Upper Nile	63	21	14	1	100

Source: NBS, 2012.

In addition, trade in charcoal is fueling deforestation in most of the states. According to GOSS and UNDP (2011)'s EIRO assessment, on average, one bag of charcoal contains more or less 1.5 trees. To give an indication of the potential for deforestation due to charcoal burning in the Upper Nile state, the EIRO report states "According to various interviews, one family (on average five persons) uses approximately one bag of charcoal per week. If we assume that 30 larger trees are found per hectare on an undisturbed savanna (based on Google Earth image of Upper Nile), then each removed tree results in the deforestation of 0.03 ha. The annual use of charcoal of one family accounts for 2.6 ha of deforestation in that area." (GOSS and UNDP, 2011).

Charcoal trade also thrives across the borders with large quantities of the commodity being exported. The Sudan for example provides a good market for charcoal and counties bordering the Sudan are a source of the commodity. Monthly trade data give an estimate that 60,000 bags of charcoal are exported from Renk County to the Sudan annually, equivalent to about 2,700 hectares of deforested land (GOSS and UNDP, 2011). Another factor worth noting is that since the Sudan has lost most of its woodlands, there will always be demand for charcoal and other wood based products from South Sudan. The overall impact on loss on forests and woodlands is enormous.

Brick Making

In many parts of South Sudan, naturally occurring stone needed for construction is not available, which creates a high demand for earth fired bricks. Brick making in itself is also damaging to the land and other natural ecosystems such as wetlands where clay soils are found and mined as a key input. Firing bricks as an activity consumes a lot of firewood, sourced from either forests or woodlands. It is estimated that one kiln producing 160,000 bricks could



Impact of brick making near the Nile in Juba. Photo credit: Jane Kahata, 2012

consume an average of 18 truckloads of firewood per year (GOSS and UNDP, 2011). This causes a considerable size of forest/woodland loss and consequently habitat loss for other species of animals that depends on forests.

Livestock Grazing and Browsing

South Sudan is endowed with huge livestock resources (estimates of 11.7 million cattle, 12.4 million goats, and 12.1 million sheep) with an estimated asset value of 7 billion South Sudanese pounds (SSP), considered the highest per capita holding in Africa (Lomuro, 2012). Overall, over 75 % of the population owns livestock (Brown & Sidahmed, 2009; AfDB, 2013). The vast area of the savannah ecosystem creates favorable conditions for livestock grazing, however they are also habitat for wildlife. While the livestock potential is enormous, the pastoral communities keep livestock for social cultural reasons such as wealth status and paying for bride price, which has led to a buildup of large herds of livestock since the 1960s. Livestock populations on average increased five-fold in Sudan from 1961 to 2004, while cattle numbers increased by 3.6 % annually (GOSS and UNDP, 2011). However, recent data on South Sudan indicates that the rate of increase in livestock numbers (2 % annually over the period from 2005 to 2010) is decreasing.

From 1973 to 2006, the area of rangelands in South Sudan decreased by 18.5 % due to degradation and land conversion (UNEP, 2007 in GOSS and UNDP, 2011). As part of the Phase 1 Pre-Field Desk Assessment, an analysis of change in rangeland cover was conducted with two sets of sequential-year MODIS reflectance data -2001-2003 and 2011-2013. Mean Normalized Difference Vegetation Index (NDVI - a commonly-used measure of vegetation health) was calculated per pixel for each 3-year set, then the newer dataset was subtracted from the older. This analysis revealed that South Sudan has lost approximately 175,000 of rangeland cover from 2000 – 2012. This is not a significant change, but could rapidly change with increases in population (See Annex A, Map 15).

In Northern Bahr el Ghazal and the flood plains, grasslands are heavily degraded and perennial grasses, such as *Andropogon gayanus*, are being replaced by grasses of lower quality (GOSS and UNDP, 2011). Range constriction leads to higher livestock stocking rates especially if there are no off takes as is the case in pastoral regions. AfDB (2013) estimates livestock densities at 2.6 animals per hectare of grassland in South Sudan as a whole; and one animal per hectare of grassland and savannah, which are considered relatively high. Overstocking combined with other factors of degradation such as fire (a common practice in South Sudan), clearing land for different purposes, low rainfall and a drop of the water table) may lead to habitat changes with the savannah woodlands becoming grasslands or deserts (Miehe et al., 2010 in GOSS and UNDP, 2011). Livestock also leads to deforestation by removing seedlings, which eliminates the capacity of the forests/woodlands to regenerate.

One of the proposals in the 2011 SSDP is to improve veterinary services as a way of boosting livestock production (GOSS, 2011). Improving such services without a change of attitude towards commercialization of livestock will increase livestock numbers thus making the land more vulnerable to degradation. The problem would be compounded if the size of the rangelands decreases related to land use changes and higher stocking rates which exacerbates further degradation. This also has the potential to increase conflicts arising from competition for pastures and water resources, a phenomena common in many pastoral regions of Africa. Livestock losses when they are young are high due to lack of veterinary services (GOSS, 2011), therefore on the whole, provision of veterinary services is likely to substantially increase herd size.

Table 16. Livestock Numbers in South Sudan States

STATE	CATTLE	GOATS	SHEEP	TOTAL
Upper Nile	990,024	650,503	447,097	2,087,624
Unity	1,188,824	1,511,319	1,784,172	4,484,315
Jonglei	1,475,096	1,423,281	1,227,409	4,125,786
Northern Bahr el Ghazal	1,590,400	1,305,897	1,657,635	4,553,932
Western Bahr el Ghazal	1,256,416	1,183,622	1,138,833	3,578,871
Lakes	1,320,032	1,252,096	1,488,919	4,061,047
Warrap	1,538,712	3,130,788	1,391,907	6,061,407
Central Equatoria	882,672	1,286,333	1,172,576	3,341,581
Eastern Equatoria	894,600	1,041,783	1,151,487	3,087,870
Western Equatoria	679,896	1,188,513	1,151,487	3,019,896
Total	11,816,672	13,974,135	12,611,522	38,402,329

Source: SIFSIA in GOSS and UNDP, 2011

Fires

Fire is used for the following purposes in South Sudan: i) to burn old tough grasses and promote growth of rush green pastures; ii) to open up land for cultivation and/or after fallow periods; iii) aid hunters by flashing wildlife from their habitats; and natural and/or accidental fires. If the temperatures generated by such fires are too high, seeds are burned and this affects the potential of rangelands to regenerate thus leading to land degradation. This in turn affects grassland biodiversity. Repeated fires also retard the growth of affected trees and shrubs, and the trees are unable to grow to their full potential.

In the Sudd areas, where fishing is a livelihood activity, large amounts of wood are used to smoke fish, a method of preserving fish. This poses a threat to the forests and woodlands in such areas (GOSS and UNDP, 2011).

DIRECT THREATS TO BIODIVERSITY RESOURCES

Poaching

Poaching has been a serious problem since the period of the civil war and this led to the near extinction of certain species in some locations. Species most affected are zebras, buffaloes, giraffes and the hartebeest (GOSS and UNDP, 2011). Important species such as the elephants, the white eared kob and tiang survived due to inaccessibility of some of their range. With the return of IDPs and refugees, this threat is likely to increase (Rucker, 2011).

Game Meat Trade

Bush meat trade in South Sudan is widespread and vendors can be spotted selling it by the roadside in places such as on the roads leading to major urban centers (Bor to Juba; Yambio to Juba). This is because traditionally, many of the ethnic communities have hunted game, which is cheaper than meat, fish and chicken, for provision of protein. During the war, game meat also provided sustenance for local people. Poaching for game meat is compounded by the ready availability of small arms amongst most of the South Sudanese (UNDP, 2009; GOSS and UNDP, 2011).

Encroachment on Migratory Corridors, Wildlife Dispersal Areas, and Other Important Biodiversity Areas in the PA System

Expected development activities such as agriculture, irrigation, oil and mineral exploration and exploitation, infrastructure developments such as roads are all likely to impact heavily on the dispersal areas and migratory routes for wildlife. The risk is even higher because these areas are not part of the PA system, thus making them more vulnerable. In some areas, mineral and oil concession blocks overlap with the PA system and other important wildlife habitats such as the Sudd (GOSS and UNDP, 2011, IRG, 2007)

For some PAs, the boundaries are unclear making it difficult for staff of the MWCT to keep encroachers out while at the same time, local communities are not aware where the limits are.

The PA system as it is; is not all inclusive and some important areas for biodiversity such as the montane forests are not included. The threat of conversion of such areas for other land uses especially agriculture is very real. The same habitats may be affected by oil exploration and exploitation (See Annex A, Map 14). For example, the migration of the white eared kob covers a round trip of 400 miles and if measures are not undertaken soon, some of the migratory corridor may be lost.

Oil and Mineral Exploration and Exploitation

South Sudan has vast reserves of oil reserves and has assigned blocks for exploration and/or exploitation in areas important for biodiversity (see Annex A, Map 3, Map6, Map 15). The country also has substantial mineral resources that include gold, iron, Bauxite, Zinc, Manganese, marble, limestone and dolomite (Adde, 2013). In the SSDP, GOSS through its Ministry of Mining and Mineral Resources is keen to develop its mineral resources and indicated it planned to increase awards for new licenses for mineral and oil exploration companies from 17 to 30 (GOSS, 2011). Oil and mineral exploration and exploitation requires opening up of a road infrastructure and other supporting services such as housing and other social amenities. These lead to destruction of critical habitats for biodiversity. In addition, oil production produces “produced water”, which has high concentrations of chemicals, minerals and water mixed with oil. Such chemical pollutants can reach toxic concentrations that will pollute the surrounding areas or waters if dispersed directly into them (Exxon Mobil, in IRG, 2007). Temperatures in produced water are high, which can affect plant and animal life. These when discharged into the environment pollute water/wetland resources thus leading to biodiversity losses. The 2007 ETOA reported that the impacts of oil exploration and exploitation were already visible in Abyei, Unity State and Upper Nile State, where the petroleum producing areas were dotted with small ponds created near the well heads to hold the “produced water” that typically comes out of the ground from the oil wells (IRG, 2007).

INDIRECT THREATS

Catchment Degradation and Associated Downstream Impacts

The catchments of the Nile River are the highlands along the border with the CAR and the DRC. These have in the past been undergoing degradation arising from land clearance for agriculture, deforestation and possibly climate change. They are the sources of the Rivers Kir, Lol, Jur, Gal, Peyia and the Yei, which contribute their waters to the Nile River. In the past, these rivers have been permanent but have been reported to become seasonal over the last two decades (GOSS and UNDP, 2011). In addition, they also carry heavy loads of silt, which affects aquatic life. As a result of these changes, certain species of fish have been reported to be on the decline or have become locally extinct as indicated the text box to the left.

Water Quality Degradation

Rapid urbanization without commensurate sanitation facilities is the major cause of pollution in river courses and wetlands in South Sudan. The situation is made worse by the fact that major urban settlements (also state capitals) are located on the Nile. These include Juba the capital city, Malakal, and Bor. Wau is another state capital located on River Jur, a tributary of the Nile.

Industrialization is also likely to add chemical pollutants and toxins to the rivers (UNEP, 2007). Some of the activities reported to be discharging wastes into the Nile include an open sewer in Malakal, waste water from a hospital and runoff from the electricity power plant, which was obviously seriously polluted and a slaughterhouse in Wau. Other factors contributing to water quality degradation include soil erosion within the catchments of some of the rivers especially those rising from the border of Sudan with the CAR.

All this is likely to affect aquatic life (fisheries and other types of aquatic life) with the possibility of leading to local species extinction. Pollution of water resources also alters species composition with the species that can tolerate pollution displacing those that are less tolerant.

Invasive Plant Species

The water hyacinth is the main invasive plant species in the Nile. The plant reproduces creating dense mats that degrade water quality through the following processes:

- Decaying organic matter enriches the waters, altering the nutrient levels;
- Dense mats reduce light penetration and dissolved oxygen levels, affecting the characteristics of aquatic life with direct consequences for primary aquatic life.

These two factors are likely to lead to changes in species diversity and may even lead to loss of species that thrive in cleaner waters.

Inefficient Use of Wood Based Fuels

Sourcing for wood fuel is a major contributor to forest/woodland degradation. The amount of wood used and by extension the number of trees felled for the purpose is dependent on household consumption of wood fuel based energy. Most of the families use the open fire cook stoves, which consume a lot more energy. Significant reductions on the amount of deforestation can be achieved by use more energy efficient cook stoves.

Example of fish species loss due to catchment degradation

Fishermen in Nyamlel on river Lol suspect that five fish species have disappeared from their river out of the 15 species they know. They also reported that the size of fish caught had also decreased; noting that the Mudfish (*Protopterus aethiopicus*) could reach a length of 1.5 m in the past; but the size had decreased in recent fish catches to a maximum of 0.5 m in length. In their opinion, the fishermen did not think that the problem was due to over fishing since fishing in these rivers is quite limited and simple techniques are being used (GOSS and UNDP, 2011).

IDENTIFICATION OF PRIORITY ACTIONS TO PROMOTE TROPICAL FORESTS AND BIOLOGICAL DIVERSITY CONSERVATION (*LIMITED SCOPE*)

Due to the current conflict in South Sudan, field work was not conducted during the preparation of this Phase 1: Pre-Field Desk Assessment report. The report has been compiled largely based on information/data from secondary sources. As a result, adequate consultations and authentication of information gathered from literature has not been done. According to the design of the FAA 118/119 Assessment, a Phase 2 (field component) will be undertaken once peace is restored in the Country. Therefore, the priority actions enumerated below are not comprehensive and will still need to be verified during the field visits.

GENERAL PRIORITY ACTIONS

The identification of priority actions is based on a limited scope desk review. This information will be expanded and verified in the field-based portion of the analysis (Phase 2).

Development of a National Land Use Plan

Development of a national land use plan that integrates natural resources management objectives into the country's development objectives would be an important priority action for conservation and biological diversity. This would help safeguard tropical forests and other habitats critical for biodiversity conservation against loss and/or degradation. In recognizing this need, the Minister for MWCT (Dr. Daniel Wani) said this "pragmatic conservation, land-use planning, and sustainable development objectives and approaches should be integrated into the reconstruction and development agenda. This will help us achieve peace dividends and long-lasting benefits for the people of South Sudan" (Rucker, 2011).

Environmental Assessments/Strategic Environmental Assessments

In the SSDP, GOSS committed to the principals of environmental sustainability, and vows to ensure that by the end of the SSDP period, 50% of large-scale investment proposals will be subject to environmental screening. GOSS also committed to strengthening the capacity of institutions responsible for environmental regulation. Environmental assessments as well as strategic environmental assessments (SEAs) can help identify potential adverse impacts of proposed development activities and mitigate them. This is especially critical in prime habitats such as the Boma to Jonglei Landscape and the Sudd.

Strengthening the Capacity of Institutions Responsible for Management of Tropical Forests and Biodiversity

There is need to strengthen capacity of the relevant institutions involved in the conservation and management of tropical forests and biodiversity resources through training and provision of the necessary resources, including vehicles and office space. Key institutions include: the MWCT, Ministry of Environment and Ministry of Agriculture, Forestry and Cooperative Development.

There is very limited information about the status of certain species of wildlife in South Sudan, which complicates the decision making process. To fill in the information gaps, aerial surveys with ground-truthing should be undertaken to verify status of wildlife. Each of the respective PAs should also be supported in strengthening monitoring systems.

Another area of interest is management of the water resources of the Nile, a critical habitat for biodiversity conservation. While this is a complex issue involving all the other Nile Basin countries, the respective Ministry in the government of South Sudan needs its capacity strengthened for interaction and dialogue with other Nile Basin riparian countries regarding management of use of the Basin resources.

The provisions of the 1929 Agreement between Egypt and Anglo-Egyptian Sudan, which gave Egypt complete control over the Nile during the dry season and the 1959 Nile Agreement between Sudan and Egypt for full control and utilization of the Nile waters still hold, and they curtail the use to which the country can utilize the waters of the Nile. Pertinent issues are if South Sudan will be restricted by these agreements in the development of hydropower dams and irrigation projects (AfDB 2013).

Building Capacity of Local Communities to Participate and Benefit from Wildlife and Forest Management

Community participation has been adopted in several other countries of Africa and more so in East Africa with success. In many others, community-based natural resources management (CBNRM) is also taking root with great benefits for those involved. This is a model that can be used especially in areas that are outside the PA system but are rich in biodiversity resources. For this to be successful, awareness needs to be created first among the communities so that they can get to embrace wildlife conservation and start seeing it as a resource they can harness. Other areas of capacity building that are recommended would be in basic skills in organizational management, community policing and monitoring of illegal activities (poaching and illegal logging).

Promote Sustainable Use of Natural Resources

Environmentally sound management and protection of natural resources in all sectors will go a long way in alleviating some of the anticipated impacts of development. In this regard, there is need to clarify issues of resource allocation, property rights and land ownership. Local communities cannot invest much in protecting resources where resource tenure is unclear.

Poverty

In many of the threats identified above, poverty and lack of livelihood options is a key driver of unsustainable exploitation of natural resources. Conservation programs should therefore integrate poverty alleviation into their programming, especially in areas that are important biodiversity habitats.

ACTIONS TO PROMOTE CONSERVATION OF TROPICAL FORESTS

Several interventions geared towards the conservation of tropical forests have been proposed in this section. These are interventions that can prevent or reduce the rate tropical forests loss/or degradation. Each of the proposed intervention seeks to address a specific threat identified in section above. These include: promotion of energy efficient cook stoves; promotion of energy efficient brick making technologies; promotion of energy efficient fish smoking technologies; and expansion of plantation forests/promotion of on farm forestry in order to reduce reliance on tropical forests and woodlands for basic needs such as construction materials and fuel wood.

Promotion of Energy Efficient Cook Stoves (Wood Fuel and Charcoal)

This can significantly reduce the area of forests and woodlands lost for purposes of providing energy for domestic use. Energy efficient cook stoves are readily available and have been in use in the Darfur region and

other parts of East Africa (GOSS and UNDP, 2011). Wood fuel is also used for lighting in the rural areas meaning more wood is consumed. Solar sources of lighting could also be promoted as an alternative, especially in the urban areas.

Promote Efficient Brick Making Techniques

There are several technologies that can be used in the making of brick such as high pressure brick molding that do not use wood fuel. Research should be undertaken to identify other such technologies, which should then be disseminated to those involved in brick making activities.

Promote Efficient Fish Smoking Methods

This can mitigate against woodlands loss where fishing is a livelihood along the Nile. Bearing in mind that there is under production of fish in South Sudan and that the government has committed to expand the sector, urgent measure must be taken to ensure the requisite measures are in place.

Improve Management and Expand Area under Plantation Forests

To prevent the need to source high value timber solely from natural forests, there is a need to increase production from forest plantations. The potential for this is enormous in the country, but plantations currently occupy only 0.1 % of the total forest estate. Efforts should be made to increase this.

ACTIONS TO PROMOTE CONSERVATION OF BIODIVERSITY

Several interventions to promote conservation of biodiversity in South Sudan are proposed in the section below and these include: training in commercial livestock production as part of an effort to keep livestock stocking rates at sustainable levels, thereby preventing land degradation; development of species conservation programs for species that are at risk of local extinction; prudent management of the exploitation of the oil and mineral resources to prevent degradation of critical habitats for biodiversity; and expansion of the PA network to include ecosystems and critical habitats for biodiversity.

Livestock Management

Livestock management is often practiced as a subsistence activity within South Sudan, however promotion of commercial management of livestock may help to better manage stock in confined areas, thus limiting encroachment into forested or other environmentally important areas. This can be achieved through the following actions according to AfDB (2013):

- Running campaigns that change the mind sets of the pastoral communities;
- Creation of a market based platform; and
- Establishment of a private sector driven value chain system that focuses on production. This would need government support.

Development and Implementation of Species Conservation Programs

Although certain species of wildlife have been significantly reduced, viable populations still exist for the giraffe, buffalo, and lions among others. Species will benefit from the implementation of species specific programs that would enhance not only protection, but also breeding. This has already been recommended for

the remaining giraffe population in South Sudan. However, the first priority should be reducing or eliminating identified threats.

Prudent Management of the Oil Sector

If well managed, oil can benefit South Sudan while at the same time causing minimal damage to the environment. GOSS has committed to ensuring sound management of the oil sector. Capacity building in terms of staff training will be a prerequisite for effective management. The Ministry of Mining and Energy is aware of this need and, with the support of international assistance, hopes to manage the sector by issuing exploration and licensing agreements, monitoring production and compliance with safety and environmental standards, and marketing (SSDP, 2011).

Expand the PA Network to Include Certain Habitats

While the PA system covers about 10 % of the country's total land area, it does not include all of the critical habitats/ecosystems necessary for the effective protection of the South Sudan's biodiversity. Proposals have been made to expand PAs to include unprotected areas. One such area is the migratory corridor/dispersal area for the White eared Kob. This critical habitat should be protected for its biodiversity importance and tourism value. Integrated planning using the Landscape approach is already underway in the Boma-Jonglei-Equatoria area by WCS/GOSS with funding from USAID (see Annex A, Map 4). Other areas proposed for inclusion in the PA network include the afro montane forests ecosystem that is also rapidly being lost (GOSS and UNDP, 2011). The principles of CBNRM can be tested and tried out in areas within the species range that are outside the PA system.

CONCLUSIONS AND RECOMMENDATIONS

South Sudan has undergone significant changes since the signing of the CPA. Key among them is the high number of returnees after independence as well as the IDPs who have been moving back to their original homes. As a result, the need to provide the requisite infrastructure and services to the people of South Sudan is even more urgent, with the numbers being overwhelming to the new government. During the years of war, the country relied principally upon food relief and post-independence, food security remains a principal challenge for the people of South Sudan.

Agriculture and infrastructure developments among many others will definitely impact tropical forests and Biodiversity. While development cannot be stopped, integrated planning for the proposed activities can go a long way towards alleviating or minimizing such impacts. GOSS has acknowledged the need to take care of its natural capital and proposes to put the necessary policies and regulations in place. It has also committed to ensuring that development activities are subjected to an environmental assessment review process, measures intended to reduce adverse impacts on the Environment. However, capacity of the respective sector ministries in environment and natural resources management is still very weak to play their roles effectively. The government's capacity to also undertake integrated planning is also limited another area where they would need support.

The following are some of recommendations made on the way forward.

- Capacity building for staff in the MAF, MWCT, Ministry of Environment and Water and Irrigation is essential for implementing the necessary environmental safeguards. Before any capacity building is done in the MWCT, there will be a need to rationalize the staff in order to create a cadre that can contribute positively towards wildlife management. In terms of personnel, and resources the government should be impressed upon to treat this as urgent.
- Ways and means of reducing the heavy reliance on forests and woodland resources needs to be identified and the recommendations implemented. Some of the actions that can be undertaken immediately include:
 - Promotion of energy efficient cook stoves especially in the urban centres. Easier access to liquefied petroleum gas (LPG) could go a long ways towards reducing charcoal consumption.
 - Regulate charcoal trade in particular that destined for the export market, which has potential to degrade vast areas of woodlands. The high demand for charcoal for export, especially in counties neighboring Sudan and parts of Kenya and Sudan can be used as an entry point to promote afforestation/farm forestry as an economic activity. Local communities will take up an initiative if they think there are benefits to be derived.
 - Even if the local communities take up afforestation/farm forestry activities, it will be a while before the tree mature. One possibility to be explored is if the woodlands can be sustainably harvested to provide the needed wood resources without destroying all the trees.
 - Clarify land ownership/tenure issues. Where this is clear, one is able to protect that which is theirs. When resource tenure is not clear, there is unsustainable extraction of natural resources.
 - Promote methods /technologies of making bricks that do not need firing.
 - To minimize impacts of illegal logging, the MAF should involve local communities in policing forests. Modalities of doing this should include a benefit sharing arrangement with the local communities.
 - To reduce the bush meat trade, awareness creation should be done in the entire country. South Sudanese must be made to appreciate their wildlife heritage. This must also be coupled with efforts by the MWCT personnel to destroy bush meat trade markets in the country. An effort such as this will only work if the MCWT is well is: (i) well connected with

their counterparts at the state/county government level (ii) well provided for in terms of personnel and resources (vehicles, fuel).

- Local Conservation groups should be formed at the local levels in particular in areas rich in wildlife. Another option could be the establishment of wildlife Clubs in schools. This helps create a constituency for wildlife among the children.

PHASE 2 TASKS AND OUTCOMES

The following are tasks that should be undertaken and/or verified during the Phase 2 of this study.

- 1) Review the policy, legislative and administrative framework for biodiversity conservation and tropical forests in South Sudan.
- 2) Discuss with the government ministries involved in the management of biodiversity and tropical forests challenges and constraints to sustainable management of these resources and ways and means of addressing some of these challenges. The new information will be used to update the section on threats and potential solutions.
- 3) Confirm the status and number of PAs in South Sudan. Although the area of the PA remains the same, there are some conflicting figures on which of these are designated as NPs and how many are national reserves.
- 4) There is also need to confirm if any work has been done towards to clarification of boundaries of each of the respective PAs.
- 5) Desk review has revealed that mapping of the forests reserves and plantations has been undertaken since 2007. There is need to verify which of these areas have been surveyed and mapped and with that new information, update information on gazetted forest reserves and existing forest plantations and their sizes.
- 6) Update information in Table 4 on donors and agencies involved in the conservation of tropical forests and biodiversity. The information in Table 4 is not current nor is it exhaustive and some of the details need to be clarified.

REFERENCES

- ADDE, A. E. 2013. Geology and Mineral Investment Opportunities in South Sudan. Ministry of Petroleum and Mining (GOSS). Juba.
- Africa Forest Forum. 2011. Forest Plantations and Woodlots in Sudan. Africa Forest Forum Working paper Series, Vol. 1: Issue 15.
- African Development Bank (AfDB). 2013. South Sudan: An Infrastructure Action Plan – A Program of Sustained Growth. Available online at: [http://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/South %20Sudan %20Infrastructure %20Action %20Plan %20- %20 %20A %20Program %20for %20Sustained %20Strong %20Economic %20Growth %20- %20Full %20Report.pdf](http://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/South%20Sudan%20Infrastructure%20Action%20Plan%20-%20%20A%20Program%20for%20Sustained%20Strong%20Economic%20Growth%20-%20Full%20Report.pdf).
- Brown, M. and Sidahmed, A. 2009. Expanding Agriculture and Food Security Activities in Southern Sudan. Assessment Report for USAID/Sudan Economic Growth Team.
- Food and Agriculture Organization of the United Nations (FAO). 2005. Global Forest Resources Assessment 2005. Rome: FAO. Available online at: <http://www.fao.org/docrep/008/a0400e/a0400e00.htm>.
- FAO. 2010. Global Forest Resources Assessment 2010. Rome: FAO. Available online at: <http://www.fao.org/forestry/fra/en/>
- Government of the Republic of South Sudan (GOSS). 2011. South Sudan Development Plan 2011-2013: Realising freedom, equality, justice, peace and prosperity for all. Available online at: <http://www.jdt-juba.org/wp-content/uploads/2012/02/South-Sudan-Development-Plan-2011-13.pdf>.
- GOSS and United Nations Development Programme (UNDP). 2011. Environmental Impacts Risks and Opportunities Assessment: Natural Resources Management and Climate Change in South Sudan. Available online at: [http://www.ss.undp.org/content/dam/southsudan/library/Reports/southsudanothertools/EIRO %20Report-fr-website.pdf](http://www.ss.undp.org/content/dam/southsudan/library/Reports/southsudanothertools/EIRO%20Report-fr-website.pdf).
- Harrison, M.N. and Jackson, J.K. 1958. Ecological Classification of Vegetation of Sudan. Bulletin No. 2. 1-45 Forest Dept. Khartoum.
- Ibrahim, A.B. and Badi, K.H. 2006. Forest Management and Conservation, HCENR, National Plan for Environment Management. Paper presented to UNEP PCEA workshop in Khartoum.
- International Resources Group (IRG). 2007. Southern Sudan Environmental Threats and Opportunities Assessment. Biodiversity and Tropical Forest Assessment. IRG, Washington, DC, USA.
- International Union for Conservation of Nature (IUCN). 2012. Red List of Threatened Species. Available online at: <http://www.iucnredlist.org/>
- Jackson J. K. Undated. The Imatong Mountains Forest Reserve. In Sudan Wildlife and Sport.
- Lomuro, M. E. 2012. 2012: The Status, Potential and the Strategy for Development of the Livestock and Fisheries Sectors. Paper Presented to the First Investment Summit of the Government of South Sudan. March 20-22, 2012. Juba.
- Marais, A.J., Fennessy, S. and Fennessy, J. 2012. Country Profile: A rapid assessment of the giraffe conservation status in South Sudan. Giraffe Conservation Foundation, Windhoek, Namibia.

- Moukaddem, K. 2011. South Sudan's tropical forests fast disappearing. Mongabay environmental news. June 6. Available online at: http://news.mongabay.com/2011/0605-moukaddem_southsudan.html
- National Bureau of Statistics (NBS). 2012. National Baseline Household Survey 2009: Report for South Sudan. Available online at: [http://ssnbs.org/storage/NBHS %20Final %20website.pdf](http://ssnbs.org/storage/NBHS%20Final%20website.pdf).
- Ogwaro, B. A. 2011. South Sudan AgriBusiness Potential. Paper Presented to the Agribusiness Forum on 19th October, in Johannesburg, Republic of South Africa by the Minister for Agriculture (PPT).
- Seme, I. 2014. Personal communication with Jane Kahata. Ministry of Wildlife Conservation and Tourism.
- Riak, M.K. Undated. Sudd Area as a Ramsar Site: Biophysical Features. *Key Documents of the Ramsar Convention*.
- Rucker, A. 2011. Sudan's Wildlife Migration Miracle. USAID Frontlines. September/October 2011. Available online at: [http://www.usaid.gov/news-information/frontlines/sudan-south-sudaneducation/sudan %E2 %80 %99s-wildlife-migration-miracle](http://www.usaid.gov/news-information/frontlines/sudan-south-sudaneducation/sudan%E2%80%99s-wildlife-migration-miracle).
- Specht, I., Dorp M.V., Okeyo, W., Groot, M.C., and de Ngong, J.P. 2009. Public Private Cooperation in Fragile States: Field study report on Sudan. ICCO Cooperation, The Netherlands. Available online at: <http://www.icco.nl/nl/linkservid/39A0FBFC-E3A3-8976-6BE8B0B809F381D9/showMeta/0/>
- United Nations Development Program (UNDP). 2009. Launching Protected Area Network Management and Building Capacity in Post-conflict Southern Sudan. Available online at: <http://www.ss.undp.org/content/dam/southsudan/library/Documents/Project%20Document/UNDP-SS-ProtectedAreaNetworkMGMTProjDoc.pdf>
- United Nations Environment Program (UNEP). 2007. Post-conflict Environmental Assessment in Sudan UNEP. Sudan 2007. Available online at: <http://www.unep.org/sudan/>
http://sudanreport.unep.ch/sudan_website/.
- United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA). 2013. South Sudan. Available online at: <http://www.unocha.org/south-sudan/>.
- United States Agency for International Development (USAID). 2005a. Best Practices for Biodiversity and Tropical Forest Assessments. Available online at: http://pdf.usaid.gov/pdf_docs/PNADE673.pdf
- USAID. 2005b. Tropical Forestry and Biodiversity (FAA 118 and 119) Analyses: Lessons Learned and Best Practices from Recent USAID Experience. Available online at: http://pdf.usaid.gov/pdf_docs/PNADE195.pdf
- Verjee, A. 2013. Is all well in the Teak Forest of South Sudan? Available online at: <http://africanarguments.org/2013/03/14/is-all-well-in-the-teak-forests-of-south-sudan-by-aly-verjee/>
- Wildlife Conservation Society. 2007. Massive herds found to still exist in Southern Sudan.
- Zimmer, C. 2007. In Sudan, an Animal Migration to Rival Serengeti. New York Times. New York. June 12. Available online at: http://www.nytimes.com/2007/06/12/science/12migr.html?_r=0

ANNEX A: MAP PORTFOLIO

Please refer to the attached Annex A: Maps – A collection of maps displaying the intersection between natural resources and human activities in South Sudan.

Annex A: Maps



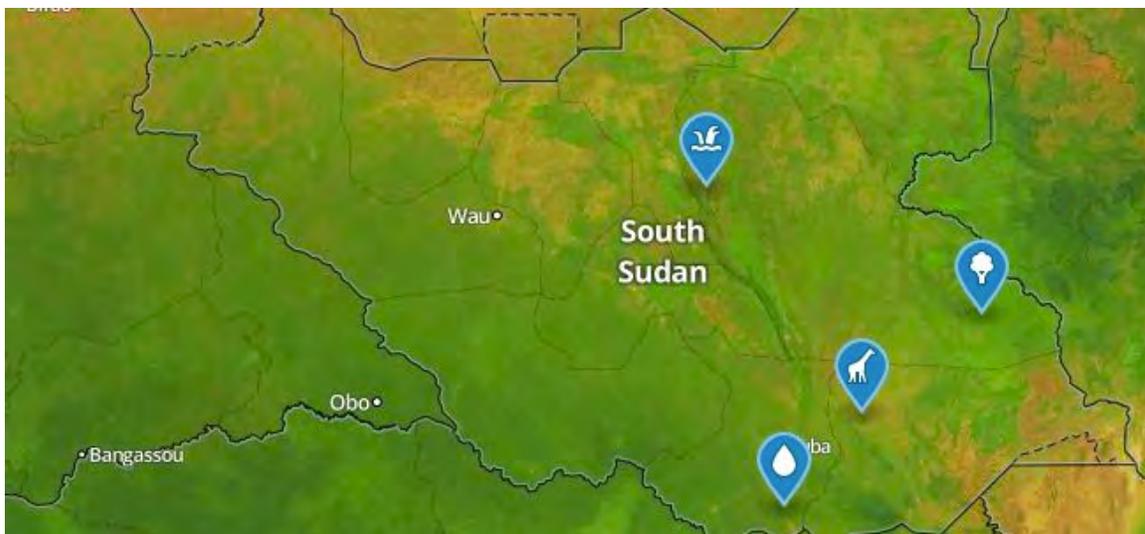
A collection of maps displaying the intersection between natural resources and human activities in South Sudan

This document was prepared by Geosprocket LLC, subcontractor to The Cadmus Group, Inc. under USAID's Global Environmental Management Support Program, Contract Number GS-10F-0105J. The contents are the sole responsibility of the authors and do not necessarily reflect the views of USAID or the United States Government.

Background: An assessment of existing, environmentally-focused spatial data infrastructure for South Sudan.

Overview

The relatively-young Republic of South Sudan has abundant resources. While mineral resources in the form of oil and gas have been the focus of international interest, geopolitical conflict and some internal division, the country's natural resources are of similar - arguably greater - importance. Since gaining autonomy in 2005 and independence in 2011, the government of South Sudan has enacted varying measures to protect these resources, which include dramatic wildlife migration routes in Bandingilo National Park and essential ecosystem services from the massive Sudd wetland complex:



Though South Sudan is [better positioned economically than many of its neighbors](#), it still grapples with extreme poverty. It is under such conditions that great pressure can be brought to bear on natural resources, and it is imperative that they be governed with the right balance of empowerment and sustainability. Enabling this balance is a clear and regular assessment of the country's biodiversity and forest resources. Following up on [a 2007 report on environmental threats and opportunities in South \(then 'Southern'\) Sudan](#), USAID is undertaking a post-independence analysis of the same resources, policies and features.

A major component of this study is an audit of existing geospatial resources that describe some portion of South Sudan's ecological spectrum. Too often - particularly in the realm of international development - mapping efforts are duplicated and results missed; it is our hope to build on established work for the present initiative, as well as to be able to pass on the resources we find. Subsequent phases of this study include remote sensing analyses of forest type and desertification patterns, as well as a geospatial investigation of the human footprint on the country's natural resources. But below is an accounting of the datasets available now that relate to the ecological landscape of South Sudan.

Note on Edits & Contributions

This catalog is not static, and it is only possible to keep it updated with support from community stakeholders. As such, all constructive [pull requests](#) will be honored, with the hope that valuable contributions will keep this resource current.

Dataset Categories

This catalog places an emphasis on national-scale datasets. Though many useful studies and maps are focused on regions and localities in South Sudan (here is [an excellent example](#) from Gorsevski et al.), for the purposes of this study we are interested in patterns and processes that can be assessed at national scale and moderate resolution.

Datasets are categorized by broad theme below. Some are hosted in this repository and others (due to file size restrictions) are linked to external resources. Wherever possible, global- and continental-scale datasets have been clipped to the [South Sudan area of interest](#), which includes disputed areas and a 20km buffer beyond the national border.

Land Use & Land Cover

Name	Source	Type	Format	Notes
UMD - Global Forest Cover Change 2000-2012	University of Maryland/Google	LULC	GeoTIFF	Available in Tiled Format
Africover - Land Cover Datasets	FAO/GLCN - Africover	LULC	GeoTIFF	Outdated - imagery vintage is 1994-1999
National LULC 2010	FAO/GLCN - Africover	LULC	PDF	Unfortunately not available here in portable format - imagery vintage is 2010
MODIS Land	Boston	LULC	HDF/GeoTIFF	Coarse resolution w/

Cover	University/NASA			high category detail
OSM - Land Use	Openstreetmap	LULC	GeoJSON	Extracted February 2014 - Access more recent versions here

Additional Academic Studies of land use/land cover in South Sudan are [available here](#), though not with downloadable datasets.

Built Infrastructure

Name	Source	Type	Format	Notes
OSM - Roads	Openstreetmap	Built Infrastructure	GeoJSON	Extracted February 2014 - Access more recent versions here
OSM - Airfields	Openstreetmap	Built Infrastructure	GeoJSON	Extracted February 2014 - Access more recent versions here
OSM - Walls/Barriers	Openstreetmap	Built Infrastructure	GeoJSON	Extracted February 2014 - Access more recent versions here
OSM - Railway	Openstreetmap	Built Infrastructure	GeoJSON	Extracted February 2014 - Access more recent versions here
UNDP - Airfields	UNITAR	Built Infrastructure	GeoJSON	Authoritative
UNDP - Roads	UNITAR	Built Infrastructure	GeoJSON	Not as extensive as OSM
GAM - Travel Time	Nelson et al. (2008)	Built Infrastructure	GeoJSON	Dated - Based on Yr 2000

Political Boundaries & Places

Name	Source	Type	Format	Notes
Africover - Major Towns	FAO - Africover	Places	GeoJSON	Data fro pre-independence
Africover - Minor Towns	FAO - Africover	Places	GeoJSON	Data fro pre-independence
Natural Earth - Disputed Areas	Natural Earth	Political Boundaries	GeoJSON	Moderate resolution
Natural Earth - Populated Places	Natural Earth	Places	GeoJSON	

Natural Earth - National Boundary	Natural Earth	Political Boundaries	GeoJSON	Does not conform exactly with other datasets
OSM - National Boundary	Openstreetmap	Political Boundaries	GeoJSON	Matches GAUL, encompasses disputed areas
OSM - National AOI	Openstreetmap	Political Boundaries	GeoJSON	Used as the clip boundary for all other datasets
OSM - States	Openstreetmap	Political Boundaries	GeoJSON	County designation in Upper Nile State Unclear
OSM - Populated Places	Openstreetmap	Places	GeoJSON	Not as extensive as UNITAR or Africover
UNDP - Counties	UNITAR	Political Boundaries	GeoJSON	Covers all but a small disputed section of Kafia Kingi
UNDP - States	UNITAR	Political Boundaries	GeoJSON	Authoritative
UNITAR - Polling Stations	UNITAR	Places	GeoJSON	Used for independence referendum
UNITAR - Populated Places	UNITAR	Places	GeoJSON	Authoritative

Hydrology

Name	Source	Type	Format	Notes
Africover-Rivers	FAO - Africover	Hydrology	GeoJSON	Outdated - Imagery ca. 1995-1999
Africover-Surface Water	FAO - Africover	Hydrology	GeoJSON	Outdated - Imagery ca. 1995-1999
OSM - Waterway Polygon	OpenStreetmap	Hydrology	GeoJSON	Extracted February 2014 - Access more recent versions here
OSM - Waterway Point	OpenStreetmap	Hydrology	GeoJSON	Extracted February 2014 - Access more recent versions here

[OSM - Waterway Line](#) OpenStreetmap Hydrology GeoJSON Extracted February 2014
- Access more recent versions [here](#)

[OSM - Wetland Polygons](#) OpenStreetmap Hydrology GeoJSON Extracted February 2014
- Access more recent versions [here](#)

Protected/Habitat Areas

Name	Source	Type	Format	Notes
IUCN - Elephant Range	International Union for the Conservation of Nature	Habitat	GeoJSON	2007 Vintage - Currently being updated
OSM - Conservation Areas	Openstreetmap	Protected Areas	GeoJSON	Extracted February 2014 - Access more recent versions here
WDPA - Protected Areas	World Database of Protected Areas	Protected Areas	GeoJSON	Poor data availability in South Sudan

Mineral Resources

Name	Source	Type	Format	Notes
ECOS - Oil Concessions	European Coalition on Oil in Sudan	Mineral	GeoJSON	2007 Vintage - Provided on ECOS Homepage with notes about planned subdivision of concession block B
ECOS - Oil Fields of Abyei	European Coalition on Oil in Sudan	Mineral	PDF	2006 Vintage - Oil production in a disputed area.

Data Providers

- [FAO/GLCN \(Africover\)](#) - Global Land Cover Network
- [ECOS](#) - European Coalition on Oil in Sudan
- [IUCN](#) - International Union for the Conservation of Nature
- [Natural Earth Data](#)
- [OpenStreetmap](#)
- [UNITAR](#) - United Nations Institute for Training and Research
- [WDPA](#) - World Database of Protected Areas
- [Google](#) - Compiled via directed Map Maker initiative

Tools for Working With Geospatial Data

- [OGRE](#) - Online conversion to/from GeoJSON and Shapefile formats
- [Quantum GIS](#) - Full-features Open-Source desktop GIS platform
- [geojson.io](#) - Online GIS editing application; GeoJSON-native
- [GDAL/OGR](#) - The Geographic Data Abstraction Library; meant for programmatic dataset manipulation

Analysis Methods

Wetlands

Derived from MOD12Q1 - MODIS Land Cover Product - for the year 2012, provided by the National Aeronautics and Space Administration. This dataset has a nominal resolution of 500m, and consists of [IGBP Land Cover Classes](#) 0 (Water) and 11 (Wetlands). The geometry file available here has been converted to vector TopoJSON format and simplified by 40% using a modified visvalingam algorithm to preserve topology. Area was calculated by pixel coverage, and as such is subject to a +/-20% margin of error.

South Sudan has just under 1 million hectares of wetland cover.

Rangeland Change

This analysis was conducted with two sets of sequential-year MODIS reflectance (Nadir BRDF-Adjusted Reflectance - NBAR) data; 2001-2003 and 2011-2013. Mean Normalized Difference Vegetation Index (NDVI - a commonly-used measure of vegetation health) was calculated per pixel for each 3-year set, then the newer dataset was subtracted from the older. Changes in NDVI of greater than 0.1 were extracted and intersected with IGBP Rangeland classes (Grassland, Open Shrubland and Savanna) derived from MOD12Q1 data. The resulting "Rangeland Change" dataset was then converted to vector format for inclusion in this study.

A more nuanced portrait of rangeland change over the past decade could conceivably be obtained by calculating changes within each of the parent IGBP rangeland classes (e.g. Grasslands), but such an analysis is beyond the scope of this study.

South Sudan lost approximately 175,000 hectares of rangeland cover between 2000 and 2012. The country has a total of about 38 million hectares of rangeland.

Travel Time

Derived from a study by [Nelson et al \(2008\)](#), this dataset was converted from raster by a simple contour extraction at an interval of 360 minutes. This produced isobars representing 6-hour intervals of travel required to reach the nearest city of 50,000 or more by land. Data latency is a potential source of error in this dataset; it represents conditions in the year 2000, and transit network datasets have greatly improved in availability over that time period.

Forest Cover Change

Produced by [Hansen et al.](#), the Global Forest Cover Change dataset represents forest cover and forest cover change at a spatial resolution of 30m, though it has been degraded to 500m for use in the current study. The original forest cover change analysis was performed on thousands of images from the USGS Landsat program, acquired between 2000 and 2012. The final determination of forest cover change was made with a weighted supervised classification algorithm.

The subset of this data available here was clipped to the South Sudan ROI polygon, then converted to vector format and simplified using a modified visvalingam algorithm to preserve topology. Area was calculated by pixel coverage, and as such is subject to a +/-20% margin of error

South Sudan lost approximately 14,000 hectares of forest cover between 2000 and 2012. The country has a total of about 17 million hectares of forest cover.

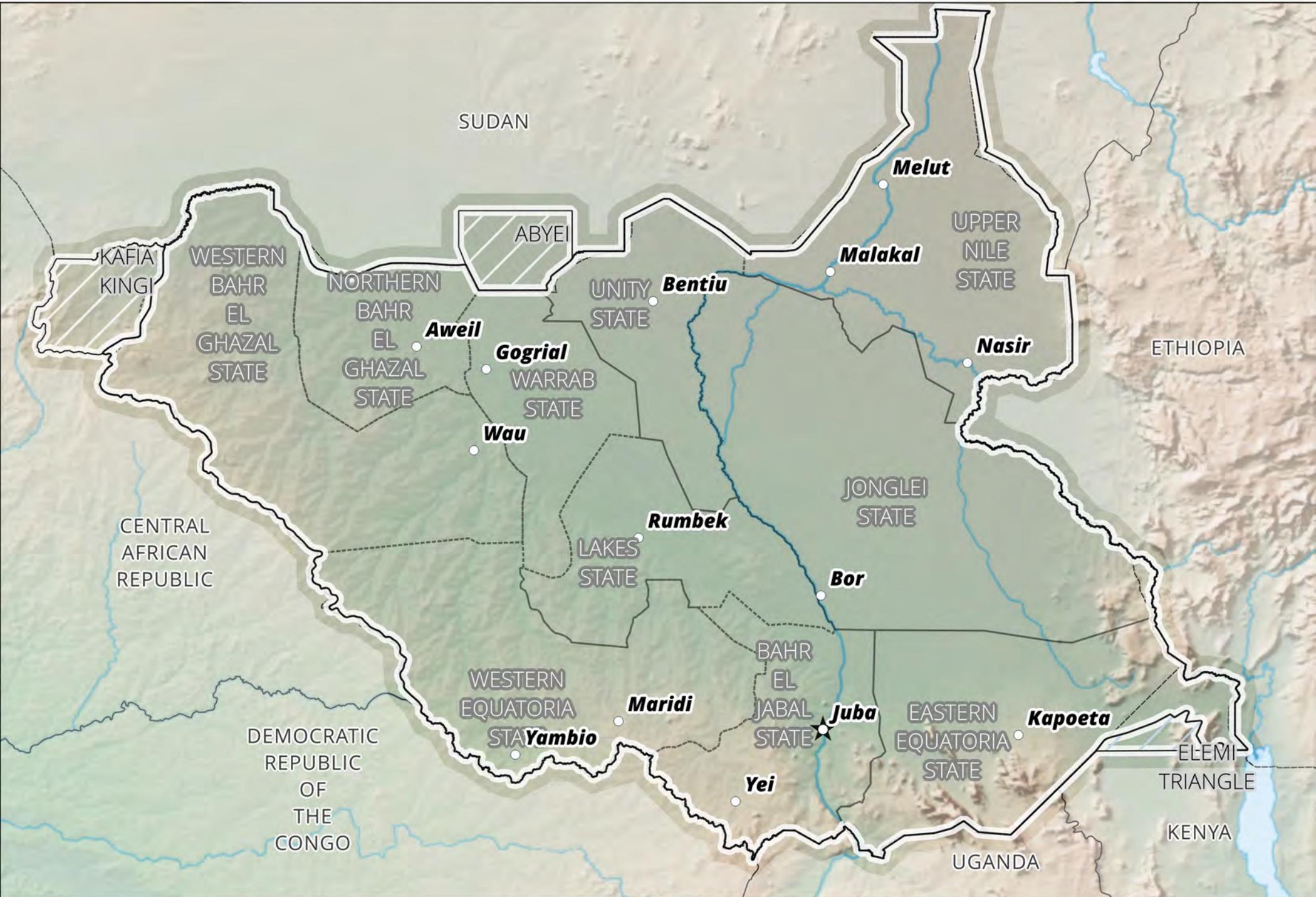
For the current study, an attempt was made to adapt part of the Hansen methodology to identify patterns of desertification over the same time period in the Sahelian region of South Sudan. Specifically, this included the same imagery inputs in a Random Forests ensemble classification scheme trained with ancillary datasets such as Africover and high-resolution imagery. However, results were not promising with well under 60% accuracy assessed, and the approach was abandoned.

Note: the static version of the forest cover change map includes barely-perceptible instances of forest cover loss over the past decade; these are mostly concentrated in the vicinity of Bor and Yei. This is partially an artifact of the spatial scale of the imagery, but may also be an indicator of reasonably-stable forest cover over the time period of 2000-2012.

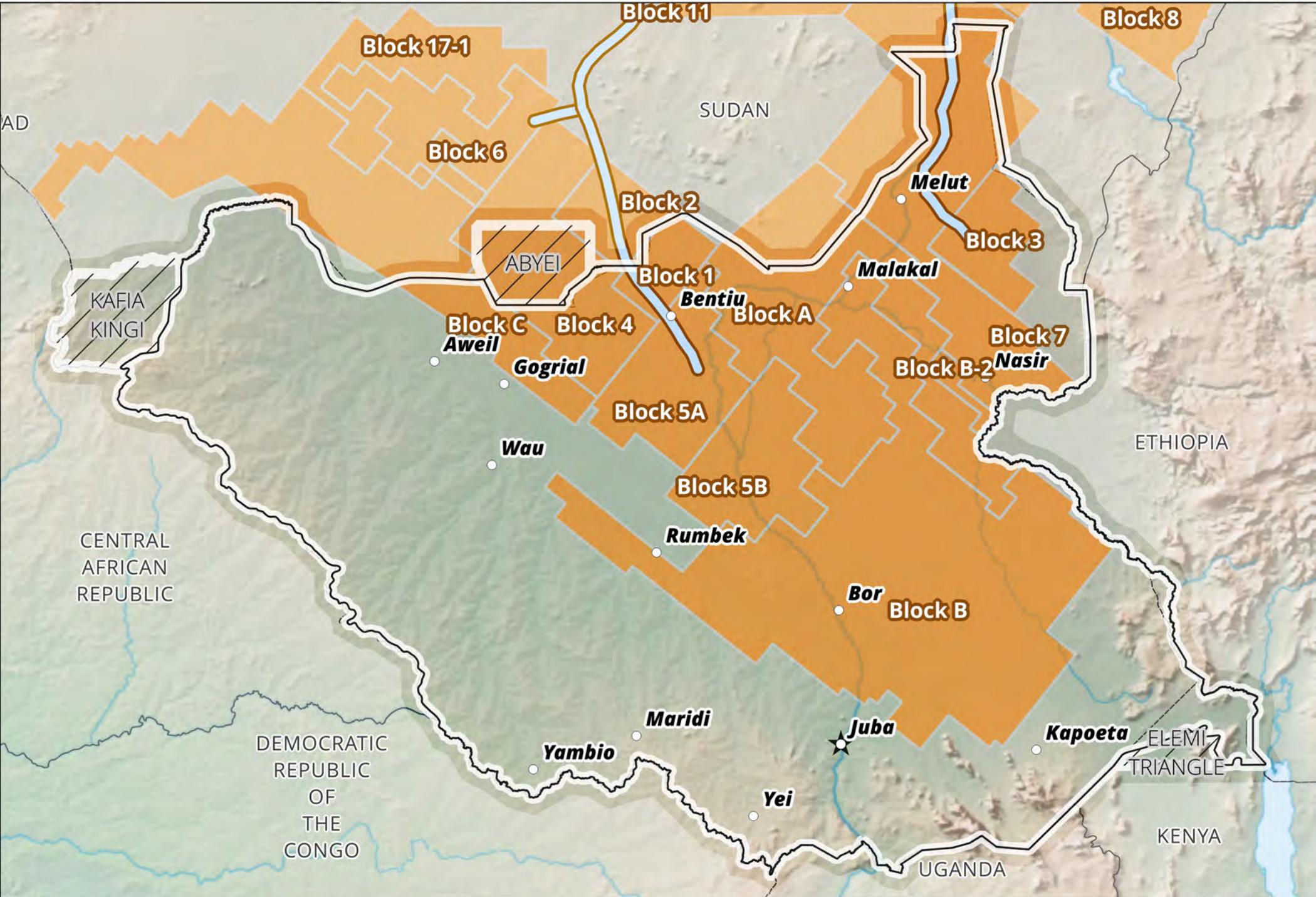
1 - Regional View



2 - States and Major Cities of South Sudan



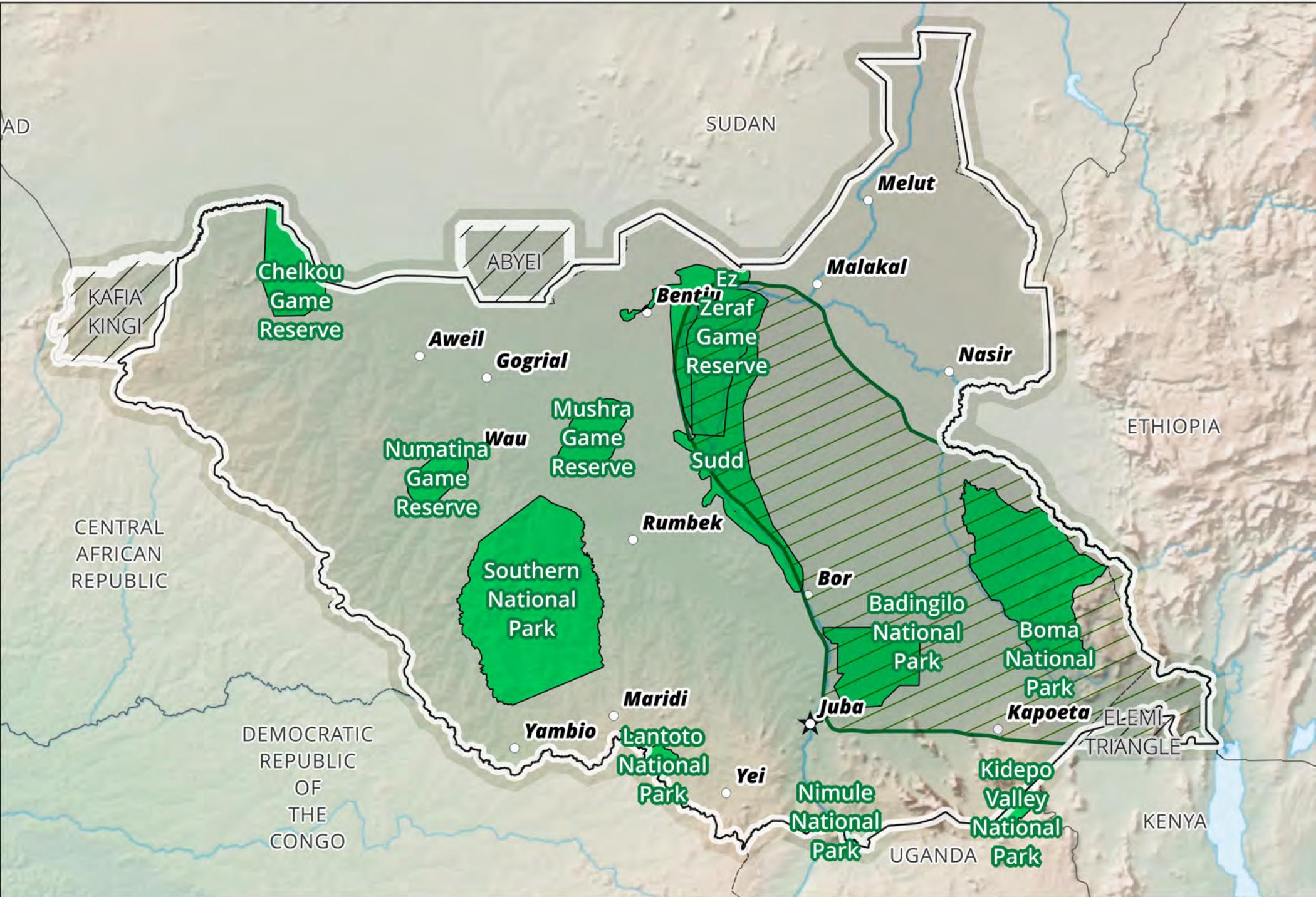
3 - Oil Concession Blocks & Infrastructure



 Oil Pipeline  Oil/Gas Concession Block

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | European Coalition on Oil in Sudan (2007 Data)

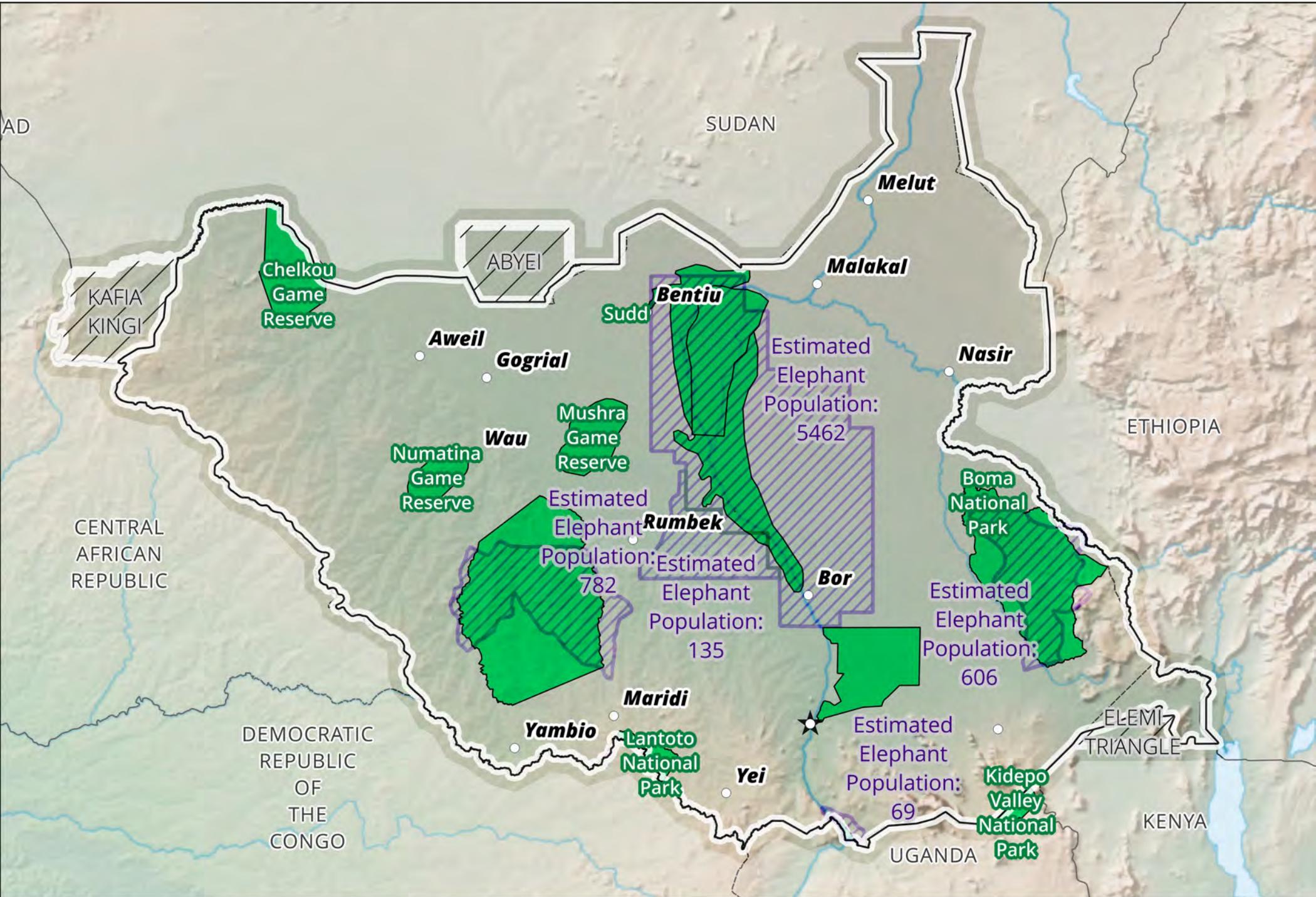
4 - Boma-Jonglei Landscape & Protected Areas of South Sudan



 Protected/Conserved Areas  Boma-Jonglei Landscape

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | World Conservation Society | USAID

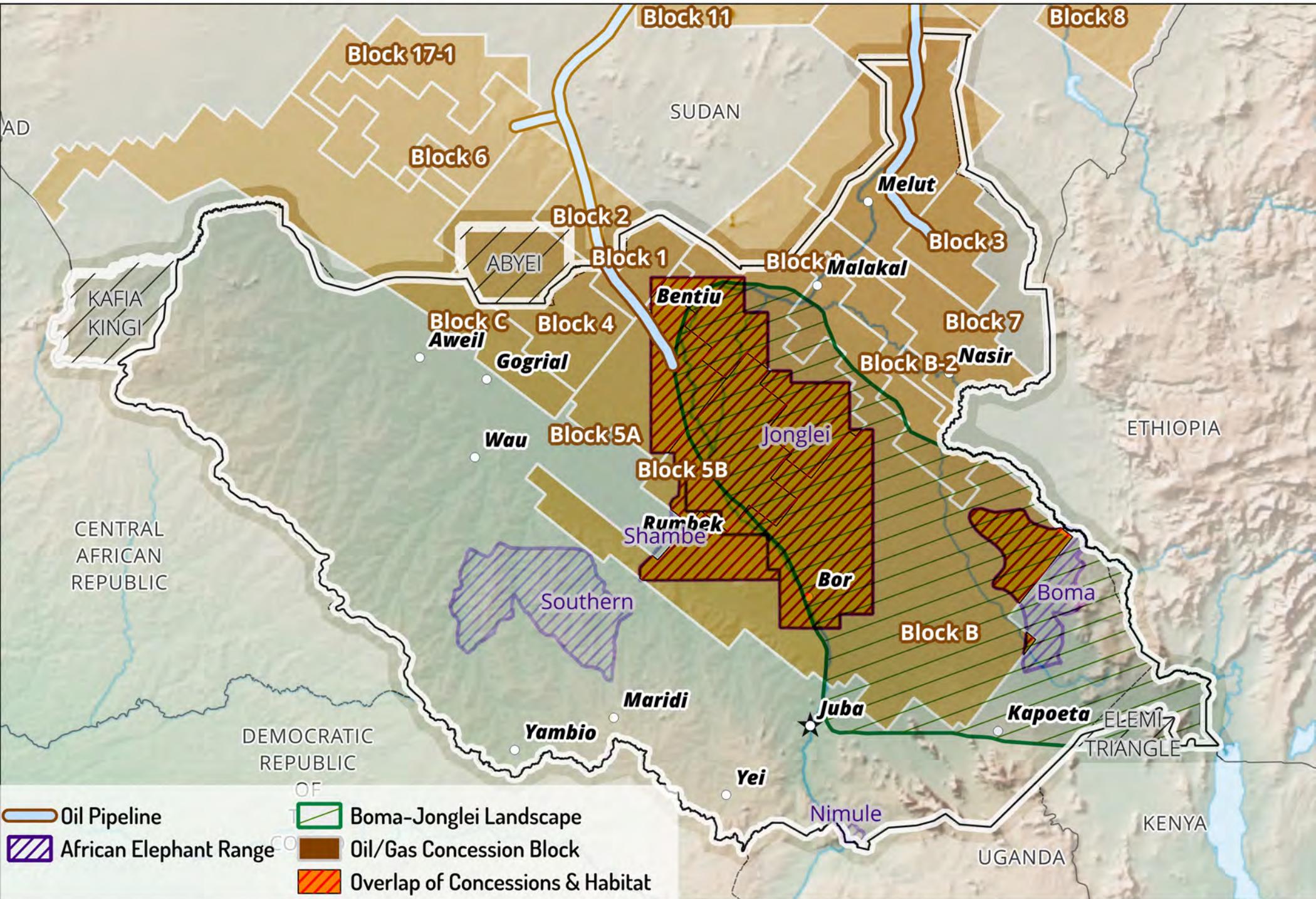
5 - Elephant Habitat & Protected Areas of South Sudan



Protected/Conserved Areas
 African Elephant Range

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | International Union For the Conservation of Nature (2012)

6 - Overlap of Elephant Habitat & Oil/Gas Concessions in South Sudan



Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | International Union For the Conservation of Nature (2012) | European Coalition on Oil in Sudan (2007)

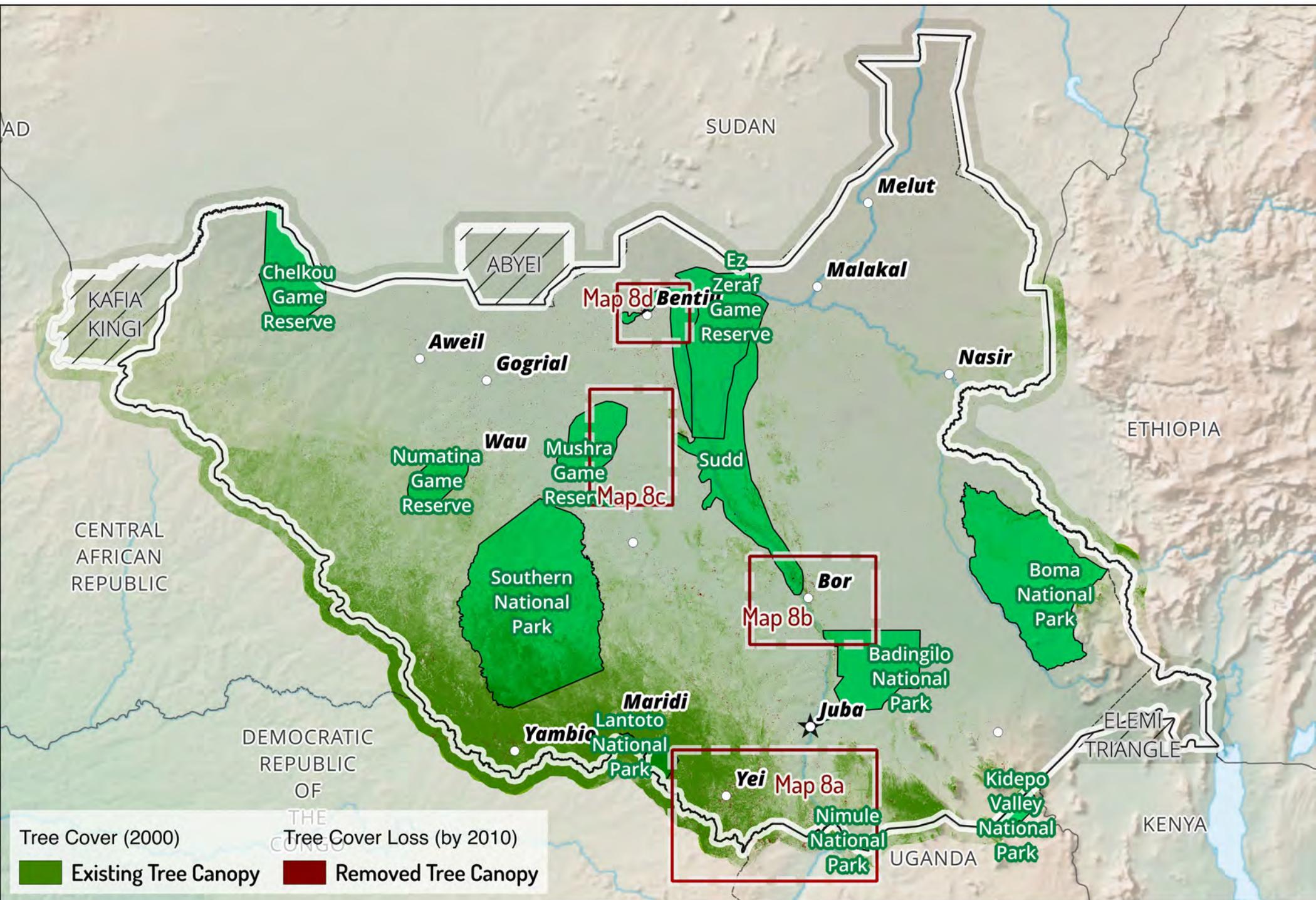
7 - Wetland Complexes in South Sudan



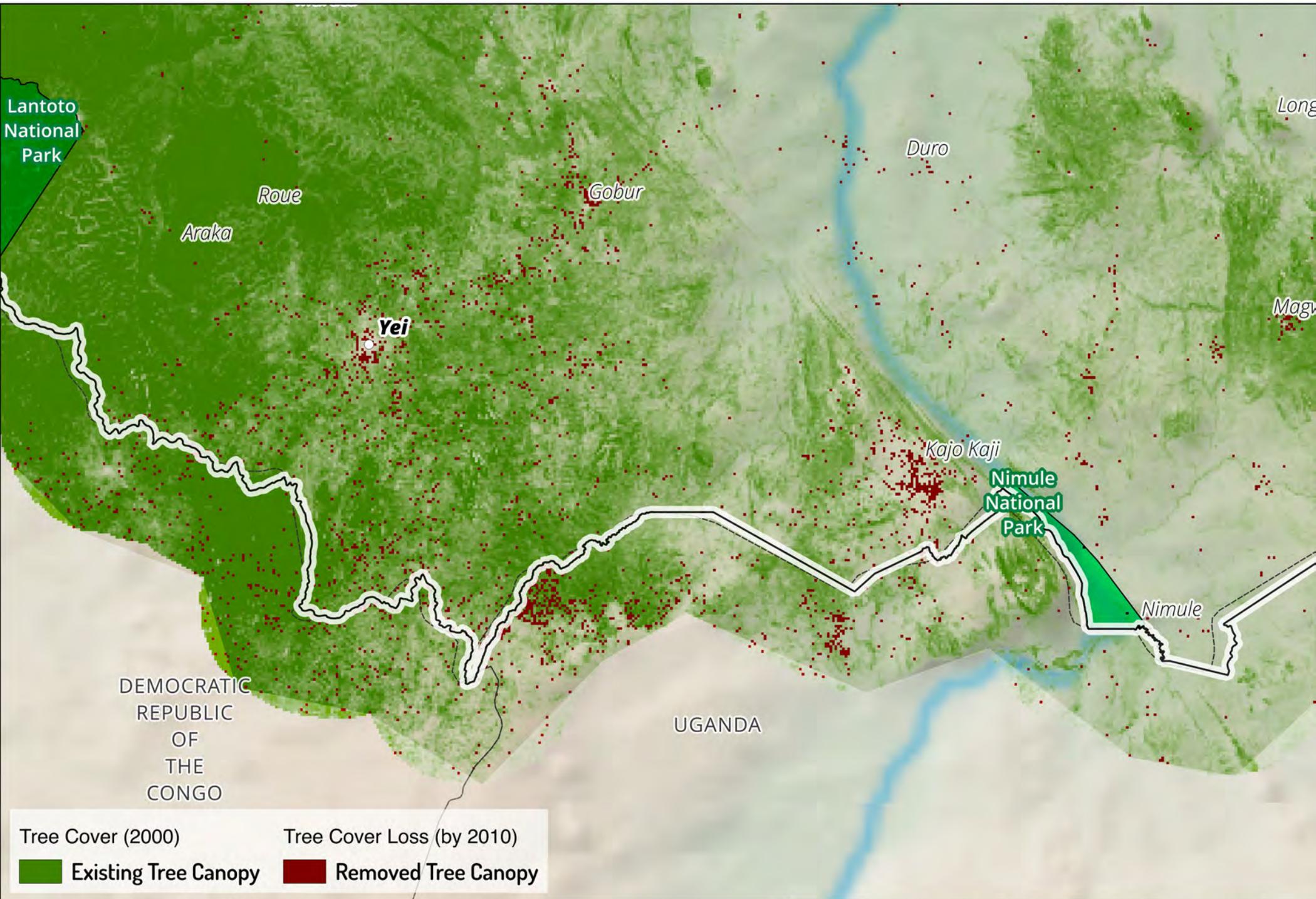
MODIS-Detected Wetlands

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | NASA (2012)

8 - Forest Cover and Forest Change in South Sudan, 2000-2012



8a - Forest Cover and Forest Change Near Yei, 2000-2012

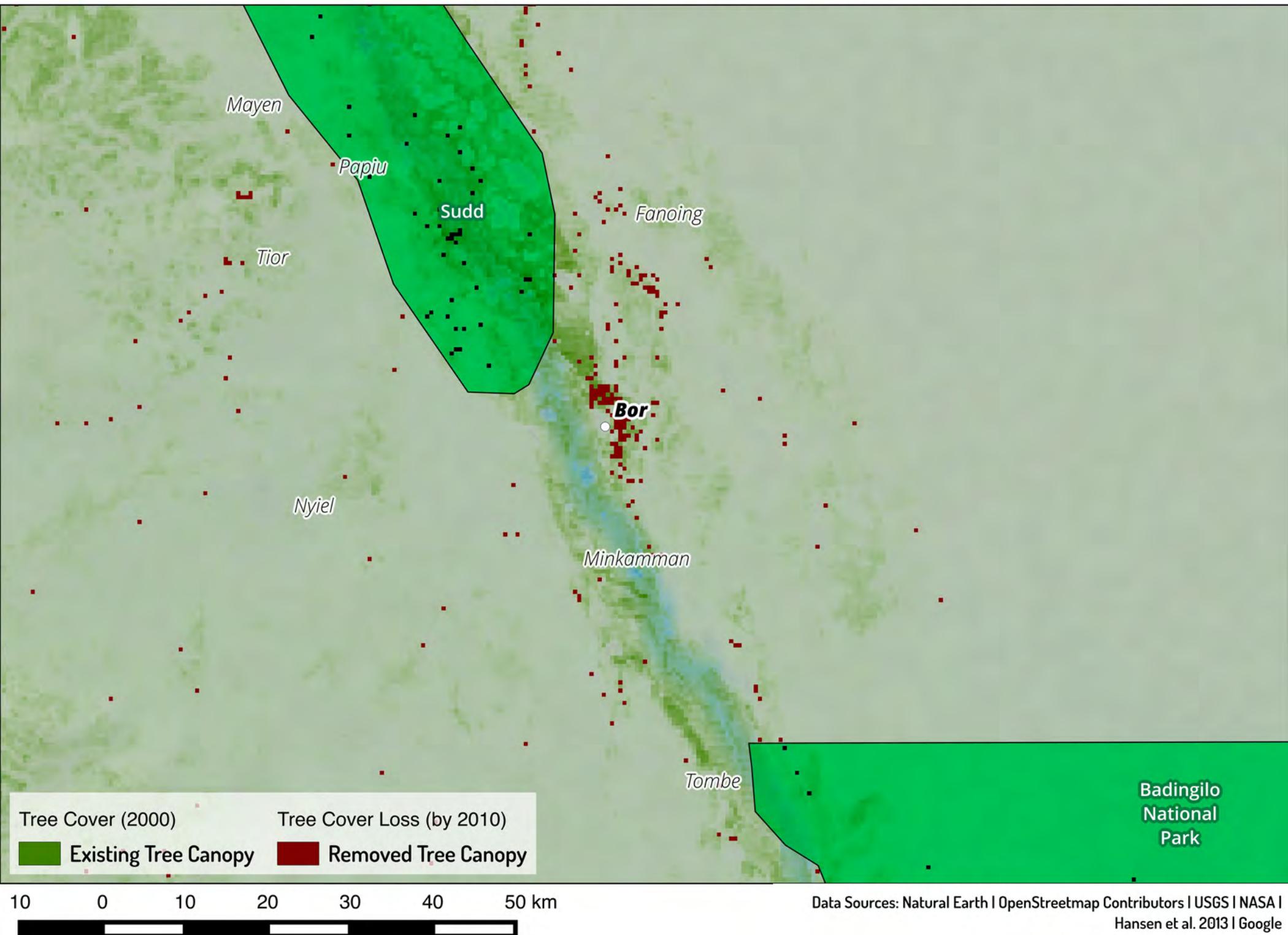


10 0 10 20 30 40 50 km

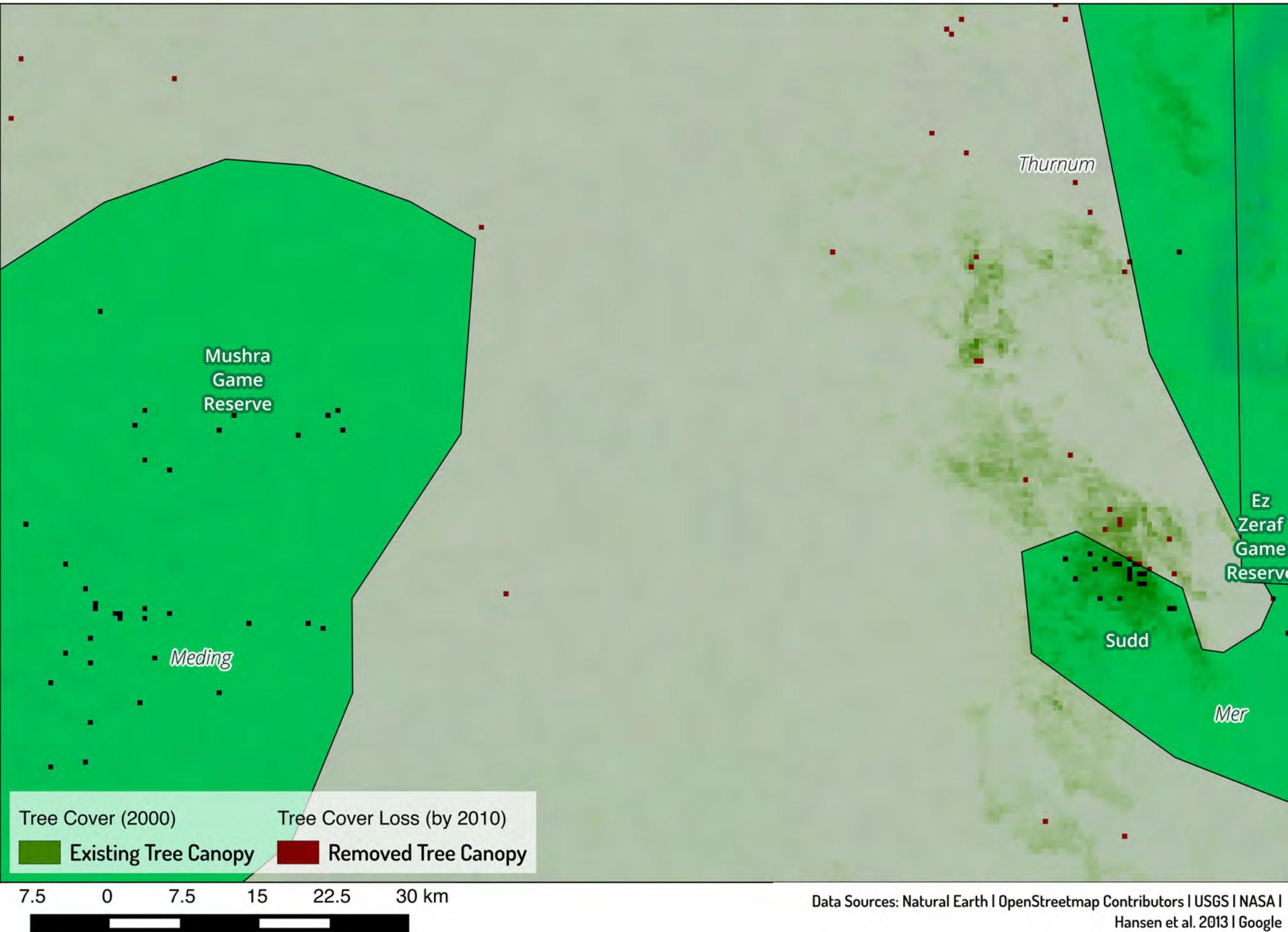


Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | NASA | Hansen et al. 2013 | Google

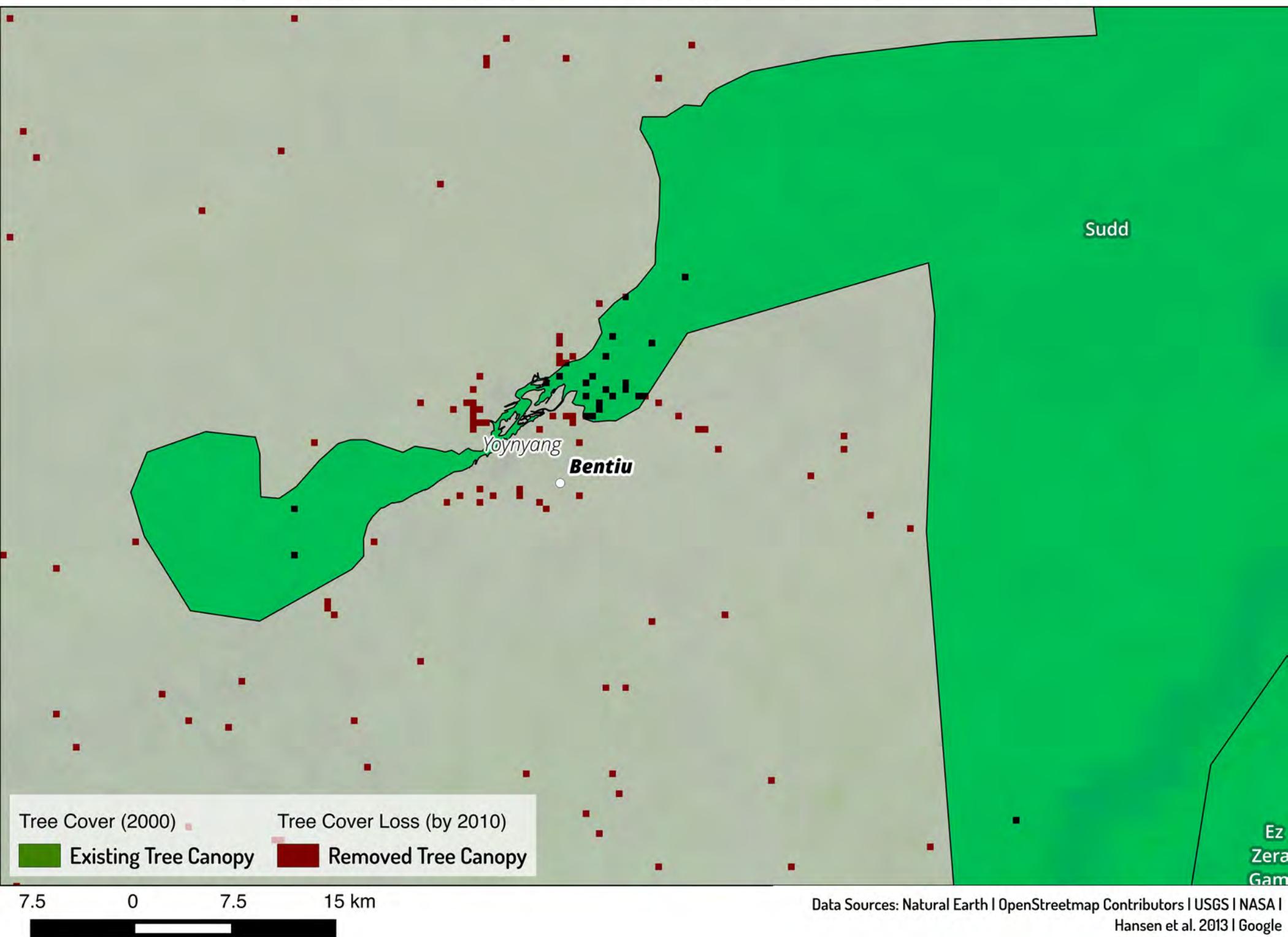
8b - Forest Cover and Forest Change Near Bor, 2000-2012



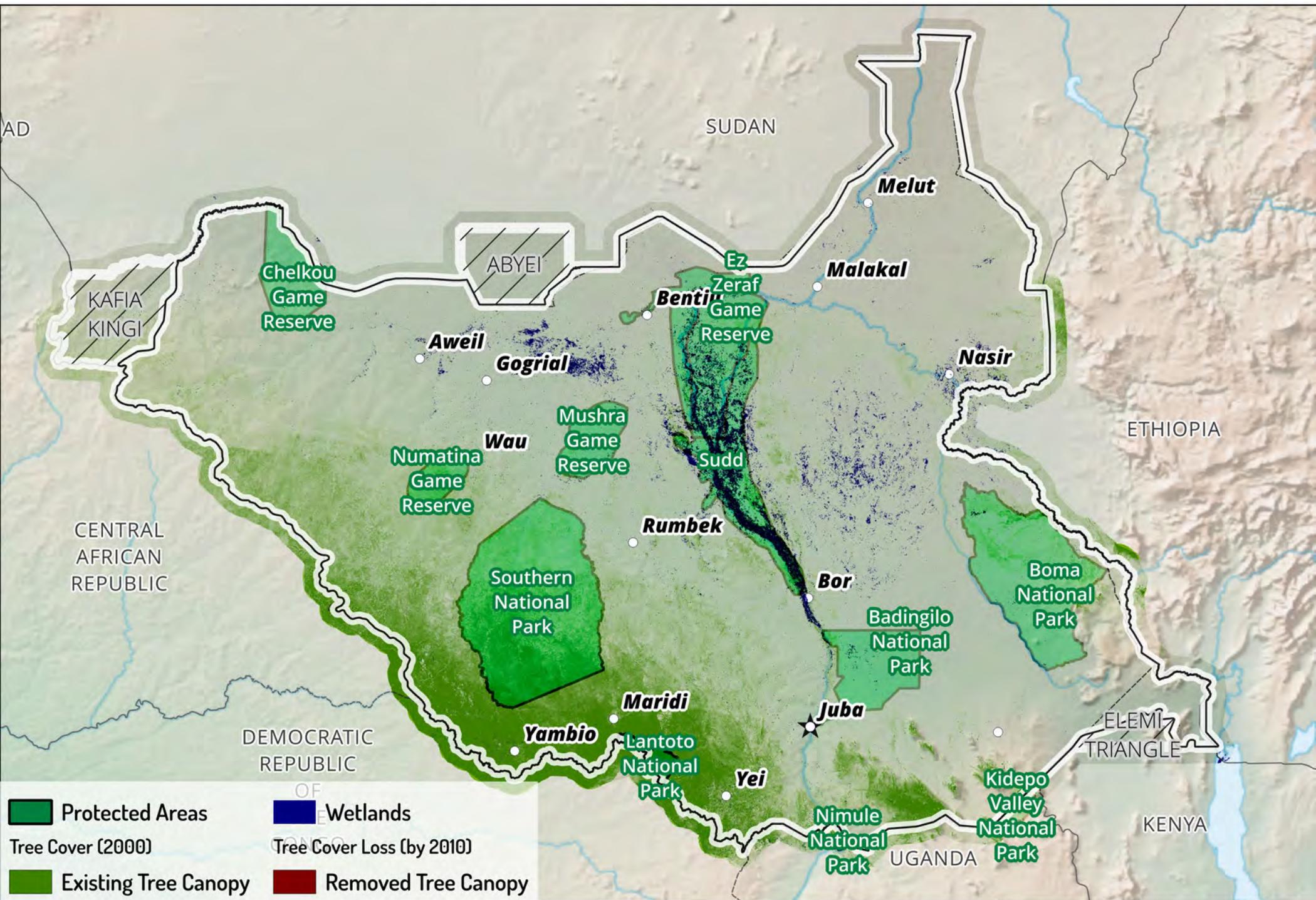
8c - Forest Cover and Forest Change Near Mushra Game Reserve, 2000-2012



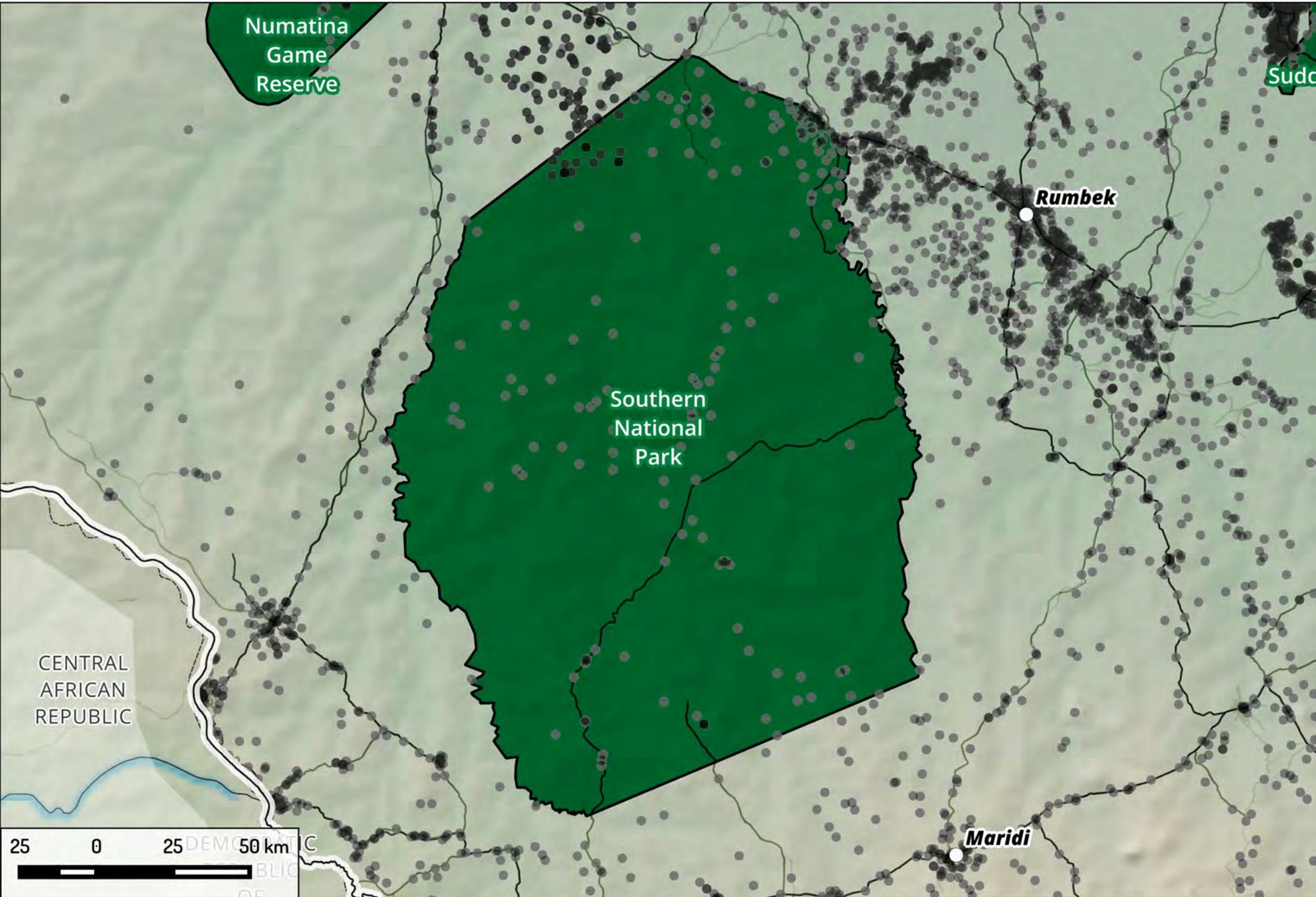
8d - Forest Cover and Forest Change Near Bentiu, 2000-2012



9 - Forest Cover, Wetlands and Protected Areas in South Sudan



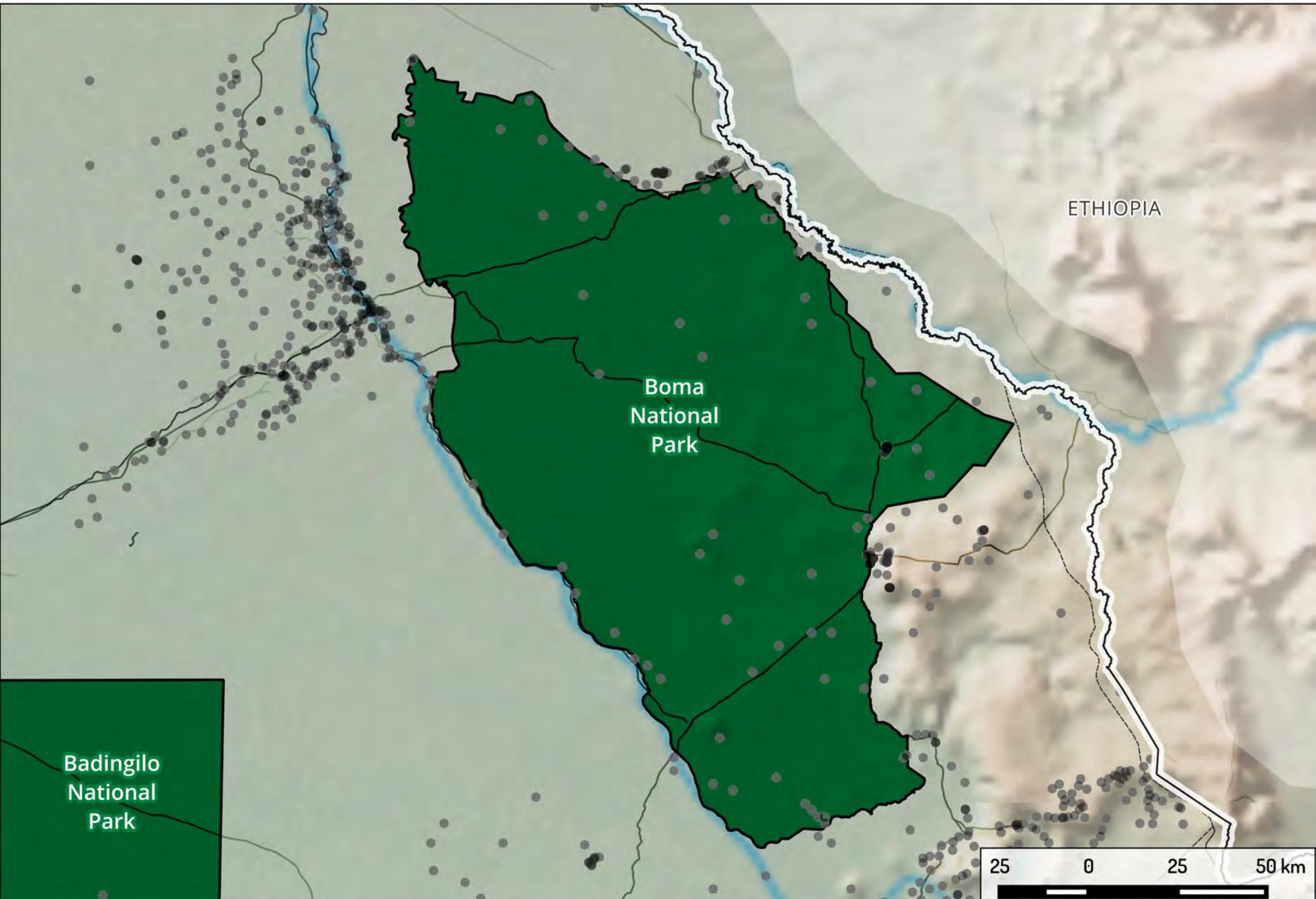
10 - Human Infrastructure in Southern National Park



— Road/Path • Settlement/Population ■ Protected Area

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | Google | UNDP

11 - Human Infrastructure in Boma National Park



Badingilo
National
Park

Boma
National
Park

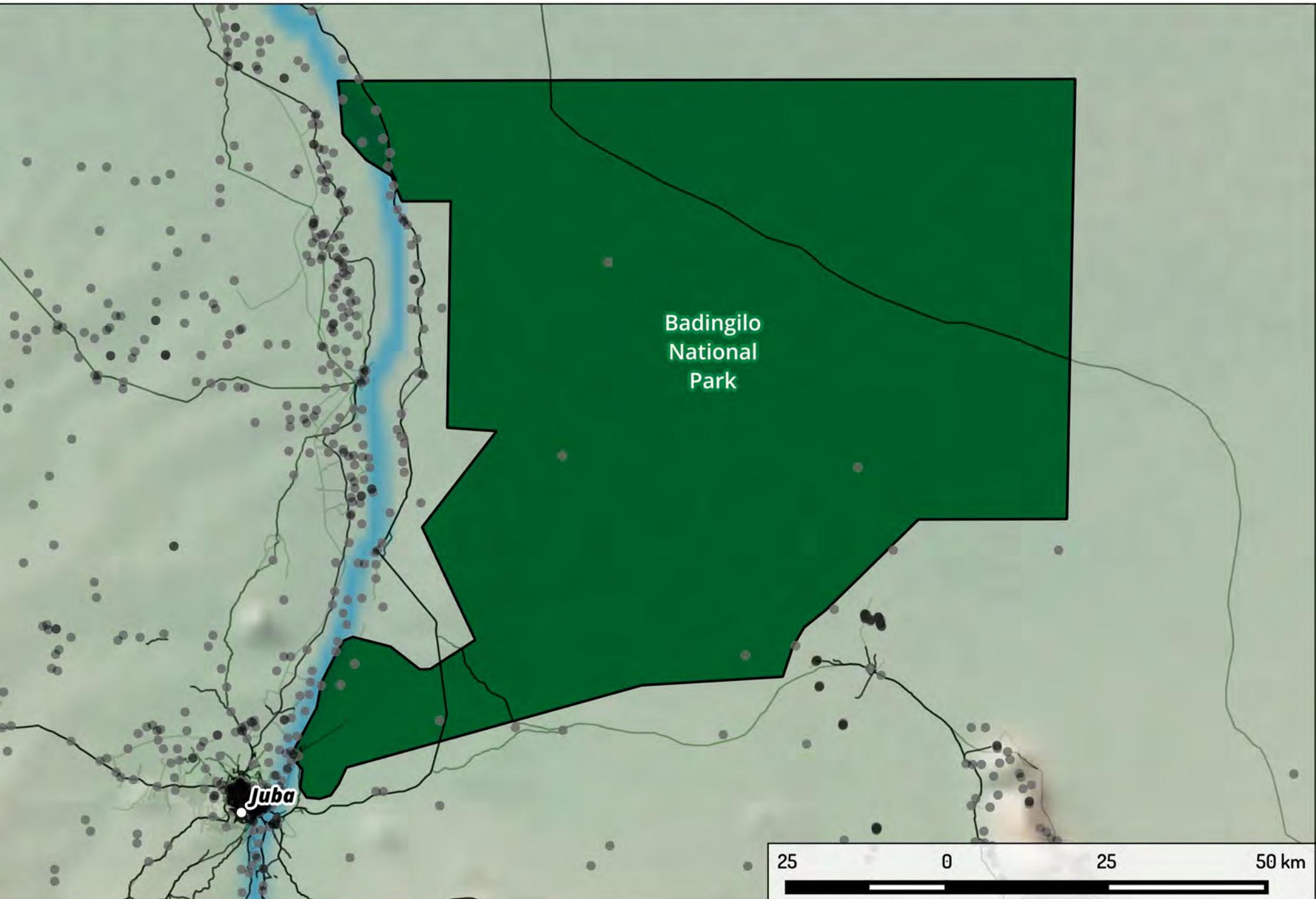
ETHIOPIA



— Road/Path • Settlement/Population ■ Protected Area

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | Google | UNDP

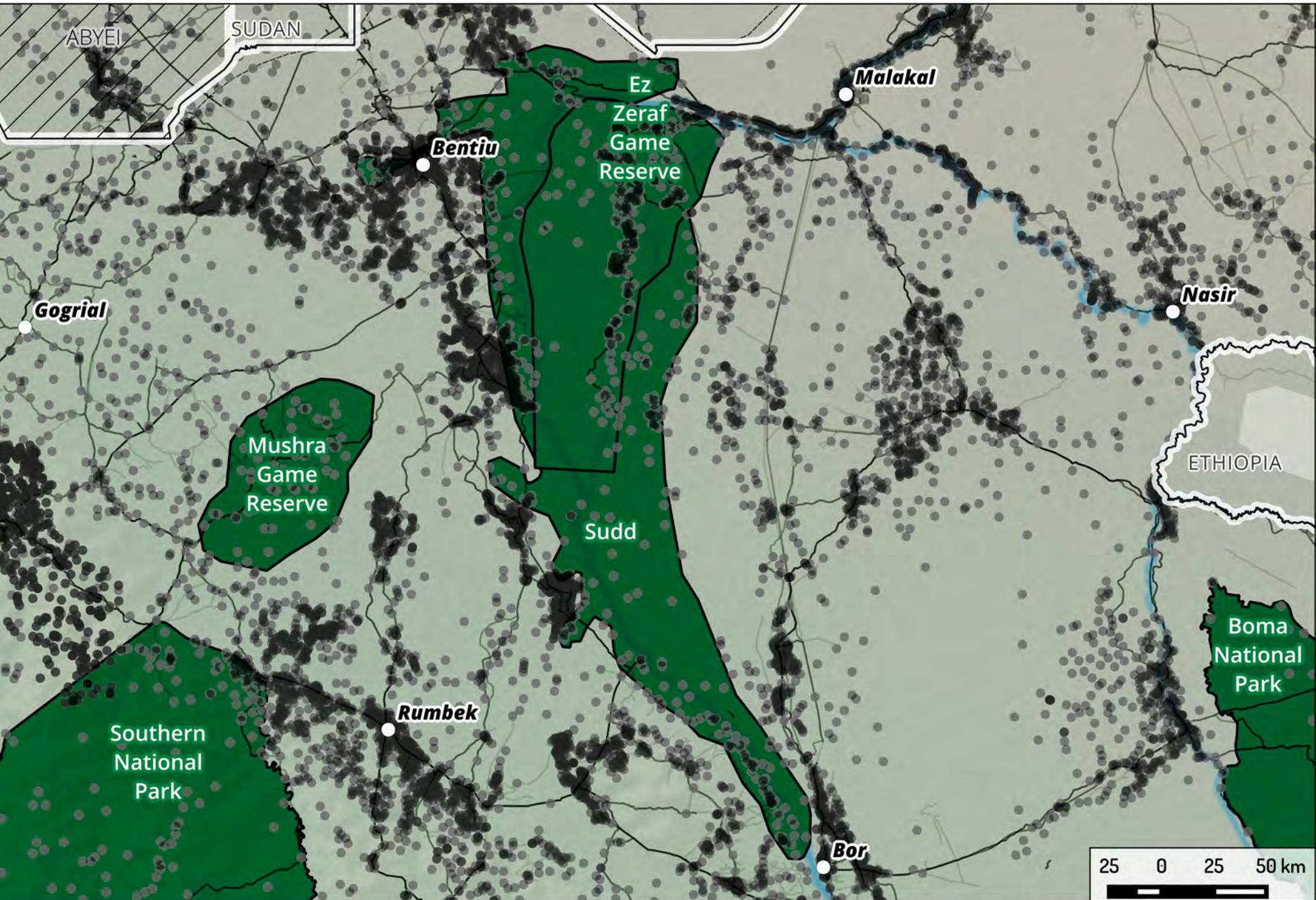
12 - Human Infrastructure in Badingilo National Park



— Road/Path • Settlement/Population ■ Protected Area

Data Sources: Natural Earth | OpenStreetmap Contributors |
USGS | Google | UNDP

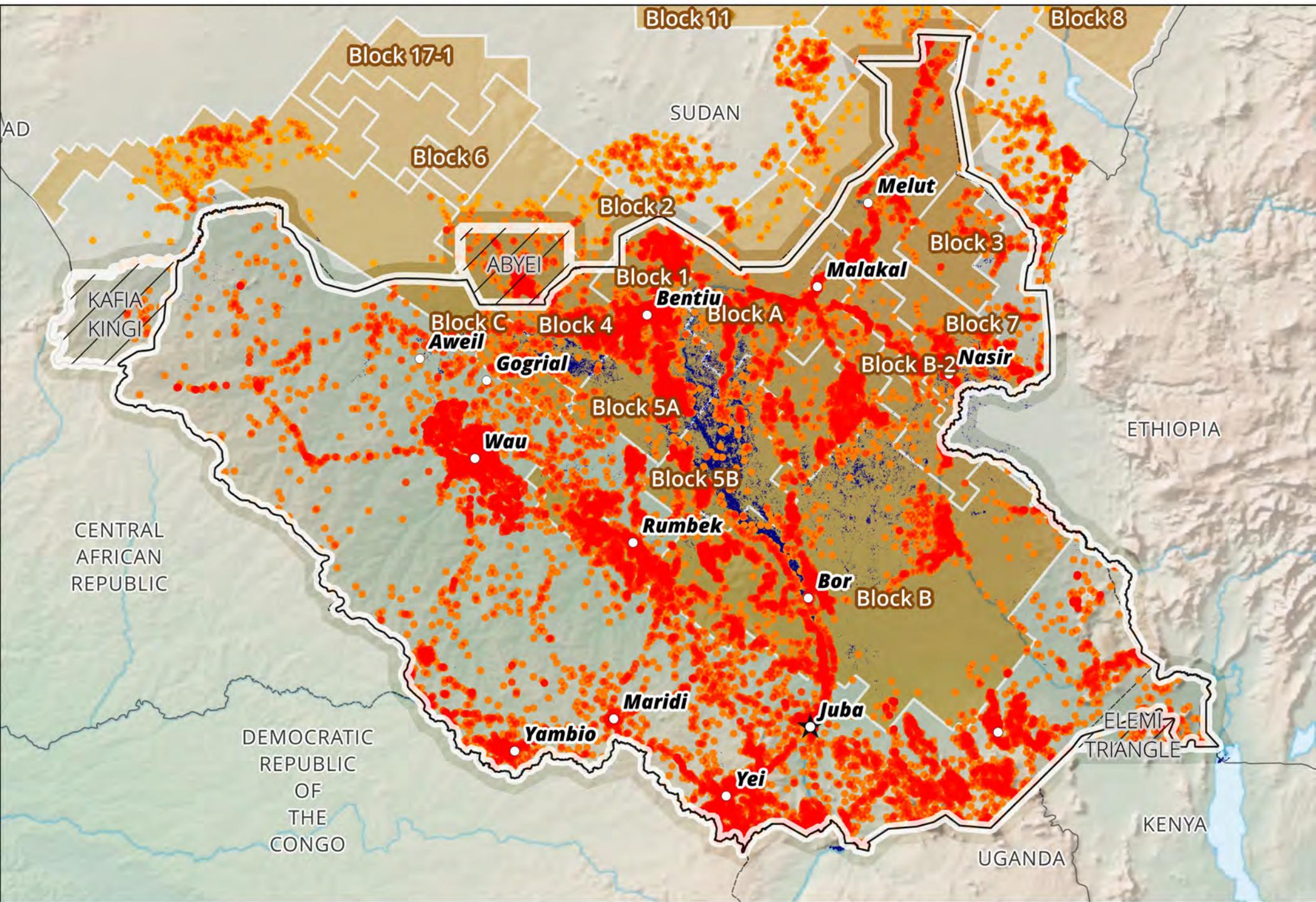
13 - Human Infrastructure in the Sudd Wetland Area



— Road/Path • Settlement/Population ■ Protected Area

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | Google | UNDP

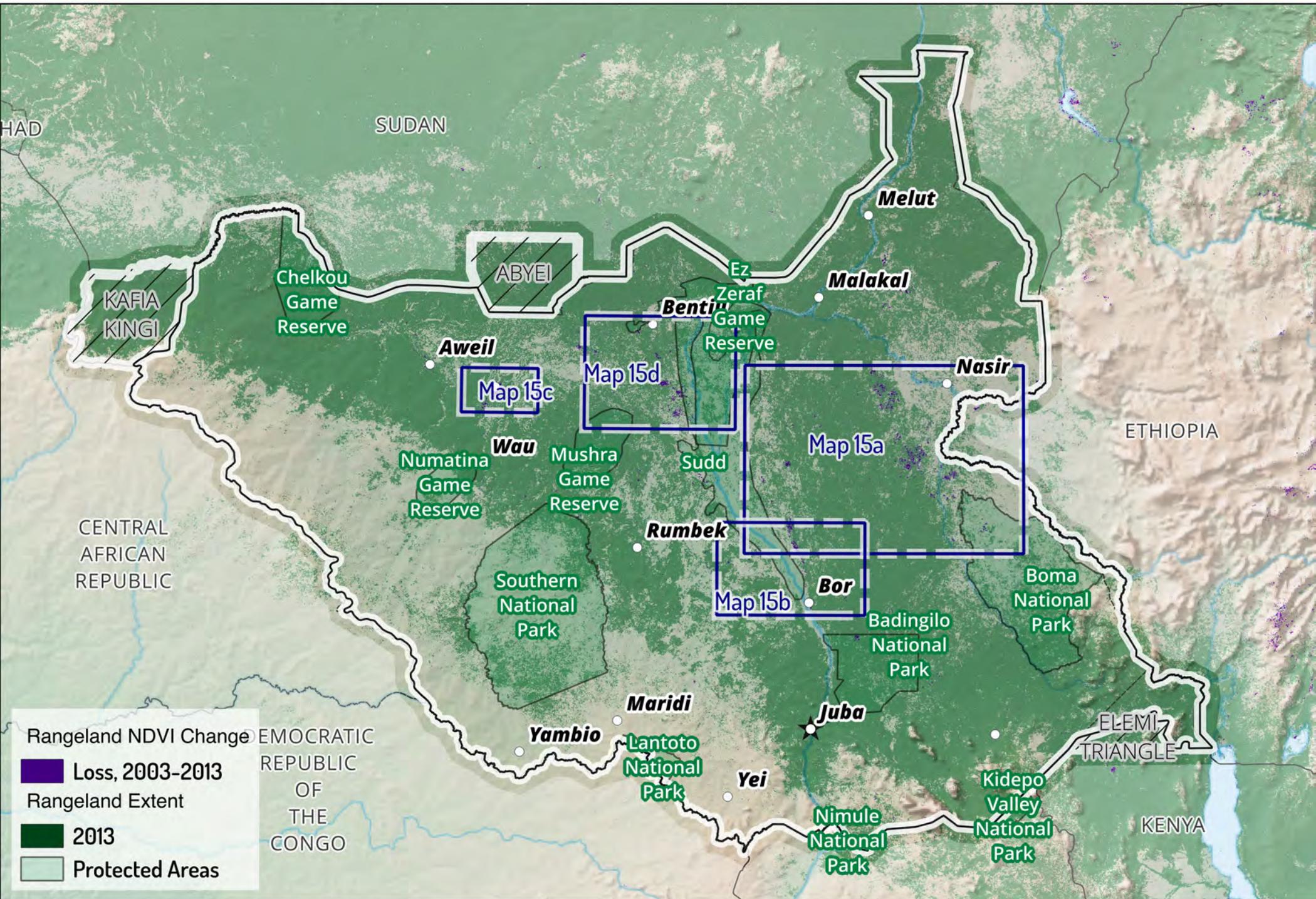
14 - Overlap of Wetlands with Oil/Gas Concessions and the Human Footprint



 Oil/Gas Concession Block  Wetland  Settlement/Population

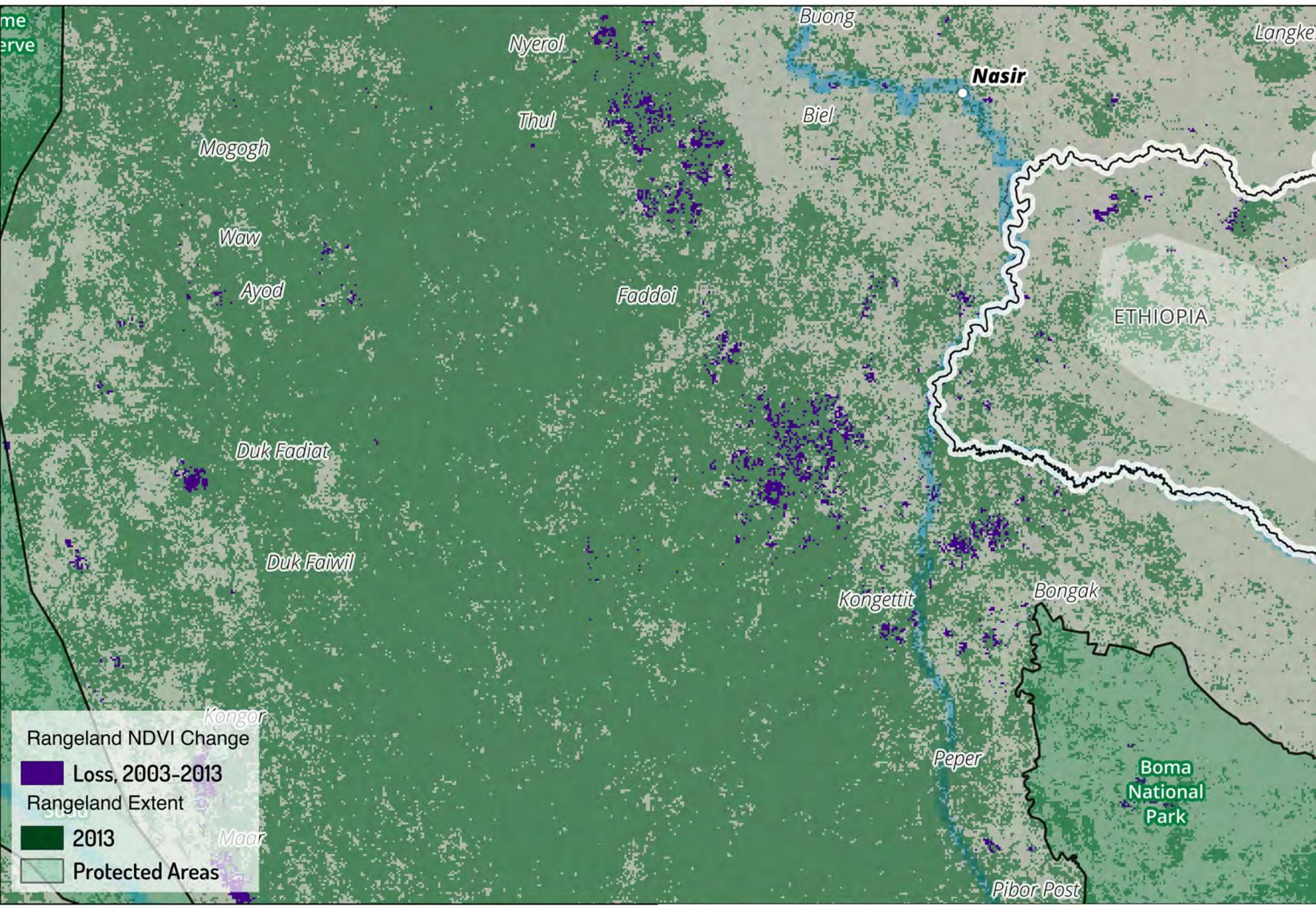
Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | UNDP | European Coalition on Oil in Sudan (2007)

15 - Rangeland Loss & Degredation in South Sudan, 2003-2013



Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | NASA | Google | Geosprocket |
 Note: "Rangeland" Includes IGBP Categories "Open Shrubland", "Savanna" and "Grassland"

15a - Rangeland Loss & Degredation in Eastern South Sudan, 2003-2013



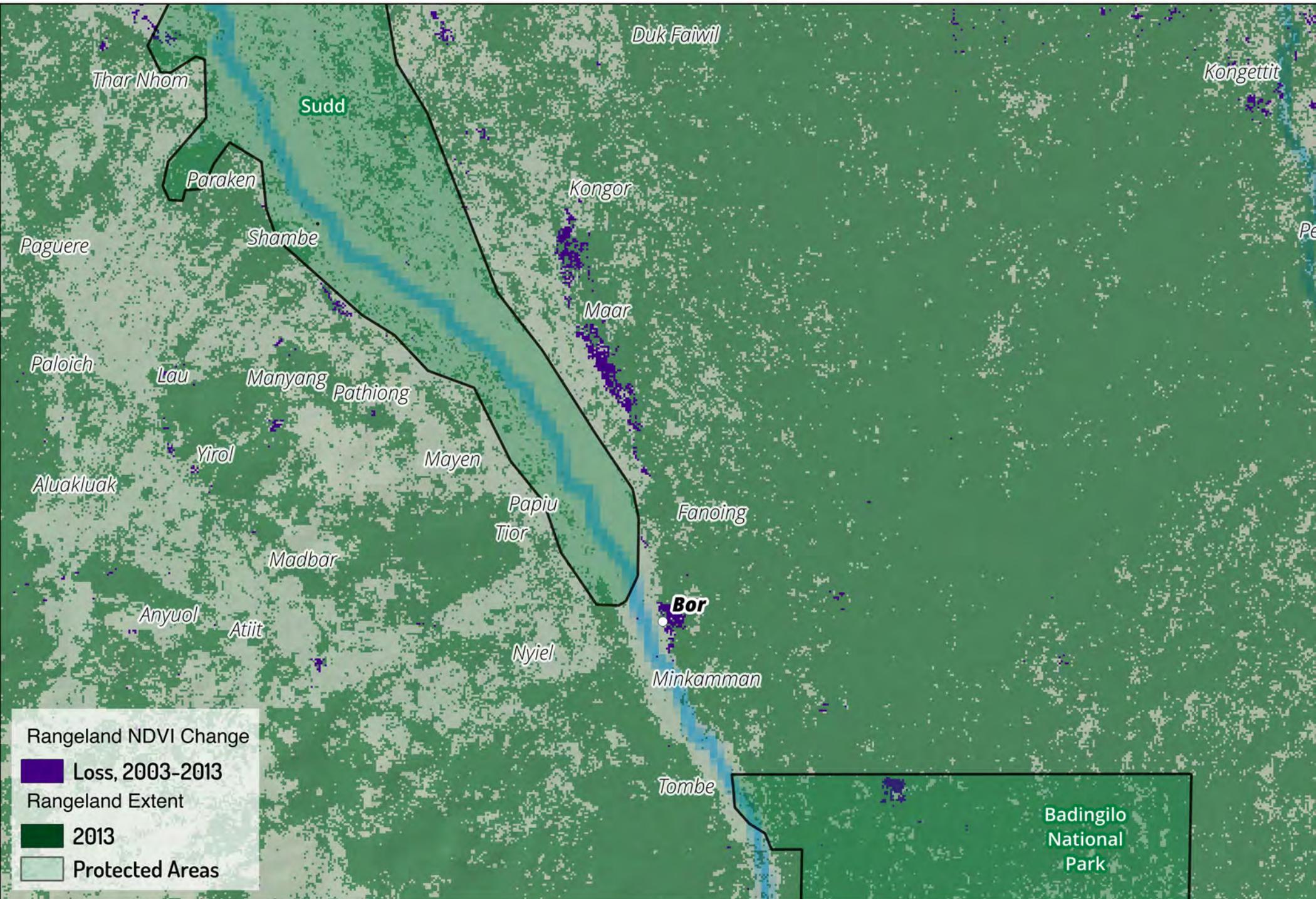
Rangeland NDVI Change

- Loss, 2003-2013
- Rangeland Extent
- 2013
- Protected Areas

25 0 25 50 km

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | NASA | Google | Geosprocket |
 Note: "Rangeland" Includes IGBP Categories "Open Shrubland", "Savanna" and "Grassland"

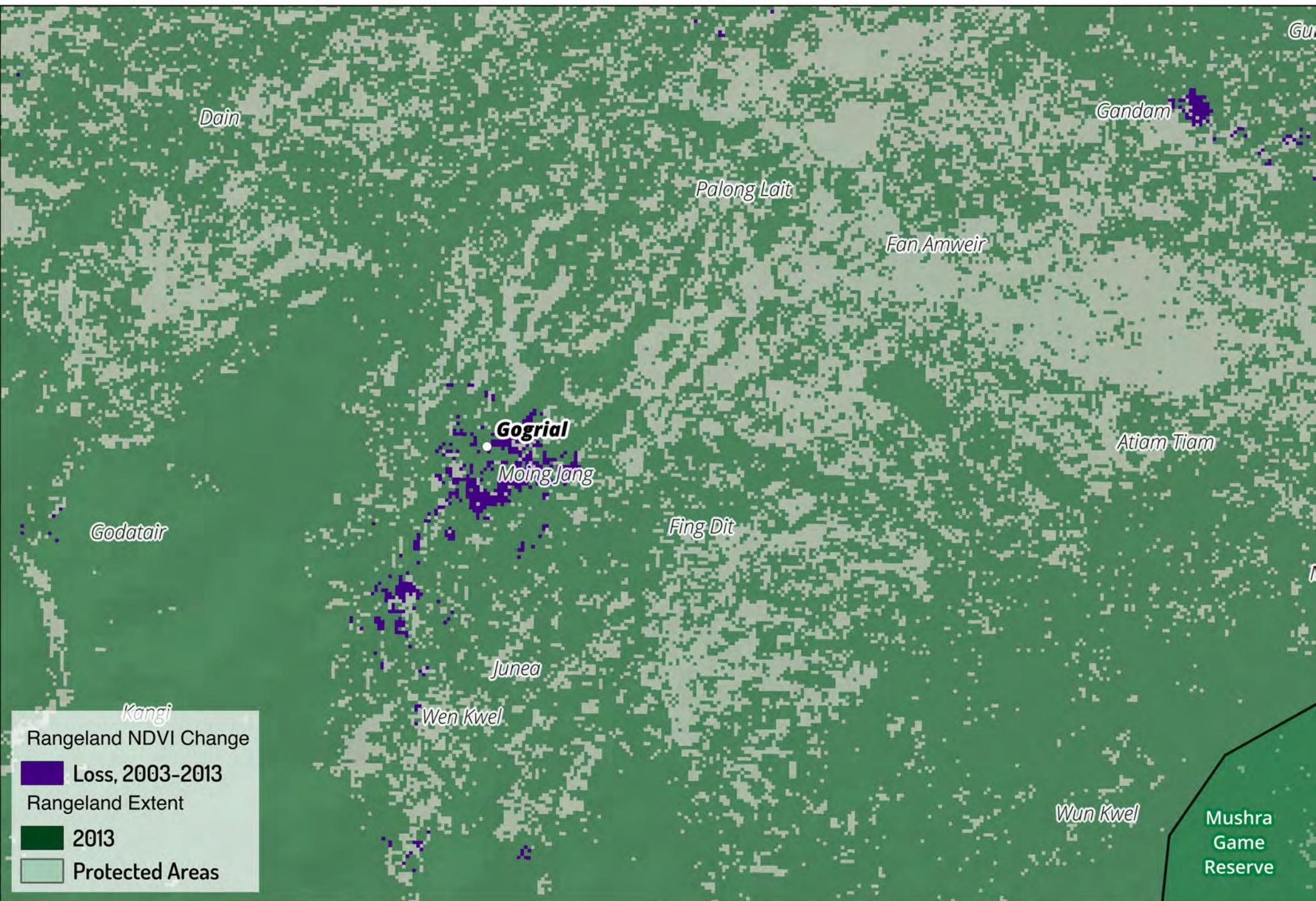
15b - Rangeland Loss & Degredation Near Bor, South Sudan, 2003-2013



25 0 25 50 km

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | NASA | Google | Geosprocket |
Note: "Rangeland" Includes IGBP Categories "Open Shrubland", "Savanna" and "Grassland"

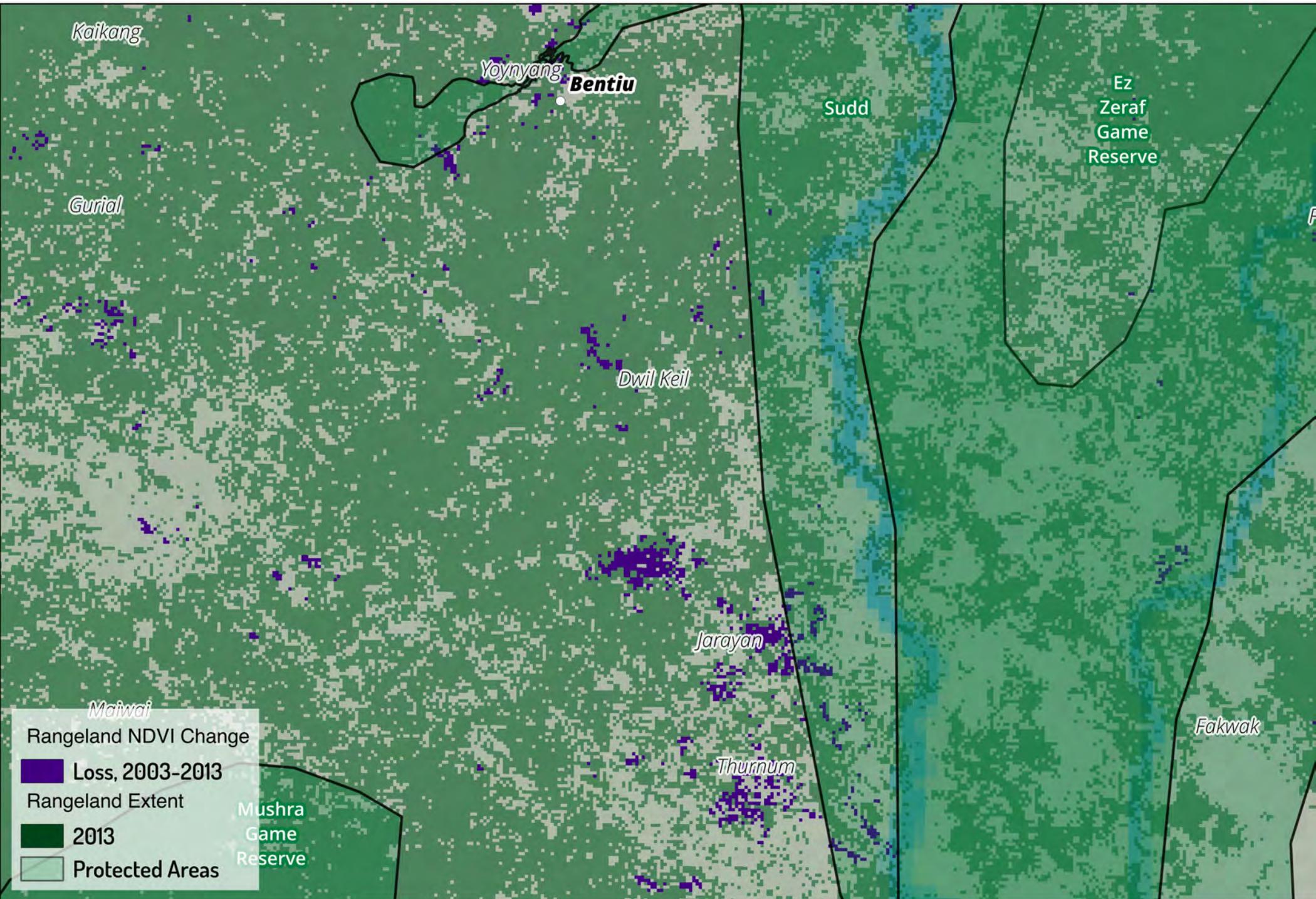
15c - Rangeland Loss & Degredation Near Gogrial, South Sudan, 2003-2013



25 0 25 50 km

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | NASA | Google | Geosprocket |
Note: "Rangeland" Includes IGBP Categories "Open Shrubland", "Savanna" and "Grassland"

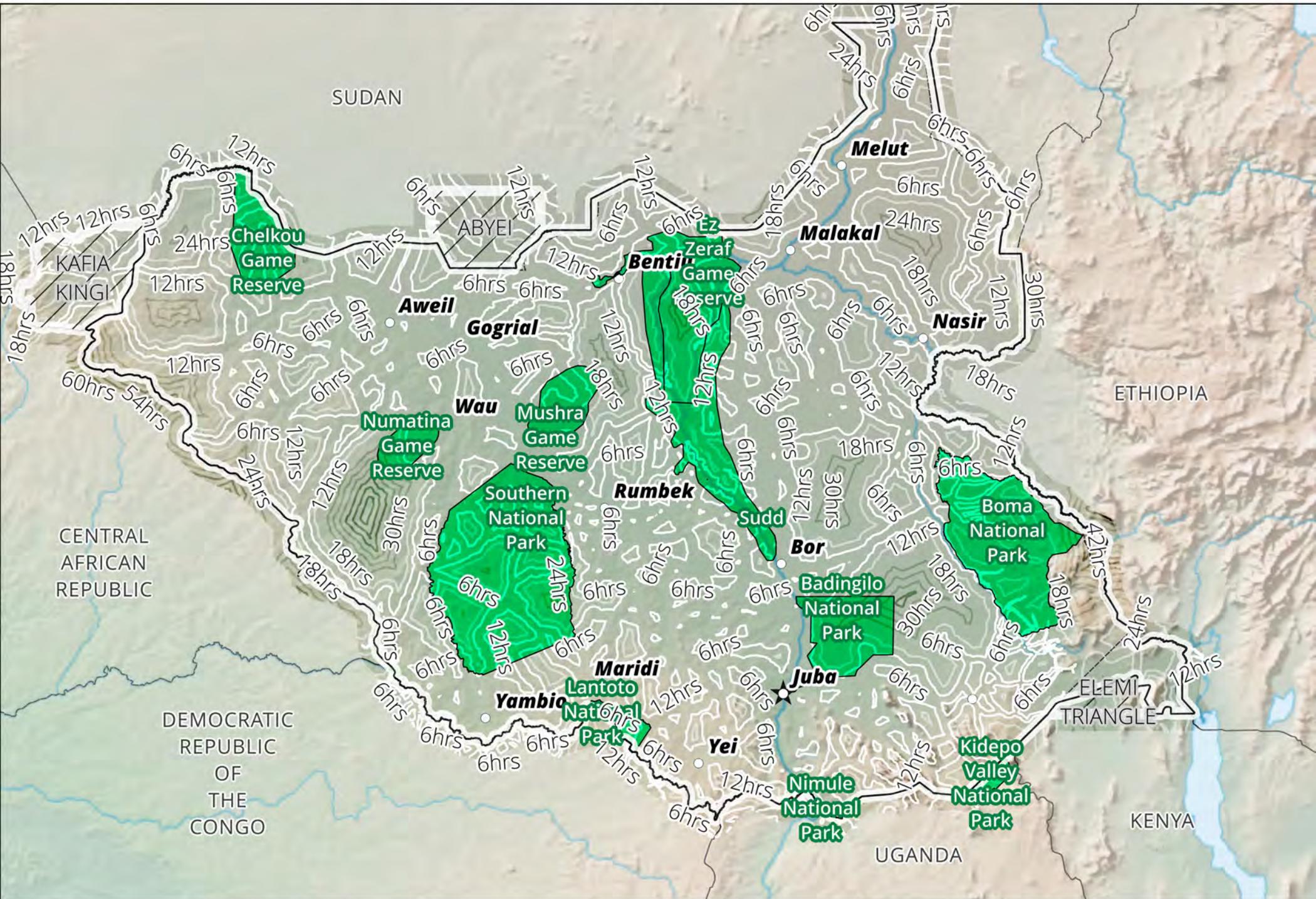
15d - Rangeland Loss & Degredation Near Bentiu, South Sudan, 2003-2013



25 0 25 50 km

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | NASA | Google | Geosprocket |
Note: "Rangeland" Includes IGBP Categories "Open Shrubland", "Savanna" and "Grassland"

16 - Travel Time by Land to Major Cities



— Travel Time Contour ■ Protected/Conserved Areas

Data Sources: Natural Earth | OpenStreetmap Contributors | USGS | Nelson et al. 2008

ANNEX B: STAKEHOLDER CONSULTATION LIST

NAME	ORGANIZATION	POSITION	CONTACT INFORMATION	RESPONSE
Isaac Seme	MWCT	Senior Biologist, Nimule National Park	iseme65@yahoo.com	Yes
Fiesta Warinwa	African Wildlife Foundation	Country Director, Kenya	fwarinwa@awfke.org	Yes
Paul Demetry	Ministry of Environment	Deputy	ladolodemen@yahoo.com	No
Beneth Bojo Nicholas	Ministry of Wildlife Conservation, Juba		nbojo@hotmail.com	No
Joseph Achaye Lam	Ministry of Environment	Deputy Director, Wetlands Conservation	josephachaye@yahoo.com	No
Mary Laku	USAID/South Sudan	Deputy MEO	mlaku@usaid.gov	No
Lona	MWCT	Wildlife Officer	lonana2008@yahoo.com	No
David Batali	Ministry of Environment	Senior Inspector in charge of Pollution Control	db_oliver@gmail.com	No
Other Potential Stakeholders				
UNDP staff implementing the GEF PA Project				
WCS Staff in Juba				
Malik Doka (Involved in the 2007 Surveys with WCS.				
PACT/South Sudan				
University of Juba, College of Environment and Natural Resources Management				

ANNEX C: STAKEHOLDER QUESTIONNAIRE

QUESTIONNAIRE ON STATUS OF TROPICAL FORESTS AND BIODIVERSITY IN THE REPUBLIC OF SOUTH SUDAN

Email to Stakeholders

We are conducting an assessment of the status of tropical forests and biodiversity in the Republic of South Sudan for USAID/South Sudan. This is done as a programming requirement as per the Foreign Assistance Act (FAA) Sections 118 & 119. As per FAA 118 & 119, USAID in its Development strategy is expected to show what it will do towards the conservation of tropical forests and biodiversity in its programs. Right now, we are undertaking a desk review and interviews on the subject matter. Field work to compliment the desk review will be conducted at a later date when calm returns to South Sudan. We would appreciate if you could complete this questionnaire.

Thank you.
Jane Kahata
ENREM Consultants

Questionnaire

1. Are tropical forests under threat in South Sudan?
2. In your opinion, are tropical forests increasing or decreasing? Please explain.
3. In (2), above, if they are decreasing what are some of the factors leading to the decline in order of priority?
 - a) _____
 - b) _____
 - c) _____
 - d) _____
4. Which are some of the locations/areas where tropical forests are affected?
5. What can be done to stop/prevent the decline (please respond according to each of the factors identified in (3) above).

BIODIVERSITY (Species & Ecosystem)

1. Are biodiversity resources (species & ecosystems) under threat in South Sudan?
2. In your opinion, are biodiversity resources increasing or decreasing?

3. In (2), above, if they are decreasing what are some of the factors leading to the decline? Please list in order of priority.

- a) _____
- b) _____
- c) _____
- d) _____
- e) _____

4. Which are some of the species/ecosystems affected?

5. What can be done to stop/prevent the decline (please respond according to each of the factors identified in (3) above?)

AQUATIC RESOURCES

1. Are aquatic resources (species and ecosystems) under threat in South Sudan?

2. In your opinion, are aquatic biodiversity resources increasing or decreasing?

3. In (2), if they are decreasing what are some of the factors leading to the decline in order of priority

- a) _____
- b) _____
- c) _____
- d) _____
- e) _____

4. Which are some of the resources (species/ecosystems affected) and their locations?

5. What can be done to stop/prevent the decline (please respond according to each of the factors identified in (3) above?)

List of Organizations working on the conservation and management of tropical forests and Biodiversity in South Sudan *(Please provide details in the table below)*

Name of donor	Project/Program/Activity being funded	Organization implementing program/activity	Locations/Areas where Program activity is being implemented

List as many as you know.

Please provide any other information concerning tropical forests and biodiversity in South Sudan.