ACTION PLAN

FOR THE IMPLEMENTATION OF SUDAN'S NATIONAL FOREST MONITORING SYSTEM (SNFMS)

FINAL SUBMISSION

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Khartoum, 2021

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ACRONYMS

AD   Activity Data

AP   Action Plan

BUR   Biennial Update Report

CC   Climate Change

COP   Conference of Parties

DFID   Department for International Development, UK

DoDD   Drivers of Deforestation and Forest Degradation

EF   Emission Factors

FAO   Food and Agriculture Organization

FCPF   Forest Carbon Partnership Facility

FNC   Forest National Corporation

FRA   Forest Resource Assessment

FREL/ FRL   Forest Reference Emission Levels/ Forest Reference Level

GDP   Gross Domestic Product

GHG   Green House Gasses

GIS   Geographic Information System

GPG   Good Practice Guidance

HCENR Higher Council for Environment and Natural Resources

HRWS   High Rainfall Woodland Savana

ICSP   Internal Carbon Sequestration Project

INDC   Intended Nationally Determined Contribution

IPCC   Intergovernmental Panel on Climate Change

LCAS   Land Cover Atlas of Sudan

LCCS   Land Cover Classification System

LDC   Least Developed Country

LMS   Land Monitoring System

LRWS   Low Rainfall Woodland Savana

LPG   Liquified Petroleum Gas

LULUCF   Land Use Land Use Change and Forestry

MoA   Ministry of Agriculture

MRV   Measurement, Reporting and Verification

MMRV   Monitoring Measurement Reporting and Verification

NAMAs Nationally Appropriate Mitigation Actions

NDC   Nationally Determined Contribution

NC   National Communication

NFI   National Forest Inventory

NAPA   National Adaptation Program of Action

NFMS   National Forest Monitoring System

NWFPs Non Woody Forest Products

NRS   National REDD+ Strategy

NPR   National Progress Report

OGM   Office of General Manager

PAMs   Policies and Measures

REDD+ Reducing Emissions from Deforestation, Forest Degradation and the Role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks

RMU   REDD+ Management Unit

RoS   Republic of Sudan

RoSS   Republic of South Sudan

R-PP   REDD+ Readiness Preparation Proposal

RPR   REDD+ Project Registry

RSS   Republic of South Sudan

SNFMS   Sudan's National Forest Monitoring System

SNC   Second National Communication

SFM   Sustainable Forest Management

TOE   Ton/ Oil Equivalent

ToR   Terms of Reference

UNDP   United Nations Development Program

UNEP   United Nations Environmental Program

UNFCCC   United Nations Framework Convention on Climate Change

USD   United States Dollar

WG   Working Group

EXECUTIVE SUMMARY

Sudan's forests cover equals about 9.8 percent of its total land surface, with an estimated annual rate of deforestation of about 170076 ha, or about 0.88 percent between 2015 and 2020. Forests have been facing encroachment by agriculture, urbanization, and unsustainable wood fuel extraction for several decades. The lack of integrated land use plans and coordination across institutions has resulted in the uncontrolled land use changes and conversion of vast forest tracts into agricultural areas over the past 40 years.

Being a party to United Nations Framework Convention on Climate Change (UNFCCC), Sudan is implementing the REDD+ Readiness Project (R-PP) with financial support from the Forest Carbon Partnership Facility (FCPF) of the World Bank (WB) to address deforestation and forest degradation. The R-PP is to ensure institutional arrangements at country level required to comply with the Conference of Parties (COP) decisions. The required arrangements are (i) a national strategy or action plan; (ii) a national forest reference emission level and/or forest reference level (FREL/FRL); (iii) a robust and transparent National Forest Monitoring System (NFMS) to meet Measurement Reporting and Verification (MRV) requirements for REDD+; (iv) and a system for providing information on safeguards. A functioning National Forest Monitoring System (NFMS) is a condition for Sudan to achieve REDD+ readiness and to enter Phase II of REDD+ implementation. A framework for Sudan's National Forest Monitoring System (SNFMS) is provided in the Sudan's R-PP document.

This Action Plan (AP) for Sudan's National Forest Monitoring System (SNFMS) is developed in consultation with relevant stakeholders. As part of a methodological approach for SNFMS AP development, a quick desk review was carried out of important documents followed by the development of checklists and interview protocols to assess the information regarding capacity gaps/ issues in SNFMS at national, regional and state levels. The capacity gap was calculated by summarizing different performance indicators for different assessment categories. These assessment categories were taken from the guiding criteria for components and element of capacity assessment provided in the UN-REDD NFMS Action Plan template. The SNFMS AP identifies the activities to be implemented to allow well-functioning and operationalization of the SNFMS through phases II and III of REDD+ readiness. The goal of the SNFMS is to generate consistent and reliable data as well as periodic information to provide strategic planning supported by adequate budget to facilitate development and ongoing monitoring, measurement, reporting and verification requirements of Sudan's REDD+ program. The SNFMS will integrate the various flows of information to produce the REDD+ reports that go into the BUR. This AP will go beyond the measurement of forest carbon and will provide information on other parameters such as forest health, biodiversity, socio-economic and environmental functions of forests and legal frameworks related to forests.

Land Monitoring System (LMS): There is no regularity in satellite-based land monitoring in Sudan. Though some satellite based national level studies (i.e. Forest/ Land cover maps of 2000 and 2010) are available but the data sets and methods lack IPCC methodological guidance for consistent reporting. Most of the Remote Sensing (RS) based studies are done by external sources on project bases and land cover maps/ products cannot be produced within the organization. The feedback mechanisms for validation and consistency checks are missing. The current software and system infrastructures are inadequate and insufficient to implement a national level LMS. The human capacities are inadequate. There is very limited knowledge of IPCC methodological guidance and understanding of relevant national/ international negotiations (UNFCCC) and decisions (REDD+ strategies and objectives). Expertise in real time forest monitoring as well as capacity to review,

consolidate and integrate existing data and information on LMS are very limited both at the national and state levels. The training facilities for LMS are also inadequate.

National Forest Inventory (NFI): The information in Sudan's first national forest inventory (1995-97) is limited to specific variables of interest and does not account for forest carbon pools/ stocks. Further the inventory did not follow IPCC/ UNFCCC guidance on reducing uncertainties (application of statistical procedures, data propagation). However, recently in 2017-2018, a 2nd NFI was carried out covering almost all the states and forest types in the country. The inventory provides information on above ground and below ground carbon pools while data on other carbon pools i.e. Dead Wood (DW), Litter (lit) Soil Carbon (SC) and Harvested Wood Products (HWP) is not available. This inventory was carried out using the national NFI manual guided by the IPCC's most recent methodological guidance of 2006. The results of the NFI are now available and need to be archived centrally through a robust data base management system. The national land use and forest classification was recently developed, however, this needs to be revised to make it consistent with IPCC's guidance on Land Representation. National level estimates on deforestation and forest degradation are not available, however, the deforestation estimates are currently being assessed only for three states (Blue Nile, El Gadarif and Sinnar), as Sudan has recently submitted its sub-national FREL covering these three states. Baseline scenarios (FREL/ FRL) are missing at the national level to monitor deforestation and forest degradation.

Green House Gas Inventory: So far, Sudan has submitted two NC documents to UNFCCC and reported national GHG emissions in chapter information. The GHG emission estimates reported for LULUCF sector were based on IPCC default values, as the country specific data is not available for national GHG inventory. Though the preparation of the 3rd NC document is in progress, and as well the national GHG inventory using IPCC 2006 guidance, this inventory will also use the Tier 1 methodological approach. Currently, there is limited capacity to process and analyse the information from AFOLU sector's GHG inventory as well as understanding of IPCC reporting requirements and guidelines for GHG inventories.

Monitoring of Forest Policies and Measures: There is very limited availability of monitoring tools, data and information to monitor the forest policies and measures. The forest monitoring indicators are currently being developed for monitoring of REDD+ activities. There is no policy guidance on standard methods and protocols to report on forest monitoring indicators, however, an action plan for implementation of REDD+ strategic options is in progress. Satellite based monitoring tools and enhanced human capacities are required to regularly monitor the forest and others land use changes.

Institutional Arrangements: The integration of SNFMS requires legal justification and formal basis for the long-term functioning of the SNFMS. Since the SNFMS will be comprised of people, institutions and resources to implement national forest monitoring in Sudan, in collaboration with other stakeholders, the coordination mechanisms responsible for SNFMS conceptualization, planning and execution within well-defined institutional mandates need to be developed. To establish a strong coordination mechanism, working relationships need to be defined (ToR) and developed (MoUs) among key institutions (like the FNC, RSSA, HCENR and other relevant institutions) through comprehensive dialogues based on existing institutional capacities and requirements. The SNFMS will be coordinated and led by FNC and will be responsible for its conceptualization, planning and execution within its well-defined mandate, based on the agreed principles and elements.
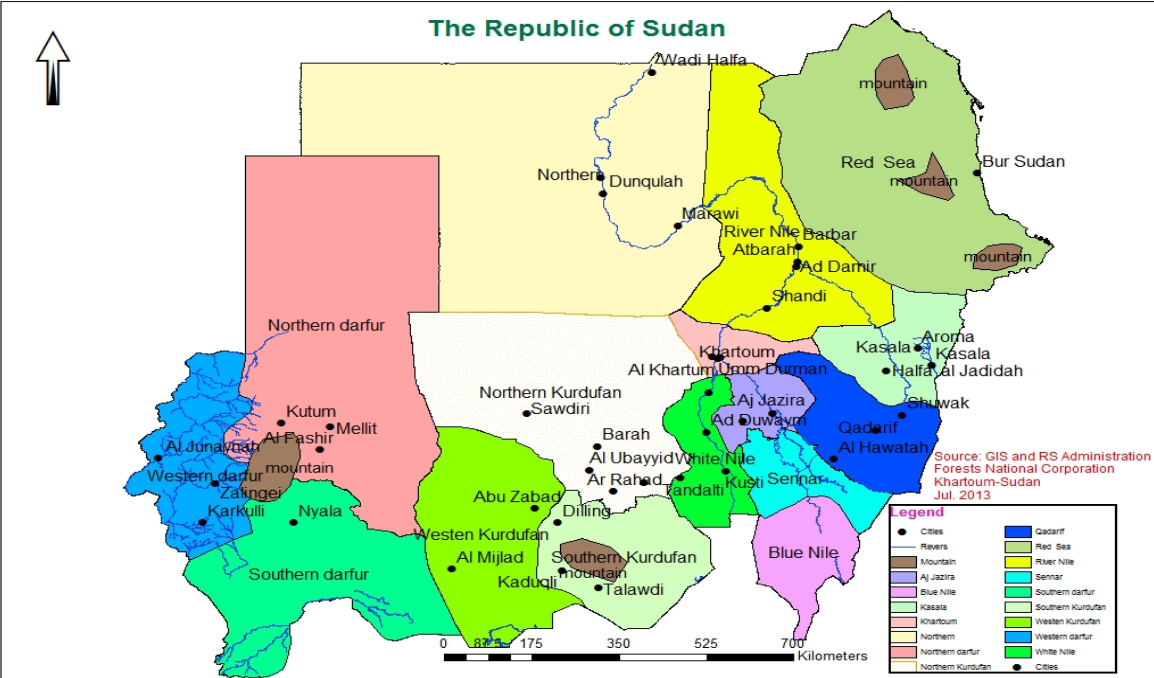
1. INTRODUCTION

FIGURE 1.1: NATIONAL TERRITORY OF THE REPUBLIC OF SUDAN

The Republic of Sudan (hereinafter referred to as Sudan), with a population of 39.6 million[1] (30% urban, 63% rural and 7% nomadic), covers an area of 1, 886, 0068 km². The country is located in North Eastern Africa bordered by Egypt, Eretria, The Red Sea, Ethiopia, Central African Republic, Republic of South Sudan (RSS), Libya and Chad. Sudan's climate is characterized by its diversity. The ecological zones extend over a wide range from the desert in the extreme north to the forests in the south, in addition to the freshwater and marine and coastal environments. In the north near the Egyptian border, desert conditions prevail and rain is rare. Arid and semi-arid ecosystems constitute most of Sudan. Desert and semi-desert areas dominate the northern part of the country above El Obeid. In the East and West and along the border with South Sudan low to high rainfall savannah and Montane vegetation is prevalent.

According to FAO's FRA 2020, Sudan's forest cover is about 9.8 percent of its total land area. The net annual change in forest area from 2010 to 2020 is 172162 ha or 0.85 percent, placing the country among the ten countries with the highest deforestation rates. Though, the recent NFI results show increased trends in cover (NFI, 2019), unplanned land-use changes, mismanagement, and reduction in the forest stock have caused the Sudan's forests to become a source of GHG emission rather than GHG sink. The Second National Communication (SNC), National Adaptation Program of Action (NAPA) and Sudan's Intended Nationally Determined Contribution (INDC) highlighted the forest sector as one of the highest priority areas for Sudan due to the high rates of deforestation and forest degradation, and its importance to the national economy and to people's livelihoods. Although

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[1] https://www.bti-project.org/en/reports/country-reports/detail/itc/sdn/itr/mena/

Sudan is not an emitter of a significant amount of GHGs, continuing deforestation and forest degradation are of high concern. Sudan initiated REDD+ activities in 2009 after recognizing the potential socio-economic benefits, and to enhance the country's resilience while contributing to the global efforts of reducing GHG emissions from deforestation and forest degradation.

Under the REDD+ mechanism, the developing country Parties are encouraged to contribute to mitigation actions in the forest sector by undertaking five activities, in accordance with their respective capabilities and national circumstances. The five activities are (a) Reducing emissions from deforestation; (b) Reducing emissions from forest degradation; (c) Conservation of forest carbon stocks; (d) Sustainable management of forests; and (e) Enhancement of forest carbon stocks" (Decision 1/CP.16). The Warsaw Framework on REDD+ (COP 19) decided that countries aiming to take REDD+ activities should develop (i) a national strategy or action plan; (ii) a national FREL/FRL; (iii) establish a robust and transparent NFMS to meet MRV requirements for REDD+; and (iv) a system for providing information on safeguards. Following the decisions of COP 19, and keeping in view the capacities and technical capabilities, global funding opportunities were created for countries seeking support to meet the REDD+ requirements under the UNFCCC decisions.

World Bank (WB) through its Forest Carbon Partnership Facility (FCPF) established the REDD+ Readiness Fund and requested country parties to submit REDD+ Readiness Proposals (R-PP) to access the funding opportunities to support REDD+ readiness activities in their countries. The Forest National Corporation (FNC) of Sudan formally started the REDD+ preparedness phase through a formal project of REDD+ Preparedness Strategy during 2012 funded by the Department for International Development (DFID), United Kingdom (UK) and United Nations Environment Program (UNEP)-Sudan's Country Office. In 2012-2013, Sudan's R-PP was formulated under the overall supervision of FNC 'Sudan National REDD+ Committee', co-opted members and consultants with courteous support from United Nations Development Program (UNDP) and UNEP Sudan Offices and the WB. The R-PP was approved in 2014. A functioning NFMS is a condition for Sudan to achieve REDD+ readiness and to enter Phase II of REDD+ implementation. A framework for Sudan's National Forest Monitoring System (SNFMS) is already provided in the Sudan's R-PP document.

Following UNFCCC guidance (through its decisions i.e. Decision 4/ CP.15, Decision 1/CP.16, Decision 21/ CP.19), Sudan intends to improve data collection, estimation of emissions from deforestation and forest degradation and monitoring and reporting capabilities through establishment of a robust and transparent NFMS. The SNFMS is intended to use a combination of remote sensing and ground based forest carbon inventory approaches for estimating emissions and removals, forest carbon stocks and forest area changes and provide transparent, consistent and accurate estimates with reduced uncertainties. The results will be publicly available for review (QA) as agreed by COP. The SNFMS will be (i) built upon existing systems to provide information on all forest areas in the country and enable the assessment of changes incurred in natural forests, (ii) flexible and allow for improvement, (iii) able to identify potential sources of uncertainties to the extent possible (QC), (iv) able to provide information on safeguards and will reflect, as appropriate, the phased approach for the implementation of REDD+ activities. Through SNFMS, the data and information on historical forest cover changes will also be collected to inform the assessment of national or sub-national FRELs/FRLs.

This AP will also help Sudan to establish fully functional institutions with clear mandates, roles and responsibilities to perform the monitoring (M) and Measurement, Reporting and Verification (MRV) functions of SNFMS simultaneously. The **Monitoring Function** will allow Sudan to assess its forest Policies and Measures (PAMs) including those specifically related to REDD+. The monitoring will focus on national, regional and state level data and information on forests, their condition, uses and values to support forest-related decision-making at international, national, regional and state levels by providing timely, relevant and reliable information. The **MRV Function** will enable Sudan to

ensure the establishment of a comprehensive process that will systematically collect, analyse, interpret, report and disseminate the national, regional and state level forest related data. It will further derive the information and knowledge at regular intervals to allow the monitoring of forest changes as well as forest related GHG emissions and removals over time through well-established LMS, NFI and GHG-I.

This SNFMS AP ensures that the activities are in line with international guidance (UNFCCC and IPCC), national context and considers existing and future national institutional, legal and procedural arrangements for the forestry sector's GHG inventory. The human, financial and technical gaps and needs are also identified through detailed consultative process of capacity needs assessment.

2. OBJECTIVES

The goal of the SNFMS is to generate consistent and reliable data as well as periodic information to provide strategic planning, supported by adequate budget, to facilitate development and ongoing monitoring, measurement, reporting and verification requirements of Sudan's REDD+ program. The SNFMS will integrate the various flows of information to produce the REDD+ reports that go into the Biennial Update Report (BUR). This AP is designed in such a way that it will go beyond the measurement of forest carbon and will provide information on other parameters such as forest health, biodiversity, socio-economic and environmental functions of forests and legal frameworks related to forests. The specific objectives of this AP to support the implementation of SNFMS are given below:

Objective 1: To operationalize a consolidated, concrete, improved and reliable participatory network of institutions and reporting systems with necessary range of expertise and clearly documented roles and responsibilities to establish SFMS

Currently, all of Sudan's structures of the REDD+ institutional arrangements are in place and operational, according to the envisaged structures and developed ToRs [Terms of References]'. These arrangements include a hierarchy from ministerial to project officer level overarching policy and program design of REDD+ within Sudan, under which the SNFMS falls. The current arrangements for the REDD+ MMRV system are top-down, where the FNC is mandated for design and dissemination of the REDD+ MMRV procedures to the states. There is recognition that the national REDD+ MMRV system must be able to deliver sub-national reporting as they relate to projects or state based activities. However, there is less emphasis put on the system design (policies, systems, processes and mandates) of the Sudan's REDD+ MMRV System due to lack of clear design document to address the relevant capacity issues. There are gaps in the MMRV design process, in that it is yet to be documented as who will be responsible for the data requirements for the REDD+ MMRV system, who will manage the data collection processes pertaining to different components (LMS, NFI, SFM, GHG-I, NPR, NC) of SNFMS and how the data will be integrated and dependent on the policy objectives. The current MMRV system requires further exploring the institutional requirements and priorities to address inconsistencies in methods, data gaps, data flow and processing responsibilities as well as loopholes in the system to provide all necessary information to legislate, plan and manage the MMRV activities efficiently and to effectively coordinate within the institutional system to fulfill respective mandates. This AP will help Sudan to come up with agreed institutional arrangements for participatory, coordinated and sustainable SNFMS. These arrangements will ensure that each function of SNFMS (i.e. LMS, NFI and GHG-I) has appropriate institutional, legal and procedural arrangements (within/among entity/ies) to avoid conflict and vacuum of responsibilities as well as loops in hierarchy.

Objective 2: To develop a transparent and integrated NFMS with completely separate functions from the National Forest Inventory, the Land Monitoring System, Sustainable Forest Management and Green House Gas Inventory in order to estimate GHG emissions and removals from forestry sector through creation of consistent time series of forest cover and periodically assess the on-ground conditions of all forest resources in Sudan (MRV Function)

The SNFMS, with the integration of the three separate components of the Sudan's MRV function, will be comprised of (i) Land Monitoring System (LMS) to collect and assess, over time, the Activity Data (AD) related to forest land and forest degradation processes over large areas following the nationally agreed land use and forest cover classification, (ii) National Forest Inventory (NFI) to collect information on forest carbon stocks and changes, relevant for estimating emissions and removals and to provide emissions factors (EF) and (iii) GHG Inventory for reporting on anthropogenic forest-

related GHG emissions by sources and removals by sinks and sustainable forest management to the UNFCCC Secretariat . This AP will enable Sudan to estimate and internationally report its national-scale forest emission and removals for REDD+ and will mostly focus on the country's commitment to measure, report and verify its actions taken under REDD+ program.

Objective 3: To implement COP's decisions[2] related to the establishment of robust and transparent NFMS for REDD+ and IPCC's guidelines for GHG Inventory of LULUCF sector.

The methodological guidance for developing SNFMS will be guided by Decision 4/ CP.15 (UNFCCC 2009) and Decision 11/CP.19 (UNFCCC, 2014). Following the UNFCCC guidance, the SNFMS will concurrently perform two functions i.e. (i) monitoring function to retrieve the periodic information on the results achieved by the national REDD+ policies and measures and (ii) Measurement, Reporting and Verification function to measure, report and verify its Nationally Appropriate Mitigation Actions (NAMAs), such as REDD+ for the forestry sector, to assess whether they are resulting in measurable climate change mitigation. The monitoring function will enable Sudan to define the criteria and indicators to be measured on a regular basis to assess the progress made in the implementation of REDD+ policies and measures to comply with the country's commitments under the UNFCCC. On the other hand, the MRV function will be used for multiple applications for land management with specific objectives in context of REDD+ such as estimate changes in forest area (AD) and changes in carbon stocks (EF) related to REDD+ activities, estimate emissions of GHGs from human activities and their sequestration/removal by sinks, and report the performance of GHG mitigation resulting from REDD+ activities to the UNFCCC. The SNFMS will follow the Intergovernmental Panel on Climate Change's (IPCC) Good Practice Guidance (GPG) for "land use, land use change and forestry" (LULUCF) as the basis for their GHG inventory reporting as encouraged by UNFCCC. GPG sets out a simple methodological approach for the development of GHG inventories: to combine information on the extent of human activities (or activity data – AD) with coefficients that quantify the emissions or removals per unit activity (or emission factors – EF). This guidance can be summarized by the following equation:

$$\text{Emissions}_{(tC/year)} = AD_{(ha/year)} \times EF_{(tC/ha)}$$

Objective 4: To establish a central REDD+ Project Registry (RPR) and link it with FNC's Electronic Resource Program as a database and archiving system including the provision of information on REDD+ Safeguards

Under the SNFMS, a REDD+ Project Registry will be established to integrate subnational or project level REDD+ result based activities into national accounting. REDD+ registries will be used as important tools to centrally record the information to facilitate transparency, easy access, and tracking of that information particularly results-based funding, benefit sharing, private investment and the information related to Cancun safeguards as to how they are being addressed and respected during the implementation of the proposed REDD+ actions. The monitoring function of Safeguards will be linked to RPR and integrated into SNFMS. The core feature of safeguards monitoring function will enable incorporation of local knowledge into national monitoring and provide inputs to validate information in a participatory way.

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[2] https://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf#page=11 (Decision 4/ CP15)
https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=12 (Decision 1/ CP16)
https://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf#page=31 (Decision 11/ CP19)

Objective 5: To develop a national forest and land use web portal for ensuring transparency, accessibility and quality of information related to Sudan's LULUCF sector

Under the SNFMS, a national database and separate web portal for the forests and land use sector will be established to ensure quality, transparency and accessibility of information related to the forest and land use sector in Sudan. These web portals will be linked to FNC's already established electronic Resource Management System.

3. ACTION PLAN DEVELOPMENT METHODOLOGY

The SNFMS Action Plan (AP), developed in consultation with relevant stakeholders, identifies the activities to be implemented to allow implementation and operationalization of the SNFMS through phases II and III of REDD+ readiness. The SNFMS AP ensures that the activities are in line with international guidance (UNFCCC and IPCC), overall context of Sudan's REDD+ policy, guidelines and set forth principles defined in Component 4a of the R-PP required to operationalize the SNFMS systems and tools. The AP also considers existing and future national, institutional, legal and procedure arrangements. A detailed desk review of REDD+ MRV related literature was carried out followed by individual and key informant interviews, focus group discussions, working group meetings, a national consultative workshop and final validation workshop. This AP has been developed in accordance with the five steps outlined below.

Step 1: Review of Important Literature

A detailed desk review of REDD+ MRV related literature was carried out to assess the information regarding capacity gaps and issues in implementing SNFMS. Over the past few years, Sudan has produced a number of reports, articles related to REDD+ MRV and some reports were being developed for different project outputs of R-PP. Key documents that were reviewed include:

- Existing guidelines and information related to REDD+ MRV in the documents of UNFCCC COP Decisions, IPCC, UN-REDD and World Bank

- FAO's Forest Resource Assessment (2005, 2010, 2015, 2020)

- FAO's Forestry Outlook Document

- Government policy documents and background studies (key sources were the reports and analyses around Government of Sudan's Readiness Preparation Plan – RPP (2014), Mid-Term Progress Review of R-PP, and National Communication Document to UNFCCC, National Forest Policy (1986), National Forest Policy (1989), Draft National Forest Policy (2006) updated 2015 together with Forest and Natural Resources Law 2002, which is still under consultation process and yet to be approved and updated progress reports of different R-PP project outputs.

- Documents of some previous REDD+ related projects in Sudan (Such as Internal Carbon Sequestration Project - ICSP)

- Scientific papers and articles related to REDD+ MRV in Sudan

- The National Forest Inventory Report (2020)

The main secondary data sources to review and assess the monitoring capacities were FAO Forest Resources Assessment (FRA) (FAO, 2005, 2010, 2015 & 2020), the National Communications to UNFCCC, the R-PP and its mid-term progress review and institutional capacity assessment report of 2017. The FAO FRA produces global tables and country reports on a regular basis which include information on the forest resources of a country, such as measurements and estimations of forest area, biomass and carbon stocks. The National Communications include a national inventory of anthropogenic GHG emissions which countries submit to the UNFCCC. The R-PP contains initial plans for a national REDD+ strategy, information on the current status of the monitoring system and GHG estimation as well as a description of the current country situation with respect to its forests. The R-PP also addresses potential challenges for implementing a REDD+ strategy and the constraints of the current monitoring system. The capacity assessment report (2017) gives an outline of capacity issues and needs for implementation of Sudan's MRV.

Step 2 : Preparation of Checklist and Interview Protocols

Based on the literature review, a checklist and interview protocols **(Annex – I)** were developed to assess the current status of existing capacities, gaps and needs of the target groups. The capacity gap was calculated by summarizing different performance indicators for different assessment categories. These assessment categories were taken from the guiding criteria for components and element of capacity assessment provided in the UN-REDD NFMS Action Plan template **(Annex – II)**. The target groups focused on retrieving the information using the above mentioned approach were:

1. Federal and state/ localities, relevant government organizations/ authorities (FNC-PMU, HCENRM, RSA of NRC, Regional REDD+ Units/ Focal Points, ZinaNet Company etc)

2. Relevant Non-Governmental Organizations having interest with varying degrees of capacity building (FAO, WWF etc)

3. Forestry/ GIS Experts

4. Researchers

5. Academia (Universities mentioned as potential stakeholders in SNFMS section of R-PP document)

A value was attributed to the capacity that was identified as lacking both at the national and regional/state level to establish SNFMS. This is called the "capacity gap".

Step 3: Awareness Raising Workshop and Review and Reactivation of SNFMS Working Group (WG)

Sudan has established six working groups (R-PP 2014). An awareness workshop was organized for the SNFMS/MRV working group to review the structure and ToR of the WG, as well as to reactivate the group, ensuring participation of all relevant stakeholders and to get their technical support for development of the SNFMS AP. The check list and interview protocols were presented and shared with the WG to incorporate their feedback and inputs. During the workshop, the ToR, the roles and responsibilities, and the operational modalities of the working group were discussed, refined and validated.

Step 4: Federal/ Regional Consultative Meetings for Capacity Need Assessment in context of SNFMS

After the checklist and interview protocols were finalized, the required information from reviewed documents was extracted to complete the check lists following consultative meetings and focused group discussions at the federal and regional levels. For this, a list, comprising of REDD+ MRV

relevant governments and other institutions, experts, groups, and key informants was prepared with the help of WG and FNC-PMU. The consultation process helped significantly to generate insights into the realities and need for the capacity development in SNFMS. The consultation also helped to reflect upon need for developing a broad and coordinated strategy for capacity building intervention for SNFMS implementation. After a thorough consultation process and assessment of responses, the SNFMS capacities were mapped and gaps and needs of national and regional forest administrations and other relevant government organizations were assessed. Capacity gap assessment was based on the state of the existing capacities for national forest monitoring and the requirements for the SNFMS implementation.

Step 5: Second WG Meeting to get Feedback and Inputs on Zero Draft of AP

After assessing the elements developed in Component 4 of the R-PP (mandate and scope of the SNFMS and each of its components) and evaluation of the proposed checklists and interview protocols, the working group jointly reviewed the zero draft of the AP. The WG was subdivided into 4 subgroups to review the zero draft of AP in the following manner:-

- Subgroup 1: Contextual chapters, cross-cutting activities and monitoring function related to cross-cutting activities such as environment and gender equality etc

- Subgroup 2: Satellite Land Monitoring System

- Subgroup 3: National Forest Inventory

- Subgroup 4: Green House Gas-Inventory

- Subgroup 5: Sustainable Forest Management

After incorporating the feedback from WGs, the first draft of the AP was shared with the relevant stakeholders for further comments and inputs.

Step 6: Final Validation Workshop

The national validation workshop was held on 10th December, 2020 at FNC Khartoum. The objective of the workshop was to share and present the SNFMS Action Plan as well as explain the development process of the Action Plan. The overall consultations, extensive document review and formal and informal interactions with various stakeholders/officials was presented. It sought recommendations for additional information and to identify key gaps or concerns on the process.

The workshop gathered critical inputs which helped to further improve the action plan. At the end, the SNFMS Action Plan was formally validated and endorsed by the participants of the workshop.

4.NATIONAL CIRCUMSTANCES

Sudan's ability to adapt to climate change, as well as its GHG emissions are influenced by a number of national circumstances. These include the country's geography, climate, people, and economy among others. The rural economy, which contributes to 70 percent of overall economic growth, is currently locked into an unsustainable, extractive, poverty environment. As a consequence, potentially high-value agricultural landscapes and forest resources are being rapidly degraded by low-yield agriculture and unsustainable fuelwood harvesting, which are projected to be exacerbated by the increasing effects of climate change. Sudan is highly vulnerable to climate change and climate variability, predominantly a result of climatic and non-climatic factors (NAPA, 2007). These factors, in addition to the interaction of other multiple stresses such as ecosystem degradation,

complex disasters and conflicts, and limited access to capital, markets, infrastructure and technology, have all reduced the country's ability to adapt to the impacts of climate change (AIACC WP No. 42, 2005; Zakieldeen, 2009). Agricultural production continues to employ some 70 percent of the work force and contributes a third (i.e. 35 percent) of GDP. The leading export crops are livestock, meat, sesame, gum Arabic, groundnuts, cotton and sugar. Sudan has the largest livestock inventories in Africa next to Ethiopia, as Sheep, cattle, goats and camels are mostly raised.

4.1 The Forestry Sector

According to Sudan's National Forest Policy Statement[3], forests contribute about 12 percent of the country's gross domestic product (GDP). This contribution is mostly due to demands at varying levels in the country for forestry products, including fuel wood, construction poles, charcoal, timber, food, gums, fodder, and native medicines. Contribution of the forest sector to the national economy, on the other hand, is under-estimated where the formal national accounts reveals an under-estimation of the forestry sector to the GDP in the range of 3 percent. This contribution is primarily accounted from annual exports of gum Arabic, and from numerous direct and indirect benefits such as environmental protection, soil amelioration, and work opportunities for rural populations, building material and wood fuel.

Of the total population, almost 70 percent of rural & nomadic peoples are considered to be forest-dependent for their livelihood, wood energy and on round timber for buildings. 66 percent of the rural population uses wood as the main source of fuel for cooking and as construction material. The industrial sector typically accounts for less than 10 percent of the total wood consumption, out of which, over 98 percent is consumed as firewood at industrial and commercial facilities with the remainder taken up by brick kilns, the lime industry, sawmills, and other wood-based industries in the country[4]. The per capita consumption of fuel wood is 0.7 m^3/annum which, when converted into Ton/Oil Equivalent (TOE), could be valued at nearly 2.0 Billion US dollars. Moreover, Non-Woody Forest Products (NWFPs) are diverse and contribute substantially to livelihoods at the household level and to the national economy. The revenue from the annual export of Gum Arabic makes up 2.4 percent of total non-oil exports and 0.7 percent of total exports[5].

Income generation from forests in Sudan include income at the government level (federal, state and local), household level and the private sector. Various sources of income generation are presently under government control and can be listed as direct sales of wood products such as fuel wood, construction timber and sawn timber. Sudan forests produce diversity of NWFPs that constitute potential sources for industrial development for local use and for export. Cottage industries could make up 20-50 percent of rural household income, amounting to some US$ 1 billion a year. Traditionally, the cottage industry supplies the market with many products that are attractive to tourists[6].

1.1.1   Forested Area

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[3] http://www.fao.org/forestry/15154-0f1a279a68972549c8f10e5aeeb9fc22.pdf
[4] https://unfccc.int/sites/default/files/resource/Sudan-2NC-Final.pdf (SNC, 2013)
[5] Sudan's Energy Consumption Study 1994
[6] https://www.forestcarbonpartnership.org/system/files/documents/R-PP%20PC17%20Sudan%20June%209%2C%202014%20Clean%20Version_rev.pdf (Sudan's R-PP Document, 2014. Pp 39)

Currently, forests cover 9.8 percent of the total area of the country[7] while the Quarter Century Strategy (2003–2027) entails that 25 percent of the total area should be assigned for natural resources. This gives a great opportunity to more than double up the area covered by forests for various purposes, allowing for better protection and development of the forest resources and environment. Future reservation of productive forests would likely be either state or community forests because since the establishment of a federal system, all unregistered land became under the administration of State Governments. In 2012, FAO produced a national Land Cover Map of Sudan using Land Cover Classification System (LCCS) that portrays national land cover classes of Sudan (Table 4.2).

Table 4.1: Sudan's Land Cover Classes (2012)

Land Cover Class	Area (ha)	%
Agriculture in terrestrial and aquatic/regularly flooded land	23,710,025	12.6
Trees closed-to-sparse in terrestrial and aquatic/ regularly flooded land	18,733,182	10.0
Shrubs closed-to-sparse in terrestrial and aquatic/ regularly flooded land	22,231,327	11.8
Herbaceous closed-to-sparse in terrestrial and aquatic/ regularly flooded land	25,982,720	13.8
Urban areas	730,331	0.4
Bare Rocks and Soil and/or Other Unconsolidated Material(s)	95,277,727	50.7
Seasonal/perennial, natural/ artificial water bodies	1,290,000	0.7
Total Sudan area #	187,955,312	100.0

Source: FAO 2012: Land Cover Atlas of Sudan: Official Sources cite total area of Sudan as 1 886 068 km° (188 606 800 ha.).

The total reserved and protected areas consist of public, institutional, community, private and wildlife protected areas and national parks and by the end of 2012 it reached 12.3 million ha. All reserved forests (public, community, private) represent 4.54% while, that occupied by other protected areas (including wildlife protected areas) represent about 7.12% of the total area of the country. The public reserved forest area was remarkably increased (by nine times) from 1.25 million ha in 1993, to approximately 12.3 million ha by the end of 2012, as a consequence of Presidential Decree in 1993. Community and private forest reservation started in the mid-1980s and has shown an increase of over six and twelve times, respectively, between the periods 1986–2000 and 2001–2012. The area of institutional forests is very small. It increased by nearly 8,687 ha (2.7 folds) from 1986 to 2012. (FNC 2011b). The percent wise current forest and woodland cover in Sudan is given in table 4.1 below:

Table 4.2: Percent-Wise Coverage of Forests & Woodland in Sudan (2011)

Desert	Semi-desert	LRWS		HRWS	Special Areas	Montane	Flood Region	Total
		Clay	Sand					
38.6	26.2	15.9	11.4	0.9	6.4	0.2	0.4	100
Arid				Sub-humid			Humid	
92.1				7.5			0.4	100

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[7] FAO FRA 2020

Source: Sudan's R-PP Document 2014. Pp46

1.1.2 Biodiversity

Sudan is endowed with a wide range of ecosystems and species diversity. There are some 184 species of trees and shrubs including 33 exotics together with a few endemic and near endemic. Special areas with a wealth of rare species are found in the Red Sea coast and mountain areas. About 204 range of species were identified. Most of the wildlife resources of the country are to be found within the High Rainfall Wood Savannas (HRWS). Wetlands on the Red Sea Coast, desert oases, dams, reservoirs and in-land lakes are important habitats for resident and migratory birds. The River Nile and the Red Sea Coast are part of the fly over for soaring and migratory birds from Eurasia to Africa. The Sudanese Red Sea is still fortunate to have attractive and mostly pristine habitats, particularly its coral reefs. There are remnants of mangrove stands, sea grass beds, and associated marine fisheries and biodiversity including sharks, dugongs, turtles, and a variety of sea birds. Two protected areas are established- Sanganeb and Dongonab-Mukawar Island with good representation of the Red Sea marine ecosystems.

Dungonab Bay and Mukawwar Island is a turtle nesting site of regional and possibly international significance and it is internationally recognized as an Important Bird Area. The Dugong population may be the most important remaining on the coast of Africa. Regional action plans (following regional surveys) were developed for corals, mangroves, turtles and breeding seabirds and are being implemented nationally via national action plans[8].

1.1.3 Forestry policy

Recognition of the need to confront the decline in forest area has led to several sustainable forestry initiatives, particularly, the adoption of community-based forestry management practices and switching from firewood/charcoal to LPG. Forest development in Sudan actually commenced at the beginning of the 20th century. Since then several important changes have occurred. These changes, legal and constitutional in nature, have introduced wide-ranging changes in forest management (FNC, 1989). Key statutory documents include the Wood and Forest Ordinance of 1901, The Forest Ordinance of 1908, Forest Conservation Rules of 1917, and the first forest policy of 1932.

The first Forest Policy issued in 1932, reviewed in (1986), encourages forest reservation and conservation, and community and private sector participation in forestry development and management. The Forest Policy Statement responded to the new concepts based on the emphasis on environmental protection, public participation and the multiple uses of forests. The prominent core of 1986 forest policy includes: recognized new forms of forest tenure including private, community and institutional forests, targeted 20 percent of the area of the country as forest reserves; stressed the role of forests in environmental protection by creating new obligations in semi-mechanized farming or irrigated area to maintain or establish green belts; emphasized the role of public participation and the international community in afforestation and sustainable management of forests; and recognized the need for research in forest development and emphasized the role of forest extension.

The Forest Act of 1989 prescribes the allotment and upkeep of 10 percent and 5 percent of rain-fed and irrigated agricultural land respectively to forests in the form of wood lots and shelter belts. The Forest legislation of 1989 is particularly notable in its call for the active participation of community and private sectors in forestry development and management. This legislation is widely perceived to

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[8] Sudan's R-PP Document 2014. Pp 137

have resulted in improved forest management practices, as well as increased levels of forest reserves and protected areas.

The Comprehensive National Strategy 1992-2002 stipulates the allotment of 25 percent of the country's land area to forest, rangelands and wildlife reserves.

The Sudan's draft National Forest policy Statement (2006), developed through technical support of FAO, is a recent update of Sudan's Forestry Policy 1986. The 2006 Statement, which has not yet been ratified, is expected to make major changes in forest development and management. It is incorporating poverty reduction strategy, improvement of people standards, amelioration of physical environment and combating desertification. The reservation of forest area as a community forest proposes coordination between the native leader, the locality, the commissioner and the state minister of agriculture to establish rights of the community over the particular area. The federal Minister makes the reservation order upon the recommendation of the general manager of the Forests National Corporation (FNC). Other policies include Water Policy, Forest Outlook, Document on Sudan's Commitment to Social Development and Population Policy. These initiatives are expected to protect forest cover in the long-term.

A parallel effort is underway to advocate explicit articles in the forthcoming Sudan Permanent Constitution about Federal, Provincial and Local prerogatives over Land, Water, Forest, Range and Minerals. Budgetary allocations for some of the aforementioned activities have been proposed in the current R-PP. The envisaged forest policy review will inevitably be consultative and participatory but would quite likely consider re-establishment of designated functions for riverine, non-riverine and montane forests to accommodate meeting livelihoods and grazing needs of forest dependent & neighbouring communities; embed forestry concerns into those other competing land using sectors such as Agriculture, Water, Mining and Oil Resources; build/consolidate synergies between National Forest & Food Security Policies & programmes and reiterate importance of judicious & rational utilization of natural resources.

4.2 National Dynamics of Deforestation and Forest Degradation

Deforestation and desertification continue to be major environmental challenges facing Sudan. Forests have been facing encroachment by agriculture, urbanization, and unsustainable wood fuel extraction for several decades. The lack of integrated land use plans and coordination across institutions has resulted in uncontrolled land use changes and conversion of vast forest tracts into agricultural areas over the past 40 years.

The average deforestation rate over the past 40 years is reported between 0.4 – 0.7 million hectares per year (World Bank 1985, FRA 2005, Daak 2007, Elsiddiget al. 2007) placing its deforestation rate among the ten highest in the world. The primary underlying causes of deforestation & forest degradation are perhaps increased human and animal populations together with demographic changes, further exacerbated by environmental and socio-economic & political variables. In 2018, a detailed study was conducted on the assessment of drivers of deforestation and forest degradations under REDD+ Readiness Preparation. The study identified various direct and indirect drivers of deforestation and forest degradation which are highlighted in table 4.3 of **Annex - III**.

4.3 Existing REDD+ Policies and Measures

Sudan has formulated a draft national REDD+ strategy to address the drivers of deforestation and forest degradation (DoDD), which are outlined in the previous section. Several REDD+ strategy options are proposed in the draft national REDD+ strategy guided by REDD+ Readiness Proposal. The strategy options lean on and draw from the country's wealth of experience amassed through practice of over a century of forest management, afforestation, reforestation, tree planting, educating, training and involving a wide spectrum of resource stakeholders and custodians, all through harnessing of support from development partners and Government and society support. The draft national REDD+ strategy used three broad types of economic policy instruments to reduce deforestation and forest degradation i.e. regulatory instruments (e.g. policies, laws, regulation, levies), fiscal instruments (subsidies through REDD+ finance and other public sources of funding, levies) and capacity building (workshops, field visits, courses). Various options are explored (refer to table 4.4) to address the DoDD with a combination of instruments, if designed well, will be the most effective, and cost efficient means of reducing deforestation and degradation.

Table 4.4: Policies and Measures to Address Drivers of Deforestation and Forest Degradation

Proposed/ Planned Policies and Measures
• *Incentives for crop intensification and more balanced livestock production* through (i) pilot projects to aid learning and adoption, besides alleviating chronic problems of landlessness and (ii) agroforestry and/or agro-sylvopastoral projects to produce high-value food cash crops, livestock & products thereof, building poles, firewood, charcoal and gums in communal lands, private holdings & FNC and State forest reserves, capitalizing on recent developments in water harvesting. These policies also need to be based on research/studies on cost-benefit analysis of agroforestry schemes, including examination of diversification benefits and supplementary irrigation from water harvesting.
• Incentives for increased gum Arabic production through developing protocols for production of gums other than gum Hashab (*Acacia senegal*) through popular participation, agroforestry and agro-pastoral systems.
• *Incentives for energy substitution to LPG through* (i) technical, socio-economic and environmental feasibility of shifting brick firing from wood to LPG and (iii) technical, socio-economic and environmental benefits/drawbacks of shifting building with wood-fired clay bricks to cemented sand blocks which are less expensive and environmentally friendly. However, these options require thorough studies & pilot experimentation to be undertaken on non-cost demand factors (that could act as barriers to fuel substitution) and fiscal instruments linked to REDD+ finance that would make LPG cheaper at point of sale.
• Develop a more sustainable industry for charcoal, based on sustainably managed plantations, high efficient kilns and improved charcoal cooking stoves. To achieve this, government plans to initiate pilot projects to produce certified sustainable high quality charcoal for domestic urban consumption and export. However, this also requires technical/environmental/socio-economic studies on potential quality of charcoal from most suitable local species (e.g. Mosquite).
• Incentives for firewood efficiency through (i) establishing firewood plantations of high calorific value indigenous tree species (*A. nilotica* and *A. seyal*) and exotic trees (*Eucalyptus spp.*) in various settings and ownership, (ii) improve harvesting efficiency & recovery of firewood from riverine (*A. nilotica)* forest plantations and (iii) design, test and disseminate fuel efficient stoves particularly in high consumption areas (e.g. Darfur).

- *Provision of incentives for renewable energy production and grid infrastructure through investment in* grid infrastructure as well as renewable sources of energy such as hydro, solar, wind and geothermal.
- Incentives for expanding reforestation and afforestation include supply side measures – particularly subsidies – and demand side measures that increase domestic and international demand for sustainably managed plantation wood products.
- Production of small size wood for value adding processing from different high value & yield timbers species on sustainable bases under short rotations.
- Production of good quality charcoal from *Acacia seyal* under short rotation from plantations partially irrigated through water harvesting.
- Production of cash crops/fodder/gum in agroforestry systems partially irrigated through water harvesting.
- Use of a revolving fund to finance reforestation, afforestation and wood processing.
- *Incentives for crop intensification and more balanced livestock production*
- Incentives for forest conservation and sustainable forest management through (i) designing and implementing various modalities of community participation in forest & rangeland conservation & management across Sudan and (ii) assessing the impacts on deforestation from switching FNC funding from levies on wood products and non-wood forest products to REDD+ funds.
- *Reconciliation of conflicting policies of rival economic sectors and streamlining of activities of supporting sectors such as education and research* Reconciliation of policies forestry, range & wildlife with those other economic sectors such as Agriculture, Industry, Mining, Oil, Tourism and Finance & National Economy.
- Full integration/ merger of research and higher education institutes of Forestry, Range & Wildlife,
- Revision of research programmes and teaching/training curricula of Forestry, Range and Wildlife to accommodate variables emanating from CC, Desertification, geo-political realities and socio-economic development.

Source: Draft National REDD+ Strategy (2017)

The most effective means of reducing deforestation and degradation through economic instruments is to use an integrated approach. Many of the options below are inter-related, and even those that are mutually exclusive will be more effective if used in combination with other options or on-going or future programmes. However, the proposed options need to be screened, prioritized and translated into effectively achievable actions through well-defined monitoring indicators in an inclusive and participatory process in consultations with key stakeholder groups.

4.4. SNFMS Development

4.4.1 Institutional arrangements for SNFMS

Sudan requires sound institutional arrangements at country level to comply with the COP decisions concerning (i) a national strategy or action plan; (ii) a national forest reference emission level and/or forest reference level (FREL/FRL); (iii) a robust and transparent NFMS to meet MRV requirements for REDD+; and (iv) a system for providing information on safeguards. A draft national REDD+ strategy with a long-term vision and strategic plan also highlights the institutional mandates and specification of roles and effective coordination mechanisms for the overall national REDD+ program. The current REDD+ institutional arrangements are still evolving in terms of their technical and institutional capacities to handle the coordination of REDD+ readiness and implementation phases.

Land and forest management within Sudan is the responsibility of multiple Ministries and agencies, depending on the land cover specifications. These include Ministry of Agriculture and Forestry, Natural Resources and Physical Development, Ministry of Animal Resources, High Council for the Environment and Natural Resources, Fisheries and Rangelands, Ministry of High Education & Science Research, Ministry of Finance, The Remote Sensing and Seismology Authority and Academia. Based on their objectives and mandates, these Ministries all have links to environmental management and monitoring and could potentially benefit from the information that is gathered from the SNFMS. However, there is still a need to establish a thorough process for planning, collecting, processing, analyzing, reporting and verifying data, based on required capacities, guiding methodologies and tools which Sudan recognizes as a need for adequate and sustainable SNFMS institutional arrangements. Sudan intends to build on and strengthen existing institutional arrangements in establishing SNFMS to facilitate use of official data sources, reduce duplication of costs and efforts, avoid institutional conflicts, help maintain consistency in reporting and maximize co-benefits.

This AP will help Sudan to formally, permanently and firmly embed the national level forest monitoring system into existing national frameworks regarding policies and legislation, government structure and financing systems (e.g. national budget) with a legal basis, permanent institutional framework and financial commitment to ensure implementation and operation of national forest monitoring. This integration will create the legal justification and formal basis for the long-term functioning of the SNFMS. The SNFMS will be comprised of people, institutions and resources to implement national forest monitoring in Sudan in collaboration with other stakeholders.

Based on the existing institutional structure, capacity assessment and needs of relevant federal and state level institutions for the implementation of SNFMS, the institutional arrangements for SNFMS are proposed in figure 4.2 below
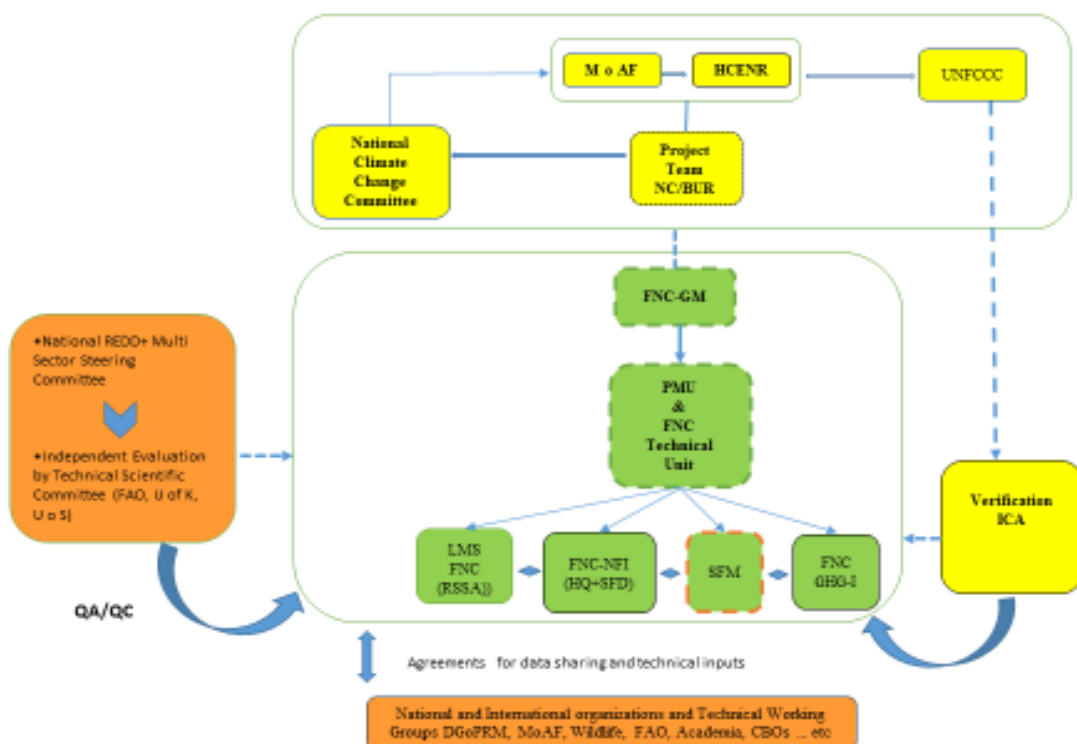

Figure 4.2: Proposed Institutional Structure for Sudan's National Forest Monitoring System

The FNC will be responsible for and leading the conceptualization of the SNFMS, as well as its planning and execution within its well-defined mandate, based on the agreed principles and elements. The immediate outcome of a SNFMS will be data, either collected in the field or obtained using remote sensing data sources at specified intervals, from which targeted information regarding the current status and changes will be derived for decision-making purposes. Provision will be made for long-term data management to allow analyses to be repeated and time series to be built from inventories at earlier points in time. Therefore, comprehensive data management is incorporated into the design of a SNFMS from the outset. Such a data management system will be located within the FNC responsible for the SNFMS, in order to guarantee long-term preservation and availability of data both for standard analyses and upcoming research questions.

High Council for Environment and Natural Resources (HCENR): The HCENR is supervised by the Prime Minister Cabinet and is responsible for developing public policies for environmental protection, in coordination with the relevant Ministries. They also coordinate scientific research in all fields of environment and natural resources, build environmental awareness, adopt and approve environmental impact assessments and set up long-term strategies and programs in the field of environment and natural vision. The Council consists of the Chair of the Council - the Minister for Agriculture and Natural Resources, and the membership of ministers and heads of institutions of direct relevance, representatives of research institutions and academics, representatives of civil society organizations, legal persons, or experts in the field of the environment. The General Secretariat has technical capabilities in the areas of coordination, capacity building research and planning and monitoring of projects. The HCENR Secretariat includes coordinating unit for international conventions, including the UNFCCC. Within this role, the HCENR is the focal point for the UNFCCC, and is responsible for preparing and submitting all reports to the UNFCCC, including the BURs, the NC, and the Technical description of the FREL/REL for review. Currently, the General Secretariat also coordinates the institutional linkage between the members of the Council from the institutions involved in the field of environmental issues at the state level. This resulted in many programs of action from joint work programs and projects being implemented in all states of Sudan. The HCENR also coordinates the efforts of the state to join the environmental conventions, including the UNFCCC. In this role, the HCENR is coordinating the national GHG-I and the third NC. This includes coordinating the activities of the sub-structures that have been established for the national GHG-I.

The Ministry of Agriculture and Forests (MoAF): The MoAF is responsible for developing and implementing policies and programs related to mechanical and irrigated agriculture, as well as forest land. This responsibility extends to State-based activities. Land gazetted as "forest lands" is the responsibility of this Ministry, as is developing agricultural policies and natural resource policies. This includes developing and improving agricultural production to provide food security and modernize traditional agriculture., carrying out scientific and applied research in agriculture and natural resources, and supervising and investing in natural resources and follow up on the implementation of laws that promote and protect forests.

National Climate Change Committee (NCCC): The NCCC is a permanent committee including members from relevant institutions to climate change such as Ministries of Agriculture, Animal Wealth, Fisheries and Rangeland, Oil, Industry, Water Resources, Electricity and Dams, in addition to the Corporations and Companies that deals with waste management. The committee is chaired by the Secretary General of HCENR. This committee is responsible for approving progress reports, Annual Work Plans, annual progress reports and technical reports, with necessary clearance from UNDP-GEF Regional Technical Advisor (RTA) and other regional and international relevant organisations. It also provides guidance for proper implementation of the project. Members of the committee include UNDP and representatives from all relevant institutions. All relevant Ministries, Universities, Research Institutions and Non-Governmental Organization will take part of the project.

National REDD+ Multi-Sector Steering Committee: The National REDD+ Multi-Sector Steering Committee is a Ministerial level committee that is responsible for designing the policy framework for the REDD+ program. The Committee is chaired by the Ministry for Agriculture and Natural Resources, and was established to facilitate coordination between sectors that are key agents in addressing the drivers of deforestation as well as sustainable natural resource management at the policy level. The emphasis is on taking action to address the drivers of deforestation and forest degradation (noting these terms are yet to be defined for the Sudanese context). The Steering committee meets on an annual basis.

The Forests National Corporation - FNC: The FNC will be responsible for overall coordination and communication regarding SNFMS. The ODM will ensure effective coordination among the federal and provincial level institutions and organizations and will make decisions regarding implementation of SNFMS. Noting the HCENR is not responsible for developing the technical description, this is the responsibility of FNC. The FNC has been the key national institution overseeing forest management. Under authority granted by the Forest legislation of 1989 Act, its principal function is to establish general policies and regulations to govern forest exploitation, development, and protection. FNC will be responsible for the coordination of data to be assembled, analysed, corrected, and approved for implementation.

REDD+ Project Management Unit (PMU), FNC: The PMU is a project focused management unit within FNC established for the FCPC project. The PMU is responsible for coordinating the development of the SNFMS, and the development of the FREL/FRL and supporting technical documentation. The PMU and FNC technical unit in the headquarters and states is responsible for the coordination of the measurement component of the MRV, as well as the preparation of technical descriptions and reports to be provided to the HCENR. The PMU has five staff allocated for this task, with financial and forestry backgrounds. These positions include the Coordinator, Communication/Extension, Administration assistance, Procurements, and Technical Specialist (focusing on the National Forest inventory). Currently, the PMU is funded through the FCPF program, with no certainty of continuation following the completion of the project.

Remote Sensing (RS)/ Geographic Information System (GIS) Lab, FNC: FNC has a long history in the field of RS and GIS since 1970 when it used GPS as the first department in Sudan for surveying and mapping its forests (Mohie eldeen 2008). However many activities have been done by or with the contribution of FNC Technical Administration. For example, the WB undertook assessment of the issues and options in the country's energy sector in 1982, and in 1983-1984 CIDA conducted aerial photography covering Blue Nile Provinces using randomly selected plots to determine the tree standing volume. In 1987, Lund University conducted a survey of 58 million hectares in central Sudan, and the NFI (1995-1997) which was implemented by FNC. Also, FNC contributed to other institutions in the development of Africover 2000 and the land cove map of Sudan 2010, which covered the whole country. FNC's GIS and RS unit have completed the Remote Sensing (RS) options complementary survey for Forest Resource Assessment (FRA) 2010 and FRA 2020 data. In 2018 FNC used RS application to monitor and assess the drylands across the Great Green Wall region of Africa. Recently, FNC has completed the second NFI 2020 and the third Sudan Land Cover Map 2020 in being developed with the help of FAO.

Remote Sensing and Seismology Authority (RSSA): The RSSA, since the establishment in late 70s, plays a vital role in sustainable development of natural resources in Sudan and builds strong knowledge in geo-informatics. The RSSA is responsible for space based international agreements and is the national focal institution for production of space based information and data management. The objectives of the RSSA are to achieve the needs of research projects by using the latest developments in the field of space information, implementation of space applications for natural resources, climate change and disaster risk reduction, identification of strategies and

allocation of projects for space information, capacity-building and knowledge transfer. The RSSA also developed the Land Cover Atlas of Sudan (LCAS) of 2000 and 2010. Currently, RSSA is developing forest cover and change maps to generate Activity Data for sub-national FREL covering three states (Blue Nile, Sinnar and El Gadarif)

FNC Technical Unit Headquarter Office: PMU and FNC technical unit are supposed to do this together. PMU will be doing the coordination and follow up and the technical part will be tackled by FNC technical experts (Technical Unit).

State Forest Administrations (State FAs): These include Forest Administrations in all 18 states of Sudan. As NFI requires a lot of field surveys, data collection and field level quality control and other technical work, it will mainly be done by the state FAs in their respective states. State FAs will then supply their data and reports to FNC through technical headquarter units for national level compilation, analysis and preparation of consolidated reports. The technical guidance and capacity building support to the FAs will be provided by PMU.

Universities and Research Centers: There are several academic and research institutions[9] with expertise in forests and forest management which may have skills of value to the development of the SNFMS. These institutions include University of Khartoum, University of Kordofan, University of Bahri, Sudan University of Science and Technology, University of Sinnar, University of El Fasher, Aljazeera University, West Kordofan University, Zalingei University and Forest Research Centre etc.

Other National Level Institutions having States in Forest Management: Other national institutions with a role in forest management include the Range and Pasture Administration, whose mandate is to protect forests for livestock; the Wildlife Administration, whose mandate is to manage Nature Reserves; and a number of other institutions such as the General Administration for National Energy Affairs, and Higher Council for Environment and Natural Resources.

International organizations: Formal or informal arrangements are required with different national and international organizations to benefit from their relevant experiences and to access the relevant data available to them for development of the SNFMS.

For this purpose, these organizations will be solicited to for data sharing agreements to share their available GHG related data (e.g. maps, satellite data, activity data, forest inventory data, allometric equations, emission factors, etc.) with FNC, RSSA and HCENR as well as other concerned institutions for the SNFMS. These organizations may become part of scientific committee (QC) to evaluate different aspects of the SNFMS according to their respective strengths.

4.4.2   SNFMS development phases

Sudan follows a phased approach proposed by the UNFCCC for the implementation of the REDD+ and the development of the SNFMS.

Phase 1 includes the planning and preparation of tools for the SNFMS including capacity building, the selection of technical systems, and technology transfer while defining policies, measures and institutional arrangements for the implementation of the SNFMS.

In Phase 2, Sudan intends to implement demonstration activities at the sub-national level in three states i.e. El Gadarif, Blue Nile and Sinnar through Emission Reduction Program, which will lead to measurable results. The demonstration activities will be monitored to assess their performance. The

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[9] www.fao.org/docrep/006/ad227e/ad227e03.htm

monitoring function will also provide information on land use and land use changes in areas where demonstration activities will be implemented and allow the satellite land monitoring to be tested and refined before full national implementation.

In Phase 3, the monitoring of REDD + activities will be extended to the whole country to assess whether national policies and measures are results-based. Each phase aims to build capacity and prepare for the next phase, thus allowing a degree of overlap between the phases, especially in terms of capacity building.
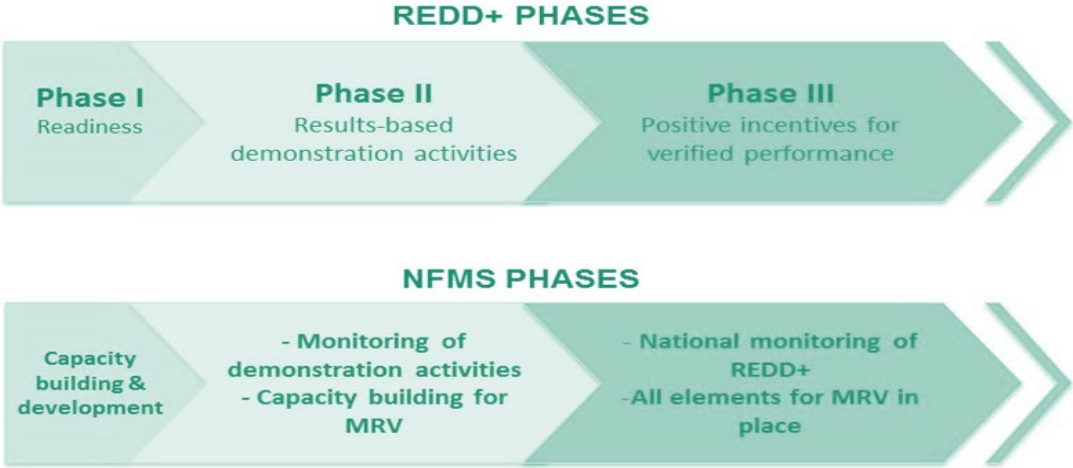
Figure 4.3: SNFMS Development Phases

4.4.3 Funding

The total cost for the SNFMS AP implementation is estimated US$ 3.621 million out of which USD 1.277 million are estimated for the LMS, USD 1.639 are estimated for NFI, USD 0.234 million for GHG-I, USD 0.3765 million for Monitoring function and USD 0.094 million for institutional arrangements of SNFMS. There is a need for detailed inventory of available funding opportunities and financial gap analysis. Further, financial sources need to be explored. Potential financial sources can be (i) funding from the federal government's developmental budget; (ii) funding from the provincial developmental budget; (iii) in kind contribution in terms of staff salaries and vehicles etc. (iv) International donor agencies such as GCF, GEF etc. National consultants will be engaged to assess various sources of funding and then develop a strategy to raise sufficient resources for the implementation of the SNFMS AP as well as its future sustainability.

5. CAPACITY GAP ANALYSIS

In order to ensure that the SNFMS (i) builds on existing systems and capacities and (ii) brings together all relevant stakeholders to avoid overlap in the development and implementation of technical systems, this section is designed to set out, in detail, the existing capacity of the country for each of the component elements of the SNFMS.

5.1. MRV FUNCTION

5.1.1   Land Monitoring System (LMS)

The effective policy decisions on land management practices need reliable, up-to-date and detailed information on the status and changing trends in land management practices. Before 2000, Sudan was most affected by the lack of assessment data and monitoring tools making their future land management decisions more difficult. Sudan recognised the importance of RS based land cover mapping, and a national level remote sensing study, for the first time, was conducted in 2000 with the development of Land Cover Atlas of Sudan (LCAS). The LCAS provides information on the land cover distribution by administrative divisions. The study used FAO's Land Cover Classification System (LCCS) and divided the country's land into six land cover classes (i.e. Woody Lands, Water Bodies, Urban, Range Lands, Bare Areas and Agriculture) using object based classification approach. In 2010, after ten years interval, another national level remote sensing based study was conducted under the same Africover project and with the same methodological approach, except for land cover classes. This study also used FAO's LCCS, but divided Sudan into 7 land cover classes i.e. (i) Agriculture in terrestrial and aquatic/flooded land, (ii) Trees in close-to-sparse in terrestrial and aquatic/flooded land, (iii) Shrubs in close-to-sparse in terrestrial and aquatic/flooded land, (iv) Herbaceous in close-to-sparse in terrestrial and aquatic/flooded land, (v) Urban area, (vi) Bare rocks and soils and/or other unconsolidated material and (vii) seasonal/ perineal, natural/ artificial water bodies. The dataset was created using the FAO/ GLCN methodology and tools. Main data sources include satellite imagery from SPOT, Landsat, IRS (Indian Sattelite), Aster, Africover land database and ancillary data. However, Land Cover Change Maps were not developed for the time period 2000-2010.

In 2017, under the REDD+ Readiness Program, Sudan initiated activity data generation to develop the sub-national Forest Reference Emission Level (FREL), as an interim measure, covering 3 states i.e. El Gadarif, Blue Nile and Sinnar. The sub-national FREL, which is still under process of development, covers 9 percent of the total land area and 15 percent of the total forest land cover of Sudan (FRA, 2015). The FREL design elements (time period, activities included, pools and gases etc.) of the sub-national FREL are already validated and made available to all stakeholders. Further design elements are still under consideration for moving from sub-national (interim) to national scale but clarity is required on the duration of the interim period of sub-national FREL/ FRL. The sub-national FREL/FRL are planned to be updated every 2 years. However, there is no clarity whether either sub-national FREL/FRL will be constructed as 08-year rolling average or 12 years rolling average. The projection period from the baseline also need to be clarified based on historical rolling average. Officially, Sudan follows an approach based on historical average of net emission from deforestation and removals from enhancement of forest carbon stocks over the past 12 years from 2006 to 2018. The reason for the choice of this approach is due to the variable factors for assessment of national circumstances which are still under study process.

Data availability and accessibility

The only national level satellite inventories available in the country are LCAS 2000 and 2010 which were developed under the Africover Project. Historically, there is no regularity in satellite based forest monitoring. Further, the available LCAS lacks application of national forest definition. The interpretation methods for land and forest cover assessments used by Africover 2000 & 2010 are inconsistent due to use of different land cover classes. For the development of recent forest cover/ forest cover change maps (for Blue Nile, Gadarif and Sinnar) Sudan used the same methodological approach (object based) and land cover classes that was used to develop the 2010 Land Use Atlas of Sudan.

To establish sub-national FREL, Sudan has adopted a systematic grid sampling approach to develop a historical time series analysis covering three epochs and 4 time points i.e. 2006, 2010, 2014 and

2018. According to the FAO team, a more accurate map for the selected sub-national FREL/FRL states has been produced. The accuracy assessment is carried out with available high resolution images of Google Earth and Bing and preliminary results on area adjusted estimates are available (Annex).

Forest and shrub mask for sub-national FREL states was created from Africover 2010 to apply the forest definition and used as ancillary data. The Government of Sudan did not yet endorse the forest definition for Sudan, which was prepared under the FAO project in a consultative process in May 2017, however, the proposed forest definition is used as basis for all project activities.

FAO's LCCs land classification scheme is most commonly used for land use mapping and forest cover assessments. The findings of recent assessments are still awaited and need to be checked if the findings are logically compared. Modeling the historic emissions and removals relies on the production of activity data with the documented Satellite Land Monitoring System (SLMS) methodology and time-series analysis. The SLMS methodology document is currently not available with RSSA and time series analysis is still in progress and results are still awaited. Within the framework of the UNFCCC, consistency in time series requires the use of similar methods and data sets in the base year and all subsequent years while the land cover classes for activity data mapping in Sudan are not consistent with IPCC guidance on land representation. The final product map shows only forest cover and forest cover change statistics and lacks information on land use/ land use change. There are consistency issues as the current forest cover mapping is done using Aster (15 m) for the reference year 2006 and Landsat (30 m) for the reference years of 2010, 2014 and 2018 respectively. Using different data sets will give different results for change assessments and cannot be compared.

Once the forest cover mapping process is completed, the time-series analysis is conducted, including the consistency checks to generate activity data concerning deforestation and carbon stock enhancement (restoration / afforestation / reforestation / natural regeneration) activities. However, the feedback mechanism regarding consistency checks, to confirm deforestation and afforestation/reforestation activities, is not clear at the moment. The uncertainty assessments/ accuracy checks of the recent forest cover maps are not available yet.

Land Use Change Maps are also not available at the state level. The results of recent land cover/ land use maps cover only three states (i.e. Sub-National FREL). Since Sudan needs to develop national FREL, Land Cover/ Land Use Change maps are also required to be developed for other states with consistent methodological approach adopted for development of sub-national FREL. A detailed assessment of data availability and accessibility at federal and state levels is given in table 5.1, **Annex - IV.**

Technical capabilities

The technical capabilities (hardware/ software equipment, tools and logistics) are adequate at relevant institutions at the federal level, however, at the state level the technical capability of relevant institutions is either missing or inadequate. There is a need to strengthen the in-house data production capacity (system and software infrastructure) of relevant institutions at the federal level. Small GIS labs/ Units need to be established in each state for state level land cover/ land use change assessments and integration of GIS (i.e. spatial planning) into future forest management planning. A detailed assessment of technical capabilities at federal and state level are given in table 5.2, **Annex - IV**.

Human capacity

Human capacity related to field data collection for Ground Truthing and Validation (sampling and use of GPS), understanding of error sources and estimation and documentation/ reporting of QC/QA

mechanism and assessment results) is either very limited or missing both at federal and state levels. Most of the institutions lack knowledge of IPCC guidance and understanding of relevant national/ international negotiations (UNFCCC) and decisions (REDD+ strategies and objectives) as well as expertise in real time forest monitoring. A detailed assessment of human capacities at federal and state level are given in table 5.3, **Annex – IV**.

Training facilities

Training facilities (training unit/ cell, training hall/ rooms, GIS training Labs and local experts/ trainers) are adequate with RSSA and FNC. However, the training units need to be strengthened with modern training equipment as well as a regular budget for such trainings needs to be allocated. At state level, the training facilities are not available. A detailed assessment of training facilities is given in table 5.4, **Annex – IV**.

5.1.2   National Forest Inventory (NFI)

The NFI of Sudan is the technical process of data compilation and analysis of forest resources from a multitude of data sources, including field inventories and remote sensing, to estimate relevant forest characteristics at particular points in time. The first NFI in Sudan was started in 1995 and completed in 1997. Since then, no activities have been undertaken to assess forest volume or biomass at the national level. However, intensive processes of forest management inventories have been going on at individual riverine and plantation forests and huge data is available from each of the eighteen States. It is the mandate of the technical sectors at each State to plan and conduct inventories in forests reserves. Recently, Sudan has developed a NFI manual. The manual is based on the multi-purpose information needs, targeted variables and accuracy for provision of relevant data to support national forest policy and to report for REDD+ under the UNFCCC. The NFI manual is guided by IPCC guidelines to ensure that the outputs from the NFI are consistent and in line with the UNFCCC reporting requirements and provide Tier 2 level for the EF, transiting to Tier 3. The manual is also tested in the field in 2017 – 2018 to assess EFs for development of sub-national FRELs.

Forest stratification was an issue of importance in the context of forest inventory. The states of Sudan initially developed forest classification and categorized forests as Dry Zone Forests, Moist Deciduous Forests, Wet Zone and Montane (adopted for sub-national FRELs of Sudan). However, the NFI 2020 followed the FAO Land Use Classification FRA Classification. Under REDD+ Readiness, Sudan has developed a comprehensive forest classification based on the existing forest types and ecological zones, in order to efficiently facilitate forests and GHGs inventories. A stratified sampling approach is adopted for NFI covering 1755 sampling units with 20 X 40 km grid spacing. However, due to resource and terrain issues, 784 SUs were actually inventoried out of 968 planned SUs to be visited. The main phase of the data-collection to assess EFs is completed in February 2019 including most of the inaccessible areas in southern parts and shrub lands. The majority of the data was collected using paper forms.

FNC is the only federal level institution with a legal mandate and basis to conduct national level forest inventories, therefore, capacity assessment for NFI is carried out only for FNC at federal level.

Data Availability and Accessibility

The results of 1995-97 inventory were produced in 2000, and did not apply the national forest definition of Sudan as the national forest definition was not available that time. Further, the inventory did not account for forest carbon pools and stocks.

In the recent inventory, the data is collected through systematic sampling (i.e. cluster sampling) for the purpose of comprehensive biomass estimation, carbon emission/ removal estimation,

commercial volume estimation as well as limited information on socio-economic dependencies. Agreed standard methodology for NFI is available in the form of a national NFI manual, which is guided by IPCC 2006 methodological guidance. The configuration and design of sampling plots is cluster nested. The data variables collected from the sampling plots include DBH, Tree/ Pole Height, litter, No. of trees, Dead wood, Stump diameter, Regeneration etc. Allometric equations and expansion factors are available for only 8 forest tree species i.e. *Accacia Seyal var. seyal, A. senegal, A nilotica, A. tortillis* and *Cassia fistula* of riverine forests and plantations. Allometric equations for most of the tree species found in natural forests are not available. The data is available both in digital and analogue form within FNC and FAO.

At the state level, the existing management plans are only available for riverine forests and plantations which does not account for forest carbon stocks. The information is only limited to commercial timber volumes and annual yields. Further information on REDD+ relevant safeguards is also missing from these management plans. The existing management plans need to be revised, keeping in view the country requirements to report GHG emissions and removals from the AFOLU sector. The natural forests are being managed without any management plan and most of the species found in natural forests lack allometric equations. Management plans need to be developed for natural forests at the state level. Local measurement units need to be consistent for reporting purposes under IPCC guidance. A detailed assessment of federal and state level capacities is given table 5.5, **Annex - V**.

Technical capabilities

The technical capabilities (institutional structure, logistics and equipment) at federal level are well established at FNC HQ Office. A REDD+ Project Management Unit is established with technical unit in FNC, which is overseeing the overall REDD+ program and inventory. Modern inventory equipment is available at the federal level.

At the state level, separate forest inventory units are established with a dedicated team of almost 4 to 5 officials mostly led by staff of an officer rank. However, expertise relevant to understanding of processes, influencing terrestrial carbon stocks, are missing among states. A detailed assessment of technical capabilities at federal and state level is given in table 5.7, **Annex – V.**

Human Capacity

Adequate human capacity is available at federal level to process and analyse the information related to NFI. There is limited human capacity in some states while other states lack technical capacity to analyse the information (i.e. technical report writing skills, review, consolidate and integrate the data and transformation of field data into reports) related to NFI in context of IPCC/ UNFCCC reporting requirements. Most of the states have no expertise on the application of statistical methods to quantify and analyze uncertainties for all relevant information (i.e. area change, change in carbon stocks, etc.). Almost all the states have the technical expertise related to understanding of drivers and factors of deforestation and forest degradation, data collection in the field, data processing, and dealing with technical challenges of sample designs and plot configuration in the field. A detailed assessment of human capacity to process and analyse the information related to NFI is given in table 5.8, **Annex – V**.

Training facilities

Training facilities are well established at the federal level. A well-equipped training room/ hall is available within FNC, which is being used for provision of trainings related to NFI and other thematic areas. Well qualified trainers equipped with up-to date knowledge and skills are also available. However, there is lack of budget for regular trainings of staff.

Training facilities are very limited among states. Though the states have the training halls/ rooms but necessary training equipment is required to equip them with training facilities. Local trainers are available, but their knowledge is limited to old fashioned conventional forest inventory techniques which need to be improved through organization of special ToT workshops on IPCC/ UNFCCC methodological guidance related to NFI. The states also lack regular budget allocations for staff trainings. A detailed assessment of training facilities at federal and state levels is given in table 5.9, **Annex – V**

5.1.3   Green House Gas Inventory (GHG-I)

Sudan has submitted two NC documents with a chapter including information on GHG inventory where net emissions from LULUCF sector were reported based on IPCC default values and some country specific Activity Data. Sudan's first NC was submitted in 2003. The assessment of GHG-I was carried out using IPCC revised guidelines of 1996, and emissions were calculated using both IPCC Beta v1.0 and Beta v1.1 Software. Three land use management practices, i.e. change in forest and other woody biomass stocks, forest and grassland conversion, and abandonment of managed lands were reported to result in net emissions. GHGs measured include CO_2, CH_4, N_2O, NOx, and CO. The results showed that emissions from forest and grassland conversion resulted in the net CO_2 emissions of 15,577 Gg, hence, this sector was concluded as net emitter of GHG (Table 5.10).

Table 5.10: Green House Gas Emissions. 1995 Land Use (Gg)

GHG Source and Sink Categories	CO_2 Emissios	CO_2 Removls	CH_4	N_2O	NOx	CO
TOTAL	15.577	0	90	1	22	787
Change in forest and other woody biomass stocks	0	-9,700	0	0	0	0
Forest and grassland conversion	28,714	0	90	1	22	787
Abandonment of managed lands	0	-3,438	0	0	0	0

Source: Sudan's First National Communication (2003)

The 2nd NC of Sudan was submitted in 2013. The GHG inventory assessment was carried out using the revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1996). In addition, the Good Practice Guidance 2000 (IPCC, 2000) and the Good Practice Guidance for Land Use, Land–Use Change and Forestry (IPCC, 2003) were also consulted. Default IPCC emission factors were used and the calculation of carbon dioxide-equivalent (CO_2eq) values was based on Global Warming Potentials from the IPCC's Second Assessment Report. Version 1.3.2 of the non-Annex I GHG Software (UNFCCC, 2007) was used to derive the estimates and tabulate emissions from different sources and sinks. Relative to overall anthropogenic GHG emissions, the Land Use Change and Forestry (LUCF) sector was reported to contribute 12 percent of total CO_2eq emissions. The conversion of forests and grasslands accounts for all CO_2eq emissions from the LUCF sector. Regarding CO_2 removals by sinks, changes in forest and other woody biomass stocks were accounted for about 76 percent of all sequestered CO_2. The remaining 24 percent of all sequestered carbon was associated with the abandonment of agricultural lands (Table 5.11).

Table 5.11: Green House Gas Emissions from LUCF 2000 (Gg)

GHG Source and Sink Categories	CO$_2$eq	CO$_2$ Emissios	CO$_2$ Removls	CH$_4$	N$_2$O	NOx	CO
Total Emissions from Land Use Change and Forestry	9,392	23,924	-15,906	59	0	15	520
A. Change in forest and other woody biomass stocks	-12,125	0	-12,125				
B. forest and grassland conversion	25,298	23,924	0	59	0.4	15	520
C. abandonment of managed lands	-3,781	0	-3,781				
D. CO2 Emissions and Removals from Soil	0	0	0				
E. Other	0	0	0	0	0	0	0

Source: Sudan's Second National Communication (2013)

There are on-going development efforts to use 2006 IPCC Guidelines for the 3rd assessment of National Greenhouse Gas Inventory (2006GL) to be reported in ongoing NC, due in June 2020. Unlike the initial and 2nd NC, the 3rd NC, under preparation, used 2013 data as base year and did not include the forests of Republic of South Sudan (RoSS) which got separated in 2011. The preliminary results of the 3rd NC show very high LUCF emissions of about 20136 Gg CO$_2$eq. This is expected since the removal by sinks has been reduced dramatically with the loss of forest estate of South Sudan as a substantial sink for emissions.

Currently, HCENR is the national focal point to the UNFCCC and is responsible for submitting all reports to the UNFCC, including the BURs, the NC, and the Technical description of the FREL/FRL for review. The HCENR has data sharing agreements in the form of MoUs with ten different sectoral (including AFOLU sector) institutions for sharing, collecting and compiling of GHG relevant data and information at the national level. Since, Sudan identified key emission categories for AFOLU sector i.e. forest land remaining as forest land (desert, semi-desert, low rainfall in Sand, low rainfall in clay, high rainfall), cropland remaining as crop land (rice land, biomass burning, urea and soil), and grass land remaining as grass land (enteric fermentation, manure management, savannah burning), therefore, the relevant institutions to report GHG inventory data from AFOLU sector were also identified based on key category analysis. The AFOLU sector institutions are the Forest National Corporation, Ministry of Agriculture, and General Directorate for Range and Pasture Management and RSSA. The capacity need assessment for GHG function was carried out for all the aforementioned relevant institutions.

Data availability

The information on national level AD was taken from FAO's FRA studies in the previous NCs. However, for the current sub-national FREL, country specific sub-national AD is being generated for Gadarif, Blue Nile and Sinnar. The EFs are developed at the national level through NFI using IPCC's Tier 3 methodological approach. Sudan has now agreed upon forest definition and national forest classification systems. Further, forest area changes, carbon inventory and emission factor data is being analysed for developing sub-national FRL/FREL. However, it is decided that these results will not be included in the upcoming GHG inventory to be submitted through NC, which will be based

on Tier 1 default values. This is because the national level Activity Data for forest and land use change is currently not available. It is also worth noting that the recent efforts under REDD+ Readiness preparations enabled Sudan to develop a database that will contribute as some potential Tier 2 level parameter inputs. The sub-national FREL and SNFMS development processes and products are to serve as key inputs of the AFOLU Forest Land Table 3.B.1. (Table 5.12 below) and AFOLU land use types data.

Table 5.12: The forest land tables (3.B.1.a and 3.B.1.b) AFOLU land use types data compliance with the FREL/FRL process inputs

3.B.1.a Forest Land remaining as Forest Land / 3.B.1.b Land converted to Forest Land	Sub-National FREL (Gadarif, Blue Nile, Sinnar)
Area Entry Table	Area entry tables for forest and non-forest estimates for 2018 over the FAO's LCCS is under process. Sudan has also developed a national forest classification system, which needs to be harmonized with IPCC guidance on Land Representation to develop National FREL.
Land use conversion matrix	Land use conversion matrices are not available for the periods 2006-2010, 2010-2014, 2014-2018. However, forest cover change matrices are under process and results are still awaited. There are also consistency issues in satellite data used to build the forest cover change maps. e.g. the 2006 forest cover map is generated using ASTER 15 metre resolution image while 2010, 2014 and 2018 forest cover maps are generated using Landsat 30 metre resolution images. On the other hand, there is no clarity on adopted methodology to develop historical time series data for sub-national FREL.
Annual increase in carbon stocks in biomass	Forest growth rates from literature / Average forest cover increment
Loss of carbon from wood removals	To be based on the annual wood removal statistics if available from the forest national corporation
Loss of carbon from fuel wood removals	To be based on the annual wood removal statistics if available from the forest national corporation
Loss of carbon from disturbance	Sudan has decided to include carbon losses due to deforestation only.
AFOLU land use types	
Land use Subcategory	Land Use Sub-Categories are defined in recently developed national land-use/ forest classification system. However, for the current sub-national FREL, FAO's LCCS is used to generate only forest cover/ change maps at tier 2 level. Country specific Activity Data and Emission Factors for agriculture and grass land is missing. Disturbances from agriculture and grass land will be reported using Tier 1 default values.
Carbon fraction of above-ground biomass	IPCC default value (0.47) will be used
Ratio of belowground biomass to above-ground biomass	IPCC default values based on Table 3.A.1.8 (IPCC 2006) will be used

A detailed assessment of data availability and accessibility for GHG-I at federal and state levels is given in table 5.13, **Annex – VI.**

Technical capabilities

The technical capabilities of MoA and FNC are already highlighted in LMS and NFI sections. HCENR has established a separate GHG Unit and assigned a post of national GHG coordinator to coordinate with relevant departments/ institutions to collect GHG related information. A fully equipped GHG laboratory is also established, which is used for compilation and archiving of required data. However, technical expertise (forestry and agricultural experts) are not available and required to review and validate the information collected from relevant departments/ institutions. HCENR mostly depends on RSSA, FNC, MoA and Directorate of Range and Pasture Management for the collection of reliable information on GHG emissions from AFOLU sector. Data sharing agreements are already in place between HCENR and the aforementioned AFOLU sector institutions/ departments through MoUs. Therefore, enhancing the technical capabilities of AFOLU sector institutions will also improve the authencity and reliability of the accurate information to be reported by HCENR. The technical capacity needs of FNC, RSSA and MoA are already discussed in LMS and NFI sections.

Human capacity

Human capacity to process and analyse the information related to GHG estimations is limited at the federal level, while at the state level the required capacity is not available. GHG-I technical team was formulated in HCENR to implement a GHG Inventory. Reporting process is also developed for AFOLU Sector including rangelands. This technical team is comprised of 11 members representing different institutions related to agriculture, forestry and rangeland. The team has got extensive trainings on how to conduct the GHG inventory for the AFOLU sector. However, the current capacities of the technical team are limited to the use of Tier 1 methodological guidance of IPCC in IPCC software. A detailed assessment of human capacity to process and analyse as well as report the GHG related information is given in table 5.14, **Annex - VI**.

Training facilities

There is a separate training unit established at HCENR to organize trainings on GHG inventory processes for different sectors (including AFOLU sector).

5.1.4 Summary

This evaluation is performed with a scoring system for each item – in order to facilitate (i) a quantitative assessment of capacity and (ii) future comparative assessments of capacity development. Periodic re-evaluation of SNFMS implementation will provide concrete information on progress, achievements and challenges

A potential simple approach for the quantitative assessment of current capacity could be based on a scoring of 1 to 3 as follows:

1. Low capacity: Expertise, systems and tools in the country do not exist and/or are not well developed or used regularly;

2. Average capacity: Human and/or technical capacity exists but does not correspond to the real needs for the SNFMS and an update and/or enhancement of the existing capacities is required;

3. Advanced capacity: Adequate capacity is available and can be used with minimal updating and/or additional work.

Table 5.15: Summary of the capacity assessment for the MRV function

CAPACITY	LMS	NFI	GHG-I	COMMENTS
Data availability	Low	Average	Low	**LMS:** Consistent national data sets are not available
				NFI: A comprehensive NFI has recently been completed and the results are now available
				GHG-I: Country specific data is not available for AFOLU sector
Technical capabilities	Average	Average	Low	**LMS**: System and Software Infrastructures are inadequate and need to be upgraded/ enhances
				NFI: Modern equipment need to be procured and distributed among all the states to ensure consistency in data collection methods for future monitoring
				GHG-I: GHG-I for the LULUCF/AFOLU sector is not embedded in the current forest management systems of the country. Data compilation facilities are required
Human capacity	Average	Average	Low	**LMS**: Limited human resource available in field of RS/ GIS
				NFI: Adequate human capacity exists for conventional forest inventories. However, their capacity and understanding on carbon-based inventories and carbon stocks assessment need to be enhanced.
				GHG-I: Limited human resource at present
Training facilities	Average	Average	Average	**LMS:** RSSA, FNC and UoK has training facilities for LMS related trainings on RS/GIS, however it needs to be improved
				NFI: At national level, the FNC has required training facilities (resource persons, training halls, training equipment, field sites for demonstration; At provincial level, no such facilities are available.
				GHG-I: HCENR has a training facility for GHG-I related trainings

5.2 Monitoring function

The monitoring function will help Sudan to monitor the government policies and measures targeted to address the varied drivers of deforestation and forest degradation (DoDD) in the country. A big challenge, however, is to identify the drivers of deforestation and forest degradation and ways to address these drivers given due consideration to the country's ability to address them. A detailed study was conducted in 2017 which identified various DoDD. A draft National REDD+ Strategy (NRS) is also developed and being updated, which highlights several options to address these drivers and envisages that the successful implementation of the REDD+ programme will ensure 50 percent of the national emissions reduction target by 2030, as set in Sudan's Nationally Determined Contributions (NDC). The draft NRS has set the strategic period for implementation of the planned activities into three phases of short, medium and long-term.

Phase I: Short-term implementation goals (2019-2020) focuses on preparing the national emission reduction targets through pilot implementation of REDD+ activities in order to achieve a 10 percent reduction in the national deforestation rate, while consolidating experiences for forest and land restoration.

Phase II: Medium-term implementation goals (2021-2025) are focused on increased investments and scaling up REDD+ related emission reduction targets at the national scale, and starts operationalizing results-based payment (RBP) at sub-national levels. The main target in this period is to bring net deforestation rate to 25 percent compared to 2018 levels.

Phase III: Long-term implementation goals (2026-2030) rolls out REDD+ related emission reduction targets and results based payments at full national scale. In this period, the country's forests and land areas shall become a net carbon sink and bring 50 percent of national emission reductions by 2030 compared to 2018 levels.

For the successful implementation of NRS, it is very important to develop national level standard mechanisms/ protocols to monitor the implementation of NRS, which are currently very limited and inadequate in the country. The current forest monitoring system is based on a bottom up system of reporting from the forest circles (the smallest management unit), up to the state forest and then to FNC at the national level. The data reported includes both qualitative and quantitative information on forest resources with more focus on reserved forests, afforestation and reforestation areas, harvest and production, fires, personnel, etc. This reporting system is done on both a monthly and annual basis. The current national reporting does not include estimation of GHGs emission/removal. Mapping of forest resources is mostly provided by RSSA and FNC (federal agencies). Forest resource assessments and research are provided by FNC and academia (university of Khartoum and University of Sudan) respectively. Due to a lack of resources, Sudan has not yet established a regular or permanent national forest inventory system and does not possess an integrated forest monitoring system that could be used as a basis for the SNFMS. Numerous efforts (surveys and studies) have however, been undertaken to study forest and range resources and changes in land use and vegetation cover in the Sudan. Though Sudan is stepping ahead in establishing ground based monitoring systems through NFI, the state of forest cover (Activity Data) can only be assessed from the incomplete and *ad hoc* surveys and studies in addition to FAO's global FRAs and other international literature. Therefore, an entirely new system of forest monitoring, consisting of both sattelite and ground monitoring, under the guidance of UNFCCC decisions and IPCC guidelines, is required to be designed, building on the capacity and resources from relevant agencies. The relevant institutions/ departments at the federal level having relevant roles for monitoring of forest resources were identified during a national workshop in October 2019. These institutions are HCENR, FNC, RSSA and Wildlife Department. The capacity need assessment for monitoring function is, therefore, focused only on these institutions.

Data availability

At state level, forest management plans, spanning over a duration of 10 years, are available mostly for riverine forests, while forest management schemes (5 years) are available for plantations. The purpose of these management plans/ management schemes is to ensure the sustainable management of riverine forests/ plantations, watershed protection, to address local firewood demands and desertification issues. Monitoring Indicators for REDD+ related activities are not well defined. However, forests are being monitored as per the standard methods/ protocols of working plans in addition to regular field staff visits and reporting. There is need for standardization and consistency in the procedures and methods for forest (including natural forests) monitoring among states. Forests are being monitored by assessing different forest monitoring indicators through regular field visits by the staff or through village level committees. Several forest related monitoring tools already exist, which need to be harmonized with new tools required for monitoring of forest

PAMs. The current forest monitoring indicators and tools related to REDD+ activities being used at the federal and state level are given in table 5.16:

Table 5.16: Forest monitoring indicators and tools/ mechanisms at federal and state level

REDD+ Activities	Monitoring Indicators		Monitoring Tools/ Mechanism	
	National	**State Level**	**National**	**State Level**
Deforestation	Changes in national forest cover and land area (feddan)	Cutting of trees, conversion of forests to agricultural lands	NFI and other International studies e.g. FAO's FRA	Field visits and surveys/ staff surveillance, Community reporting
Forest Degradation	Decrease in forest density (percentage of forest cover) Soil land degradation/ Erosion	Over grazing per unit area (increased no. of animals/ tremplings, damage to plants shoots), firewood collection (legal and illegal), wild fires, pests and diseases	Social/economic surveys	Same as above
Enhancement of Forest Carbon Stocks	Areas (in feddan) afforested/ reforested/ regenerated. No of plants planted each year	Afforestation (area in feddan), reforestation (no. of plants/ area reforested in feddan), regeneration (counting of no. of plants and area regenerated in feddan)	Afforestation/ reforestation plans, annual plantation targets/ reports from states, official statistics provided by other institution on plantations	Post activity visits, counting of trees on regular basis to assess survival percentage
Conservation	Conservation policies/ laws/ regulations, protected area notifications of government	Implementation of laws, regulations etc, fire management	Protected area networks, enacted laws/regulations, guided by national Policy guidance	Enforcement of laws/ regulations (enforcement checks)
Sustainable Management of Forests	No of Management Plans at national level	Management plans (forest types/ area covered)	Review reports of Implementation progress from states	Review of implementation progress of management plans (forest area/types covered)

A detailed assessment of data availability and accessibility for monitoring of government's policies and measures related to the forestry sector are given in table 5.17, **Annex - VII**.

Technical capabilities

See table 5.18, **Annex - VII**

Human capacity

The number and qualifications of staff of the federal and state level institutions is somehow relevant and able to carry out monitoring of relevant forest policies and measures and has technical capabilities in the areas of capacity building and coordination with other institutions. However, their technical knowledge/ skills need to be improved on statistical analysis and production of data, financial planning and budgeting, wildlife surveying and techniques, and inclusive policy making processes.

Training facilities

See sections on LMS, NFI and GHG-I

6. IMPLEMENTATION OF THE NATIONAL FOREST MONITORING SYSTEM

The outputs and activities mentioned here are tailored to national circumstances, capacity assessment and country specific objectives. Outputs and activities that are defined in this section are also detailed, justified and budgeted. Risks that could affect the implementation of activities and related mitigation measures are also presented for each activity.

6.1. MRV function

6.1.1 Land Monitoring System

This section presents the activities that Sudan could consider implementing to develop a LMS.

Global Objective: To measure land use and land use changes and to collect Activity Data

The LMS is the tool within the SNFMS used to collect AD (i.e. data on land use and land use changes resulting from human activities). The use of remote sensing data, rather than field data, to assess AD, offers Sudan a way to assess historical changes in land use. The use of remote sensing also facilitates the reduction of the quantity and cost of ground-based measurements (e.g. for validation) for the assessment of AD. During early implementation, the main results of LMS in terms of reporting requirements will be:

- A 'starting point' matrix for the LMS that describes national land use for the year in which the LMS is established;

- A 'reference' matrix that describes changes between a reference year and the 'starting point' matrix (i.e. historical analysis);

- An annual matrix of land use change;

- An annual conversion matrix that accounts for changes between land-use sub-categories in detail.

Output 1: The national level LMS data is available and accessible for generation of Activity Data (AD)

- Activity 1.1: Organise a national validation workshop to formally endorse national forest definition
- Activity 1.2: Notify (through government notification) and legally adopt the national forest definition
- Activity 1.3: Organise a technical WG meeting to review the National Land Use and Forest Classification System consistent with IPCC guidance on Land Representation
- Activity 1.4: Organise consultative meetings in each state to categorise state level land use/ forest types based on national land use/ forest classification system
- Activity 1.5: Organise a technical WG meeting to assess and characterize existing satellite data for historical land use/ forest cover changes and future monitoring
- Activity 1.6: Purchase/ procure/ acquisition of required satellite imagery based on recommendations from Activity 1.5.

Output 2: The LMS is operational and Functional

- Activity 2.1: Develop Land Use/ Land Use Change and forest cover/ forest cover change maps for all the states based on national forest definition and national land use/ forest classification system
- Activity 2.2: Historical analysis of State level Land Use and Forest Cover Changes i.e. generate Sub-national AD for each state or cluster of states
- Activity 2.3: Integrate sub-national AD to generate national level AD for Land / Forest Cover Changes
- Activity 2.4: National Agreement and Validation of Reference Year for National FREL based on historical analysis i.e. activity 2.2 & 2.3
- Activity 2.5: Set up Quality Control/ Quality Assurance procedures (quality management plan, quality assurance by third party, quality control) for review and validation of LMS results
- Activity 2.6: Publish the results in the form of national report to ensure national ownership and reliability

Output 3: The national FREL is defined and developed for Sudan

- Activity 3.1: Develop sub-national FREL for each state (or cluster of states) based on data inputs from historical analysis of AD produced at state level (i.e. Activity 2.2) and Emission Factors (EFs) developed through NFI
- Activity 3.2: Integrate sub-national FRELs to develop National FREL for Sudan
- Activity 3.3: Conduct detailed study on national circumstances to identify the future development indicators due to government's planned policies, which are likely to impact (directly/ indirectly) deforestation/ forest degradation. The study will help to assess the needs for FREL adjustment

Output 4: Technical Capacities for LMS at Federal and State Level are enhanced/ reinforced

- Activity 4.1: Organise a high level meeting to define working relationships among RSSA, FNC, MoA and HCENR for effective coordination of LMS activities
- Activity 4.2: Allocate space and establish national LMS laboratory
- Activity 4.3: Purchase of office supplies and equipment for national LMS laboratory
- Activity 4.4: Establish small GIS units/ cells in each state (or sectoral/ regional technical sections)
- Activity 4.5: Purchase of office supplies and equipment for state level GIS units/ cells (or sectoral/ regional technical sections)
- Activity 4.6: Appoint technical staff (GIS experts) for state level GIS units/ cells (or sectoral/ regional technical sections)

Output 5: LMS data is centralized, archived and sustainably managed

- Activity 5.1: Organise state level consultative meetings to define and develop coordination mechanisms and facilitate data sharing agreements with clear roles and responsibilities for timely and effective flow of information from state to federal level institution
- Activity 5.2: Develop robust data base management system to centrally archive the information on LMS

Output 6: Training facilities are well established and technical Human capacities (skills/ knowledge/ expertise) relevant to LMS are enhanced and available at both federal and state level

- Activity 6.1: Identify and notify the national training institution for LMS related trainings
- Activity 6.2: Establish national LMS training unit/ cell
- Activity 6.3: Purchase modern training equipment to strengthen national LMS training Unit/ cell
- Activity 6.4: Train technical staff by provision of relevant trainings on (i) UNFCCC's requirements for reporting on land use changes (ii) basic RS/GIS techniques (iii) satellite image corrections, enhancement and interpretation (iv) open source software (e.g. Collect Earth, Open Foris, QGiS etc) to assess land use and forest cover changes (v) land cover classification and forest stratification (vi) monitoring afforestation, deforestation and forest degradation using RS techniques (vii) statistical methods/ tools to assess uncertainties related to the generation of AD and (viii) IPCC reporting requirements relevant to AD.

6.1.2   National Forest Inventory

This section presents the activities that Sudan should consider to develop and implement a REDD+-compatible NFI

Global Objective: To assess forest resources and carbon stocks in the different forest types of Sudan

The National Forest Inventory (NFI) is an important tool for measuring forest carbon stocks and changes (EFs) and thereby to estimate GHG emissions and removals associated with forests. NFI involves ground-based measurements at sites strategically and statistically identified through forest stratification. Direct forest measurements are used to estimate carbon stocks in different forest types. By assessing forest type-specific emission factors, NFI data can be used to greatly increase the precision of GHG estimates.

Sudan's NFI is designed to include the collection of data needed to assess forest carbon stocks and their changes, as well as multiple additional data parameters that could be used to guide forest policy and management decisions.

Following the IPCC guidance, Sudan's NFI is based on a system of forest stratification to identify homogeneous forest populations to reduce the number of ground plots per population and thereby produces more financially efficient field inventories. Stratification will also help identify predominant land uses and intensify field sampling efforts accordingly. Stratification is used as a criterion for forest sub-division classification. Samples are subsequently selected in each forest stratum to obtain estimates of the total population. Field data collected during NFI will be used to validate the data collected by the LMS, thus providing a basis for improving the accuracy of the national forest stratification.

IPCC Tier 3 reporting of EFs is the highest accuracy level and requires precise country-specific data. It is therefore desirable for countries to develop allometric equations for tree species and/or forest types identified in the country. An activity to generate this information should be contemplated, if appropriate to national circumstances.

Output 1: The National Forest Inventory Data is available and accessible

- Activity 1.1: Stratify the national level forests based on updated national forest classification system and determine the number and distribution of field plots
- Activity 1.2: Organise a technical WG meeting and review and update the forest inventory forms to include the information on NTFPs, and soil carbon data in different forest types
- Activity 1.3: Extend, plan and carry out national level forest inventory in all the states covering all forest strata and types following the methodological approach in national NFI manual
- Activity 1.4: Analyze and verify data, estimate the variability within forest strata and compile forest carbon data according to forest types
- Activity 1.5: Carryout Socio-economic surveys as a parallel activity with National Forest Inventory to collect detailed information on socio-economic dependencies on forests
- Activity 1.6: Conduct research study to develop allometric equations for all the forest tree species covering all forest types in the country
- Activity 1.7: Conduct research study to assess annual growth rates for different tree species in different forest types, annual harvest (legal and illegal impacts), and annual disturbance rate (may include fires etc) to develop removal factors for different forest types.

Output 2: Technical capabilities related to NFI are improved and well established at federal and state levels

- Activity 2.1: Establish a separate NFI unit on regular basis at FNC
- Activity 2.2: Allocate space and establish central and field NFI laboratories at federal and state levels
- Activity 2.3: Equip the federal and state forest departments with adequate numbers of modern NFI tools (i.e. computers, digital callipers, laser vertex etc)
- Activity 2.4: Purchase vehicles for NFI field activities
- Activity 2.5: Purchase field tents, first boxes, equipment storage boxes, field kits (shoes, jackets rain coats etc) for field staff
- Activity 2.6: Procure/ purchase modern licensed statistical software tools (PSS, R etc) for data analysis
- Activity 2.7: Centralise and archive the existing data by designing a comprehensive data base management system

Output 3: Human capacity to analyse and process the information related to NFI is improved and available both at the national and state level

- Activity 3.1: Identify team leaders and trainers from state forest departments and other related departments and train them on NFI methodology guided by National NFI manual.
- Activity 3.2: Organise trainings to train technical staff/ trainers on the measurement of forest carbon stocks by delivering the trainings on (i) forest inventories (inventory design and field sampling techniques for forest carbon inventory, plot design, configuration and data collection from carbon pools, use of latest equipment i.e. vertex, densitometer, high accuracy handled GPS), (ii) IPCC Good Practice Guidance for the measurement of forest carbon stocks, (iii) descriptive statistics, (iv) development of allometric equations, (v) processing and analysis of inventory data (including the use of open source software).

Output 4: NFI training facilities are well established at federal and state levels

- Activity 4.1: Establish and Strengthen national NFI training Unit on regular basis
- Activity 4.2: Provision of regular budget for staff trainings on annual basis
- Activity 4.2: Strengthen the central, sectoral technical sections and state forest departments with provision of necessary training equipment (multimedia projectors, projection screens, lap tops, furniture etc)
- Activity 4.3: Organise regular (annual basis) trainings for field staff on NFI

Output 5: Quality control/ quality assurance procedures are developed and implemented at federal, regional and state levels

- Activity 5.1: Identify all potential data partners (governmental, NGOs, universities, etc.)
- Activity 5.2: Facilitate the sending of a letter (from the Minister) to all data partners
- Activity 5.3: Establish a technical scientific committee comprised of technical members from relevant institutions for review and internal validation of inventory results/ reports, as well as identify a 3rd party to review institution(s) to reassess (i) the quality of the inventory as how it is being compiled and (ii) category uncertainty estimates and subsequent improvements in the estimates of emissions or removals.
- Activity 5.4: Establish and carry out quality control and harmonization of data

6.1.3   Green House Gas Inventory

This section presents the activities that Sudan should consider to implement its REDD+-compatible national GHG inventory

Global Objective: To estimate GHG emissions and removal for the LULUCF sector

A greenhouse gas (GHG) inventory is required to estimate and report emissions and removals of GHGs to the UNFCCC. In addition to data on land use (supplied by the LMS) and data on carbon stocks changes (provided by the NFI), specific measures of emissions and removals of GHGs as well as uncertainty estimates are compiled in the GHG inventory. The GHG inventory will be the key tool to assess whether REDD+ produces measurable climate change mitigation.

The quality of the GHG inventory depends not only on the credibility of the estimates, but also the methods used to gather and present the data and information. These must be documented according to the IPCC's Guidance and Guidelines.

Output 1: Country specific GHG inventory data of AFOLU sector is available to update the GHG chapter information in Sudan's NC document

- Activity 1.1: Conduct a research study on national livestock population count for each livestock group, type and amount of feed consumed by livestock
- Activity 1.2: Develop emission factor for enteric fermentation and manure management
- Activity 1.3: Conduct a research study on the extent, application and management of manure on crop lands. The expected results of the study will give country specific emission factors of manure application on crop lands.
- Activity 1.4: Develop country specific Emission Factors for rice cultivated areas, biomass burning and urea application on crop lands.
- Activity 1.5: Conduct a national level comparative research study on soil disturbances in forest lands, crop lands and grass lands and its impact on soil carbon. The expected results of the study will give country specific soil emission factors for the three land use categories (i.e. Forest land, Crop Land and Grassland).

- Activity 1.6: Generate Activity Data (AD) for savannah burning areas, biomass burning on crop lands and rice cultivated areas.
- Activity 1.7: Update national GHG inventory of AFOLU sector based on country specific data that will be generated through implementation of aforementioned activities as well as activities in LMS and NFI sections

Output 2: Technical capacities on National GHG inventory of AFOLU sector established, strengthened and improved at federal and state levels

- See implementation framework for LMS, NFI and Monitoring Function

Output 3: Human Capacities on National GHG inventory preparations and reporting are enhanced

- Activity 3.1: Recruit technical GHG inventory and reporting experts (forest and agriculture) for AFOLU sectors at HCENR
- Activity 3.2: Identify trainers at both federal and state levels and conduct TOT workshops on the following required knowledge and skills:

  o GHG-I of AFOLU Sector using Tier 2 & 3 methodological approach

  o Development of emission Factors for enteric fermentation, application of manures and savannah burning

  o Improvement of technical report writing skills

  o IPCC reporting requirements for Forest, Grass and Cropland Category

  o Development of emission Factors for rice cultivated areas, biomass burning on crop lands, urea application and soil disturbances relevant to croplands

Output 4: Training facilities for national GHG inventory of AFOLU sector established and strengthened

See sections on LMS, NFI and Monitoring function

6.2. Monitoring Function

This section presents the activities that Sudan should consider to develop the monitoring function of their SNFMS. Depending on the method chosen by the country, the monitoring function, including the LMS), can become a key tool for national forest management and planning.

Global Objective: To assess the results of REDD+ policies and measures

In the context of REDD+, the objective of monitoring is to assess the performance of REDD+ activities (demonstration activities in Phase 2 and national policies and measures in Phase 3). While the MRV function focuses on the measurement of forestry-related emissions and removals, the monitoring function goes beyond the assessment of forest carbon and focusses on other parameters such as forest health, biodiversity, forests conservation, provision of non-timber forest products, and social uses of forests.

Output 1: National Forest Monitoring Indicators and tools to monitor forest related policies and measures are available

- Activity 1.1: Review and update a national REDD+ strategy to define and include actions and monitoring indicators (to monitor the actions) against REDD+ strategic options
- Activity 1.2: Organise a national workshop to screen and prioritise strategic options and actions, finalise forest monitoring indicators and tools
- Activity 1.3: Develop Policy Guidance on standard methods/ protocols to report on wildlife and AFOLU sector GHG monitoring indicators
- Activity 1.4: Review and update the MRV document to include the nationally agreed forest related monitoring indicators and tools

Output 2: State REDD+ action plans and locality level forest management plans for all forest types are developed and available for regular forest monitoring

- Activity 2.1: Develop provincial (individual states or cluster of states) REDD+ Action Plans guided by national REDD+ strategy
- Activity 2.2: Review and improve the existing forest management plans for riverine and planation forests to align them with national and relevant sub-national REDD+ strategic objectives and actions
- Activity 2.3: Develop forest management plans for natural forests guided by national REDD+ strategy and relevant provincial REDD+ action plan

Output 3: The Technical capabilities of relevant federal and state level institutions for monitoring (Sattelite based) of government's land use/ forest related policies and measures are enhanced and operational

- Activity 3.1: Develop inter-institutional / departmental coordination and communication mechanism among HCENR, RSSA, FNC, MoA, General Directorate of Pasture and Range Management and Academia (UoK and UoS) for information sharing on monitoring of AFOLU sector policies and measures
- Activity 3.2: Develop and maintain Land Use Web Portal (maintained by RSSA and supported and coordinated by AFOLU sector institutions) to ensure regular monitoring of land use changes and accessibility of information
- Activity 3.3: Develop SNFMS/ forest web portal (layout, functions, data etc, train operators, technical parameters, national workshop to present the web portal), maintained by FNC and supported/ coordinated by RSSA, to ensure regular monitoring of forest changes due to government policies and measures
- Activity 3.4: Procure/ purchase monitoring (fire and wildlife) equipment for Agriculture and wildlife department

6.3. SNFMS Institutional Arrangements are Assessed and Clarified

The first step of implementation is the agreement on identified and proposed institutional arrangements for the development and implementation of the SNFMS through close coordination and consultation among all relevant institutions at the national and state level. The establishment of institutional arrangements, including clear definition of the roles and responsibilities of various identified stakeholders, is important to establish a national system for monitoring and MRV on sustainable basis.

Output 1: Sustainable and participatory network of institutions with necessary range of expertise and clearly documented roles and responsibilities are established for SNFMS

- Activity 1.1: Organise a national workshop to formally agree/ endorse the proposed institutional arrangements
- Activity 1.2: Organise consultative meetings to identify joint working relationships and develop joint working teams pertaining to different technical components of SNFMS functions i.e. monitoring and MRV (LMS, NFI, GHG-I)
- Activity 1.3: Develop clear and detailed ToR on the relevant roles and responsibilities (with necessary definitions of SNFMS coordination, communication, LMS, NFI, GHG-I as well as quality assurance and quality control) of relevant proposed institutions/ organizations/ departments
- Activity 1.4: Enact legally-binding institutional arrangements for the implementation and operation of SNFMS
- Activity 1.5: Undertake consultations on the design and type of REDD+ demonstration activities that will be implemented as a testing ground for the implementation of the SNFMS

Output 2: SNFMS funding arrangements are assessed and clarified

- Activity 2.1: It is critical to carry out a detailed assessment of the funding needed to ensure the long-term sustainability of an SNFMS. All domestic and international sources of funding should be inventoried to assess which components of the SNFMS are covered and where gaps exist. This funding analysis can serve as a domestic tool to support requests for national government funding and as a tool for requesting international support on specific work areas.

Table 6.1: Example template for inventory of available funding:

Outputs	SNFMS Activities	Source of funds	Amount secured (USD)	Financing period	Financing gap (USD)

- Activity 2.2: Assess domestic financing needs and timeline and modalities for delivery of these funds
- Activity 2.3: Assess the levels, sources and work areas of initial donor funding and the process required to transition to a sustainable self-financing arrangement
- Activity 2.4: Develop a timeline of funding allocations and implementation
- Activity 2.5: Implement a national validation workshop of SNFMS funding allocations and the implementation process
- Activity 2.6: Formally adopt the mechanism for allocating funds and the process of implementation (legal enactment where possible)

7. LOGICAL FRAMEWORK

See **Annex - VIII**

8. BUDGET AND WORK PLAN

See **Annex – IX**

Annex - I

The evaluation will be performed with a scoring system for each item – in order to facilitate I) a quantitative assessment of capacity and II) future comparative assessments of capacity development. Periodic re-evaluation of NFMS implementation will provide concrete information on progress, achievements and challenges. A potential simple approach for the quantitative assessment of current capacity will be based on a scoring of 1 to 3 as follows:

- **Low capacity**: Expertise, systems and tools in the country do not exist and/or are not well developed or used regularly;

- **Average capacity**: Human and/or technical capacity exists but does not correspond to the real needs for an NFMS and an update and/or enhancement of the existing capacities is required;

- **Advanced capacity**: Adequate capacity is available and can be used with minimal updating and/or additional work.

The components and elements for capacity assessment given in UN-REDD NFMS Action Plan Template

Satellite Land Monitoring System (SLMS)

- Data available and accessible

- Technical capabilities (equipment and logistics)

- Human capacity for processing (analysis) information related to the SLMS

- Human capacity for the preparation of reports from the SLMS

- Capabilities related to data verification (quality control and quality assurance)

- Training facilities

- Analysis of areas for improvement

National Forest Inventory (NFI)

- Data available and accessible

- Technical capabilities (equipment and logistics)

- Human capacity for processing (analysis) of the information related to the NFI

- Human capacity for the preparation of reports from the NFI

- Capabilities related to data verification (quality control and quality assurance)

- Training facilities

- Analysis of areas for improvement

GHG Inventory (GHG-I)

- Data available and accessible

- Technical capabilities (equipment and logistics)

- Human capacity for processing (analysis) of the information related to the GHG inventory

- Human capacity for the preparation of reports from the GHG inventory

- Capabilities related to data verification (quality control and quality assurance)

- Training facilities

- Analysis of areas for improvement

National communications (NC)

- Preparation method and regularity

- Task Force

- Analysis of areas for improvement

Summary

	GHG Inventory	NFI	SLMS
Inventory	Yes / No	Yes / No	Yes / No
Basic information (data available and accessible)	Poor / Fair / Good	Poor / Fair / Good	Poor / Fair / Good
Technical capabilities (equipment and logistics)	Poor / Fair / Good	Poor / Fair / Good	Poor / Fair / Good
Human capacity for processing (analysis) of information	Poor / Fair / Good	Poor / Fair / Good	Poor / Fair / Good
Human capacity for the preparation of reports	Poor / Fair / Good	Poor / Fair / Good	Poor / Fair / Good
Human and technical capacity for data verification	Poor / Fair / Good	Poor / Fair / Good	Poor / Fair / Good

Annex – II
Checklists – Interview protocols

Formulation of the Action Plan (AP) for Republic of Sudan's Forest Monitoring System (SFMS)

INSTITUTIONAL CAPACITY NEEDS AND GAP ASSESSMENT

MONITORING FUNCTION

KEY INFORMANT INTERVIEW (DECISION LEVEL)

The Sudan REDD+ Program Team is conducting an institutional capacity needs and gap assessment to understand the existing capacities/strengths of the stakeholder organizations in terms of Monitoring Function for Sudan's Forest Monitoring System (SFMS). This assessment will enable us to identify the most appropriate institutions and map their existing capacities and requirements for monitoring of forests to be integrated with SFMS. Your cooperation in responding to and filling in this checklist will be highly valued and will support the development of SFMS Action Plan. Please use separate paper with reference to question number wherever necessary.

Institution/Organization Information

(Please provide general information of your organisation /institution and yourself)

Institution/Organization	
Section/Unit	
Respondent's Name	
Designation/Position	
Email	

1. **Do you have an institutional mandate for undertaking monitoring of forest policies and measures?**

   ☐ Yes   ☐ No   If yes, please provide a reference to the policy/regulation document

2. **What are the specific functions/ tasks of your ministry/ department/ organization/ institution? (Please list functions/tasks the section/unit undertakes to fulfil its mandates)**

Functions		Specific Tasks
Policy design/ strategy development		
Statistical analysis and production of data		
Financial planning and budgeting		
Policy implementation		
Monitoring and evaluation		
SFMS coordination		
Other (please specify)		

3. **How do you perceive the importance of the following factors for your ministry/ department to be able to carry out monitoring of forest policies and measures? (1 = hardly relevant, 2 = some relevance, 3 = relevant, 4 = highly relevant)**

Number of staff	1	2	3	4
Qualifications of staff	1	2	3	4
Coordination with other institutions	1	2	3	4
Organisational setting	1	2	3	4
Legal basis	1	2	3	4
Financial resources	1	2	3	4
Other (please specify)				

4. **Does your ministry/ department/ organisation/ institution use any tools to monitor the forests policies and measures over time?**

1. Yes ☐ **2. No** ☐

(If your answer is "Yes" than please give the details of monitoring tools?

Monitoring Tools		Existing/ Planned (please also provide reference)
National Web Portal		
National/ Regional/ Forest Registries		

Community Forest Monitoring		
Regular Field Inventories		
Satellite Land Monitoring		
Other (please specify)		

5. What kind of data and information does your ministry/ department use as basis to monitor forest policies and measures (e.g. quantitative, qualitative, and process)? Do you consider the information to be statistically reliable? If not, why not?

_____

_____

_____

6. Is there any centralised data base available to support the monitoring process and assess, over time, the national/ regional/ state forest policies and measures?

1. Yes ☐   2. No   ☐

(If your answer is "Yes" than answer 6.1 to 6.2)

6.1 How the data is being collected to inform the centralised data base? Is the data collection approach consistent?

_____

6.2 What is the frequency of data collection?

_____

7. Is there any policy guidance on standard methods/ protocols to report on forest monitoring indicators to inform the improved forest policy decisions on REDD+ activities?

1. Yes☐   2. No   ☐

(If your answer is "Yes" please list the indicators (e.g. forest area change, number of planted trees, extent of protected areas, number of logging concession under forest certification schemes etc?

REDD+ Activities	Indicators	standard method/ protocol
Deforestation		
Degradation		
Sustainable Management of Forests		
Conservation		
Enhancement of Forest Carbon Stocks		

8. **Are the current monitoring indicators linked to drivers of deforestation and forest degradation and safeguards information?**

    ☐ 1. Yes   2. No ☐

(If your answer is "Yes" please give details which specific indicators (direct or indirect) are used to address DoDD and safeguards)

DoDD	Safeguards
Direct Indicators	
Indirect Indicators	

9. **Are there any current or past studies/ projects on monitoring of forest resources in Sudan?**

1. Yes ☐   2. No ☐

(If your answer is "Yes" please give details of studies/ projects with allocated funding)

Name of the Study/ Project (Current/ Past)	Scale (National/ Regional/ State)	Allocated budget	Time Frame

10.   Does the compiled information and knowledge is made accessible?

1. Yes   (if yes then tick the relevant box below) ☐   2. No ☐

- The data is accessible within the department in digital format ☐

- The data is accessible within the department published in the form of papers, reports etc ☐

- The data is accessible with other organization in digital format ☐

(Please specify the name of institution): _____

- The data is accessible with other institution published in the form of papers, reports etc ☐

(Please specify the name of institution): _____

11. How would you rank your organization regarding data availability and accessibility in terms of monitoring?

1. (Low) ☐   2. (Average) ☐   3. (Advanced) ☐

12. Is there a legal basis for inter-ministerial/ departmental/ organizational/ institutional coordination in the monitoring process? If so, how does it work in practice? Please provide three recent examples, providing relevant details (who leads the process, how frequently meetings are held, how consensus is reached, etc.).

- _____

- _____

- _____

13. Are MoUs, Laws, Decrees and/ or Agreements have been made between entities to give legal authority to perform monitoring function   (please provide details if any)

1. Yes ☐   2. No ☐

(If yes, please also provide reference document)

14. Is there a legal basis for stakeholder involvement in the monitoring of forest policies and measures? If so, how does it work in practice? Please provide three recent examples (who leads the process, how frequently meetings are held, how stakeholders' opinions are used in monitoring process, etc.).

_____

_____

15. Does the ministry use tools for linking planning, expected results and budgeting? If so, please mention up to five specific tools (e.g. regular internal reporting, financial monitoring, results monitoring).

_____

_____

16. What specific actions would you suggest in order to improve the institutional arrangements in relation to monitoring of forest polices and measures? List up to five main priority actions (e.g. monitoring tools, system for evidence-based policy making, coordination and communication systems, financial monitoring and budgeting).

_____

_____

17. What do you consider to be the most important changes that would allow an improvement in your ministry's/ department's/ organization's/ institution's role and function in relation to monitoring of forests? Please name at least three (e.g. financial and legal resources, organizational settings, information tools, human resource and training of staff).

- _____

- _____

- _____

18. What mechanisms do you require by which the support could be delivered?

1. Specific expertise ☐　　　　　2. Guidelines ☐　　　3. Workshop ☐

_____　　　　　　_____　　　_____

4. Direct funding ☐　　　　　5. Other☐ (specify)

_____　　　　　　_____

19. Do you have an estimation of the funding required?

1. Yes (provide estimate for each sub-component below) ☐ 2. No ☐　　　3. Require support to ☐ estimate the funding

- Data available and accessible
_____

- Technical capabilities (equipment and logistics)
_____

- Human capacity for processing (analysis) of the information
_____

- Human capacity for the preparation of reports
_____

- Capabilities related to data verification (quality control and quality assurance)
_____

- Training facilities
_____

20. Who will be the beneficiaries from the support?

1. Indigenous/ local communities/ people ☐　　2. Civil Societies ☐　　3. Government Institution ☐

4. Others (specify) ☐

Annex - III

Drivers of Deforestation and Forest Degradation (DoDD) and Policies and Measures to address the DoDD

Table 4.3: Direct and Indirect Drivers of Deforestation and Forest Degradation

Direct Drivers	
Agricultural expansion	This is the most prominent direct cause of deforestation and some 40 million Feddans (17 million ha) have been converted into mechanized & traditional rain fed and irrigated agriculture during the period 1940-2012. The country is home to some of the largest irrigation schemes in the world (Gezira, Rahad, New Halfa, Suki, Kenana and White Nile Sugar Schemes)
Energy consumption	Sudan's forests contribute 70 - 81 percent of energy supply (through wood extraction for fuel and charcoal) in the country (FNC, 1995), hence, closely linked to deforestation. The fuel wood share of the total energy consumption is estimated to be 87.5%. Its contribution to national energy consumption however fell from 83 percent in 1981 to 78 percent in 2001 and to 63 percent in 2009. Sudan's principal energy sources are hydropower (one percent), locally produced crude petroleum (36 percent) and biomass (63 percent). Energy from biomass mainly constitutes the burning of firewood and charcoal. The household sector is the dominant consumer with 49 percent in 2008, against 60 percent in 2001. Household energy consumption meanwhile – used chiefly for cooking – comes almost entirely from biomass sources which constitute 96 percent of total energy consumed by the household sector in 2001.
Increasing demand for grazing & browse material	Overgrazing by burgeoning domestic herds devastate the young tree seedlings in forest gaps caused by felling and numerous other factors causing serious impediment to the natural restocking of forest stands. The actual concern is that animal population exceeds the potentiality of the resource and causes severe damage to the forest.
Refugees and internally displaced people	Contribute to the removal of forests to obtain their requirements of fuel-wood and building houses (IDPs in Darfur and refugees in the Eastern and Western Sudan).
Factors affecting forest health	Though little information is available about insects, diseases and other hazards impacting forests resources, however, it is estimated that 102,874 km^2 of forested areas in Darfur, Kordofan, Eastern and Central states were affected by insect pests and diseases hindering natural regeneration. Fires are also used for land preparation for cultivation but it also destroys the range land and large animals leave their habitats to remote areas or may be subjected to death.
Natural Disturbances	Mainly drought, related to CC
Indirect Drivers	
Major indirect causes of deforestation and forest degradation in Sudan	a. Early forest policies such as that of 1932 endeavoured to instil the concept of division of authority over and benefits from forests & woodlands between the Central and Provincial levels of government. b. Subsequent Forest Policy Statement, that of 1986 endeavoured to fine tune the concept and devolve authority to lower levels of governance. The numbers and extent of forest reserves or holdings have increased substantially of literally all categories of forests namely Federal, State (Provincial), Institutional, Community &

	Private Forests. yet, the rate of deforestation continued due to many interwoven environmental, socio-economic & political factors
	c. Forest clearance and tree removal went on unabated while the various sectors were slowly assimilating and adopting the reservation and allocation process while clearance of forest tracts for all developmental activities did not go through any impediments. Both forces were chipping away from the same resource; one to 'fence away' some tracts, the other clearing a wider area. At the end of the day, out of some 60 million ha (140 million feddans) forest land in early 1960s, some 3,000,000 million were reserved or allocated under the 1932 policy and 27,000,000 under the 1986 policy while during the same period mechanized rain fed and irrigated agriculture expanded from 1.5 and 4.0 to 6.0 and 35 million feddans respectively
Policies of other sectors (There is no integrated policies for natural resources, or may say cross cutting issues in related sectors`s policies).	It is the policies or lack thereof of three sectors that had the greatest effect on deforestation in Sudan:
	a. The agriculture policy of horizontal expansion
	b. Global & local humanitarian policies of caring for refugees & internally displaced populations. When such people temporarily settle in an area, they take to the forest: wood for shelter, fuel and sale for income. The forest authorities are implicitly and explicitly directed to leave these people alone. The settlement of some 1 000.000 refugees from neighbouring countries in Eastern Sudan between 1963-1995 is but an example.
	c. The lack of policies of such sectors as range and war lords at times of civil strife such as the case of Darfur since 2003. The former is reflected in the uncontrolled growth of herds while the other simply means devastation with foresters being the first to abandon the area and do not come back until the war or strife end if they ever do.
Demand for forest products (mainly poverty increase the demand for forest products	a. The most notable of these is superior charcoal with metallic lustre from *Balanites aegyptica*, *Acacia seyal* and *A. mellifera*. Such charcoal is in demand for a number of domestic purposes such as barbeque, roasting coffee beans and smoking sheesha or argela all over the Arabian Peninsula and the north up to Turkey. If it is not openly allowed for export it is simple smuggled all along the Red Sea from almost all countries; Sudan being no exception
	b. Technically, it has been proven to be very profitable from sustainably managed forest tracts with supplementary irrigation from rain water harvesting. It even lends itself to a certification scheme. Yet the Sudanese forest authorities are conscientious objectors to the notion

Annex – IV
Assessment of LMS Capacities at Federal and State Level

Table 5.1: Assessment of Data Availability and Accessibility for LMS at Federal Level

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
RSSA	• Land Use Atlas of Sudan 2000 and 2010 available both in digital and analogue format (the raw images of 2010 are available with RSSA and FAO) • Aster data (15 m) for 2006 and Landsat data (30 m) for years 2010, 2014 and 2018 are available only for three states i.e. El Gadarif, Sinnar and Blue NileThe data is available both in digital and analogue (hard copies) format. • Country specific forest definition is available (0.4 ha, 10%, 4m) followed for forest related land use maps, however for other land use categories the guiding definitions from IPCC/ FAO-FRA were followed • Ground truthing followed by systematic grid sampling has been done through navigational GPS for 2000 and 2010 forest cover maps i.e. Forest Atlas. The GPS coordinates are available • IPCC methodological guidance (1996, 2003 & 2006) followed to produce forest/land cover maps • The maps can be freely accessed in digital format from online web map service (ref)	• There is no regularity in satellite based land monitoring • Lack of high resolution images • Uncertainties are not addressed properly and limited to only validation of sample points. Uncertainties related to area estimates, accuracy assessment and overall uncertainty assessment are not calculated • Forest/ Land cover maps of 2000 and 2010 prepared using object based methods with different land cover classes which shows inconsistency in methodology • Trees outside of forest areas were not considered • Most of the RS based studies are done by	• The satellite image data (Aster and Landsat) is required with full national coverage. • High Resolution Data (Lidar, Aster 15 m, SPOT 2.5 m or Quick Bird 0.5 m) is required for verification and validation of results to monitor the deforestation hotspots. • Standard methodology/ guidance on LMS to address the issues of inconsistency • Forest land cover classes to be consistent with IPCC guidance on land representation • National land use and forest classification requires updation to make it	1
FNC	• Satellite images with spatial resolution of 30m and spectral resolution of Landsat 7 and Landsat 8 covering parts of Sudan are available		consistent	1

	• Aerial photographs of the year 1983 covering Blue Nile State area are available in analogue format • GT Sheets of scale ____ covering _____ (area) available • Land Use Atlas of Sudan 2000 and 2010 available both in digital and analogue format • The processes and outputs are normally documented in the form of annual reports	external sources on project bases and land cover maps/ products cannot be produced within the organization • Ariel photographs are not available for whole country's forests	with IPCC guidance and need to approved and notified by the government • Forest Carbon stock base maps • National Forest Definition need to be notified • High resolution data is required to assess the degradation patterns in pilot sites. • Field data (quantitative and qualitative) need to be collected on extent of degradation factors in pilot sites and for future monitoring	
MoA	• Land Use/ Land Cover maps of productive areas are produced within the organization on annual basis (by in-house capacity or external sources?) • Guiding definitions from IPCC/ FAO-LCCS were followed • Ground truthing followed by systematic sampling has been done through navigational/differential/mobile GPS. The GPS coordinates are available • IPCC methodological guidance (2003 & 2006) followed to	• Though there is regularity in satellite based land monitoring but the monitoring is limited to only crop production areas • Uncertainties are only limited to area estimates followed by	• Activity data need to be generated to account for emissions from fire events in crop/ range lands	3

	produce crop land cover/ change maps • The maps can be freely accessed in digital format from online web map service (ref) and can also be accessed in analogue format (hard copies) • The processes and outputs are normally documented in the form of annual agricultural outlook report.	crop cutting surveys. • Mapping is limited to crop production areas, hence, no forest areas are covered • Ariel photographs are not available	
State Level Assessment			
Forestry Departments	• Land cover maps of 2000 and 2010 are available for each state in Land Cover Atlas of Sudan which was developed under the Africover Project. • Aster and Landsat maps are available for Sinnar, Blue Nile and El Gadarif • Aerial photographs of 1983 are available only for Blue Nile state	• The existing maps of 2000 and 2010 land cover atlas lacks IPCC guidance on land representation • Land Use/ Land use Change Maps are not available at state level • Except Sinnar, Blue Nile and El Gadarif, no sattelite imagery is available for other states	• Land use/ land use change (including forest cover/ forest cover change maps) maps required to be developed for all states using consistent methodology following IPCC guidance • SPOT, ASTER or Landsat Imagery is required for all the states • State level forests classification need to be alligned with National Land Use/ Forest Classification, once notified

Table 5.2: Assessment of Technical Capabilities for LMS at Federal and State Level

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
RSSA	• Provided with legal institutional mandate, institutional arrangements and set-up for LMS • Well equipped GIS lab available • System infrastructure (i.e. 1 x server, 1 x work station, 5 desktop computers, 8 x external hard drives of 80 terabits, 1 x scanner and 5 good handled GPS) is available and operational • Software infrastructure (i.e. Free licensed windows, free licensed QGIS, licensed diffenium mapscape snaptool, and free licensed post GIS) is available	• Lack of Feedback mechanism/ field data collection for Ground Truthing and Validation • Lack of mechanism for information sharing/ networking with other relevant institutions having required technical capabilities • Both system and software infrastructure are inadequate and insufficient	• Web hosting, Data management/archive system, high definition computer machine, DGPS and total stations, Drones with high definition cameras for monitoring of forest activities, equipment for Fixed Point Photography monitoring, scanners, plotters, Softwares (licensed software as well as open source for image processing) • High speed internet connectivity • Institutional Coordination/ arrangements through MoUs with FNC and state forest departments for feedback mechanism / ground truthing and validation of mapping results	1
FNC	• GIS lab is established at FNC central office • Only one plotter is available which is non-operational • Software infrastructure (only QGIS) is freely available	• No legal institutional mandate, institutional arrangements and set-up for LMS • Limited availability of both system and software infrastructure • Lack of mechanism for information sharing/ networking with other relevant institutional having required	• GIS/ RS/ IT Equipment • Training Units • Software infrastructure (licensed) • High speed internet connectivity • Coordination mechanism	1

		technical capabilities		
MoA	• Provided with legal institutional mandate, institutional arrangements (Agricultural Statistics Department) and set-up (Independent GIS/RS Unit) for LMS • System infrastructure (i.e. 1 x server, 2 desktop computers, and 1 x laptop, 2 x internet connectivity, 1 x firewall security system, 4 differential GPS and 4 handled GPS) is available and operational • Software infrastructure (i.e. 2 operating systems, 4 x GIS, 2 x image processing, 4 x digital photogrammetry, 2 x DGPS processing, 3 x web portal, 3 x web GIS server, 2 x spatial database) windows, free licensed QGIS, licensed diffenium mapscape snaptool, and free licensed post GIS) is available	• Lack of mechanism for information sharing/ networking with other relevant institutional having required technical capabilities • Both system and software infrastructure and software infrastructure are and inadequate and insufficient	• Financial (training facilities, equipment and software) • Administrative (coordination) • Technical (guidelines and trainings)	1
State Level Assessment				
State Forest Departments	• Almost all the states have separate forest inventory units with dedicated team of almost 4 to 5 officials mostly led by staff of an officer rank. • A small GIS unit is established only Gezira state with one computer. A cracked version of Arc GIS is being used for project based GIS mapping in Gezira	• Lack of field equipment (GPS) for recording coordinates for ground truthing • Except Gezira state, there are no GIS units established in any state • Internet connectivities are very slow	• Establishment of small GIS units in each state to facilitate states to use spatial information into forest management and planning. These labs will also act as feedback units to provide consistency checks for national level mapping • Procurement of computers, GPS and liscened softwares for each GIS Lab to be established	

Table 5.3: Assessment of Human Capacities for LMS at Federal and State Level

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
RSSA	• Qualified and trained human resource available (i.e. 25 x LMS exerts, 25 x RS experts, 25 x RS operators/ technicians, 15 x GIS experts/ analysts, 10 x GIS operators/ technicians) • Technical competencies of image acquisition (i.e. download satellite imagery from freely available domains), optical image processing (i.e. geometric/ atmospheric corrections), SAR image processing, Image interpretation/ classification, LULC data production, and temporal LULC data production are available • Technical competencies in Data Verification, Quality Control and Quality Assurance are only limited to Application of statistical method for error assessment, area and uncertainties estimation. • Expertise in use of GIS/ RS tools for spatial and temporal analysis related to assessment of deforestation and forest area changes, dealing with technical challenges of image interpretation (cloud cover, geo-referencing etc.) and use of GPS system in the field. • Human capacity for preparation of reports from LMS is only limited to professional report writing skills (1-3) and transform image analysis into reports (1-3)	• Understanding of error sources and estimation and documentation/ reporting of QC/QA and assessment results • Lack of knowledge (IPCC guidance) and understanding of relevant national/ international negotiations (UNFCCC) and decisions (REDD+ strategies and objectives) • Lack of expertise in real time forest monitoring • Lack of human capacity to review, consolidate and integrate existing data and information on LMS • Understanding of UNFCCC/IPCC reporting requirements	• Build/ Enhance knowledge and skills on IPCC methodological guidance (Land representation, Generation of Activity Data, QC/ QA procedures (accuracy assessments and consistency checks), real time forest monitoring, IPCC reporting requirements, FREL Development • Development of national standard guidelines on Land Monitoring system • Develop Training Manual on Sattelite Based Forest Monitoring	3

FNC	• Qualified (M.Sc.) and trained human resource available (i.e. 5 x LMS exerts, 5 x RS experts, 5 x RS Analysts, 5 x RS operators/ technicians, 3 x GIS experts/ analysts, 3 x GIS operators/ technicians and 2 x IT experts) • Technical competencies in Data Verification, Quality Control and Quality Assurance are only limited to Field data collection for Ground Truthing and Validation (sampling and use of GPS), • Expertise in use of GIS/ RS tools for spatial and temporal analysis related to assessment of deforestation and forest area changes, dealing with technical challenges of image interpretation (cloud cover, geo-referencing etc.) and use of GPS system in the field.	• In addition to above, limited technical competencies related to image acquisition (i.e. download satellite imagery from freely available domains), optical image processing (i.e. geometric/ atmospheric corrections), Image interpretation/ classification and LULC data production • Lack of expertise in SAR image processing • Lack of human capacity for preparation of reports from LMS (i.e. professional report writing skills, review, consolidate and integrate existing data and information on LMS, understanding of UNFCCC/IPCC reporting requirements, transform image analysis into reports)	• Improve technical competancies related to image acquisition, optical image processing, image interpretation/ classification, LULUC data production, SAR image processing • Enhance technical knowledge/ skills on application of statistical methods for uncertainity assessments (QC/QA) • Understanding of IPCC reporting requirements • Improve basic report writing skills	
MoA	• Qualified (B.Sc) and trained human resource available (i.e. 10 x LMS exerts, 10 x RS experts, 20 x RS operators/ technicians, 6 x GIS experts/ analysts, 10 x GIS operators/ technicians, 20 x MIS/ IT experts, 2 x system developers, 3 x System administrators/ engineers) • Technical competencies in Data Verification, Quality Control and Quality Assurance are available (i.e. Field data collection for Ground Truthing and Validation (sampling and use of GPS), Application of statistical method for error assessment, area and uncertainties estimation, Understanding of error sources and estimation and Documentation/reporting	• Same as above	• In addition to above, improve technical competancies in use of sattelite data for fire monitoring	2

	of QC/QA mechanism and assessment results) • Expertise in use of GIS/ RS tools, spatial and temporal analysis (deforestation, forest area changes), dealing with technical challenges of image interpretation (cloud cover, geo-referencing etc.) and use of GPS system in the field • Human capacity for preparation of reports from LMS is only limited to professional report writing skills (1-3) and understanding of UNFCCC/IPCC reporting requirements (1-3)			
State Level Assessment				
State Forest Departments	Not Available	• Expertise relevant to understanding of processes influencing terrestrial carbon stocks are missing. • In-adequate human capacity to analyse the information (i.e. technical report writing skills, review, consolidate and integrate the data and transformation of field data into reports) in context of IPCC/ UNFCCC reporting requirements related to NFI	• GIS experts for each GIS lab at state level	

Table 5.4: Assessment of Training Facilities for LMS at Federal and State level

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
RSSA	• Training facilities are available and limited to local experts/ trainers (5), and training equipment/ facilities (computers)	• Lack of training unit/ cell and budget allocations for staff training	• Establish a training unit/ cell with in RSSA to keep laison with relevant institutions and provide	1

			relevant trainings • Allocation of regular busget for staff trainings that will enable RSSA to get acquaintained with new and emerging Land Mapping/ Monitoring methodologies	
FNC	Training hall/ room is established with a capacity to accomodate almost 40 participants	• Lack of budget allocations for staff training, • Lack of GIS/ RS related training equipment • Lack of Trainers	• In addition to above, technical experts are required at departmental level to run the GIS lab and keep it functioning • Training equipment (computers, furniture etc)	1
MoA	Non	• Lack of training facilities (training unit/ cell, local experts/ trainers, budget allocations for staff training, training equipment, training rooms)	Same as above,	1
State Level Assessment				
State Forest Departments	Not available	• No budget allocations for trainings • Less opportunities for relevant trainings	Regular budgets need to be allocated for staff trainings and the regional technical sections need to be revived to facilitate such trainings for respective states	

Annex – IV
Assessment of LMS Capacities at Federal and State Level

Table 5.1: Assessment of Data Availability and Accessibility for LMS at Federal Level

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
RSSA	• Land Use Atlas of Sudan 2000 and 2010 available both in digital and analogue format (the raw images of 2010 are available with RSSA and FAO) • Aster data (15 m) for 2006 and Landsat data (30 m) for years 2010, 2014 and 2018 are available only for three states i.e. El Gadarif, Sinnar and Blue NileThe data is available both in digital and analogue (hard copies) format. • Country specific forest definition is available (0.4 ha, 10%, 4m) followed for forest related land use maps, however for other land use categories the guiding definitions from IPCC/ FAO-FRA were followed • Ground truthing followed by systematic grid sampling has been done through navigational GPS for 2000 and 2010 forest cover maps i.e. Forest Atlas. The GPS coordinates are available • IPCC methodological guidance (1996, 2003 & 2006) followed to produce forest/land cover maps • The maps can be freely accessed in digital format from online web map service (ref)	• There is no regularity in satellite based land monitoring • Lack of high resolution images • Uncertainties are not addressed properly and limited to only validation of sample points. Uncertainties related to area estimates, accuracy assessment and overall uncertainty assessment are not calculated • Forest/ Land cover maps of 2000 and 2010 prepared using object based methods with different land cover classes which shows inconsistency in methodology • Trees outside of forest areas were not considered	• The satellite image data (Aster and Landsat) is required with full national coverage. • High Resolution Data (Lidar, Aster 15 m, SPOT 2.5 m or Quick Bird 0.5 m) is required for verification and validation of results to monitor the deforestation hotspots. • Standard methodology/ guidance on LMS to address the issues of inconsistency • Forest land cover classes to be consistent with IPCC guidance on land representation • National land use and forest classification requires updation to make it consistent	1
FNC	• Satellite images with spatial resolution of 30m and spectral resolution of Landsat 7 and Landsat 8 covering parts of Sudan are available			1

	• Aerial photographs of the year 1983 covering Blue Nile State area are available in analogue format • GT Sheets of scale ____ covering _____ (area) available • Land Use Atlas of Sudan 2000 and 2010 available both in digital and analogue format • The processes and outputs are normally documented in the form of annual reports	• Most of the RS based studies are done by external sources on project bases and land cover maps/ products cannot be produced within the organization • Ariel photographs are not available for whole country's forests	with IPCC guidance and need to approved and notified by the government • Forest Carbon stock base maps • National Forest Definition need to be notified • High resolution data is required to assess the degradation patterns in pilot sites. • Field data (quantitative and qualitative) need to be collected on extent of degradation factors in pilot sites and for future monitoring	
MoA	• Land Use/ Land Cover maps of productive areas are produced within the organization on annual basis (by in-house capacity or external sources?) • Guiding definitions from IPCC/ FAO-LCCS were followed • Ground truthing followed by systematic sampling has been done through navigational/differential/mobile GPS. The GPS coordinates are available • IPCC methodological guidance (2003 & 2006)	• Though there is regularity in satellite based land monitoring but the monitoring is limited to only crop production areas • Uncertainties are only limited to area estimates followed by	• Activity data need to be generated to account for emissions from fire events in crop/ range lands	3

	followed to produce crop land cover/ change maps • The maps can be freely accessed in digital format from online web map service (ref) and can also be accessed in analogue format (hard copies) • The processes and outputs are normally documented in the form of annual agricultural outlook report.	crop cutting surveys. • Mapping is limited to crop production areas, hence, no forest areas are covered • Ariel photographs are not available		
State Level Assessment			
Forestry Department s	• Land cover maps of 2000 and 2010 are available for each state in Land Cover Atlas of Sudan which was developed under the Africover Project. • Aster and Landsat maps are available for Sinnar, Blue Nile and El Gadarif • Aerial photographs of 1983 are available only for Blue Nile state	• The existing maps of 2000 and 2010 land cover atlas lacks IPCC guidance on land representatio n • Land Use/ Land use Change Maps are not available at state level • Except Sinnar, Blue Nile and El Gadarif, no sattelite imagery is available for other states	• Land use/ land use change (including forest cover/ forest cover change maps) maps required to be developed for all states using consistent methodology following IPCC guidance • SPOT, ASTER or Landsat Imagery is required for all the states • State level forests classification need to be alligned with National Land Use/ Forest Classification, once notified	

Table 5.2: Assessment of Technical Capabilities for LMS at Federal and State Level

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
RSSA	• Provided with legal institutional mandate, institutional arrangements and set-up for LMS • Well equipped GIS lab available • System infrastructure (i.e. 1 x server, 1 x work station, 5 desktop computers, 8 x external hard drives of 80 terabits, 1 x scanner and 5 good handled GPS) is available and operational • Software infrastructure (i.e. Free licensed windows, free licensed QGIS, licensed diffenium mapscape snaptool, and free licensed post GIS) is available	• Lack of Feedback mechanism/ field data collection for Ground Truthing and Validation • Lack of mechanism for information sharing/ networking with other relevant institutions having required technical capabilities • Both system and software infrastructure are inadequate and insufficient	• Web hosting, Data management/archive system, high definition computer machine, DGPS and total stations, Drones with high definition cameras for monitoring of forest activities, equipment for Fixed Point Photography monitoring, scanners, plotters, Softwares (licensed software as well as open source for image processing) • High speed internet connectivity • Institutional Coordination/ arrangements through MoUs with FNC and state forest departments for feedback mechanism / ground truthing and validation of mapping results	1
FNC	• GIS lab is established at FNC central office • Only one plotter is available which is non-operational • Software infrastructure (only QGIS) is freely available	• No legal institutional mandate, institutional arrangements and set-up for LMS • Limited availability of both system and software infrastructure • Lack of mechanism for information sharing/ networking with other relevant institutional	• GIS/ RS/ IT Equipment • Training Units • Software infrastructure (licensed) • High speed internet connectivity • Coordination mechanism	1

		having required technical capabilities		
MoA	• Provided with legal institutional mandate, institutional arrangements (Agricultural Statistics Department) and set-up (Independent GIS/RS Unit) for LMS • System infrastructure (i.e. 1 x server, 2 desktop computers, and 1 x laptop, 2 x internet connectivity, 1 x firewall security system, 4 differential GPS and 4 handled GPS) is available and operational • Software infrastructure (i.e. 2 operating systems, 4 x GIS, 2 x image processing, 4 x digital photogrammetry, 2 x DGPS processing, 3 x web portal, 3 x web GIS server, 2 x spatial database) windows, free licensed QGIS, licensed diffenium mapscape snaptool, and free licensed post GIS) is available	• Lack of mechanism for information sharing/ networking with other relevant institutional having required technical capabilities • Both system and software infrastructure and software infrastructure are and inadequate and insufficient	• Financial (training facilities, equipment and software) • Administrative (coordination) • Technical (guidelines and trainings)	1
State Level Assessment				
State Forest Departments	• Almost all the states have separate forest inventory units with dedicated team of almost 4 to 5 officials mostly led by staff of an officer rank.	• Lack of field equipment (GPS) for recording coordinates for ground truthing	• Establishment of small GIS units in each state to facilitate states to use spatial information into forest management and planning. These labs will also act as feedback units to provide	

	• A small GIS unit is established only Gezira state with one computer. A cracked version of Arc GIS is being used for project based GIS mapping in Gezira	• Except Gezira state, there are no GIS units established in any state • Internet connectivities are very slow	consistency checks for national level mapping • Procurement of computers, GPS and liscened softwares for each GIS Lab to be established	

Table 5.3: Assessment of Human Capacities for LMS at Federal and State Level

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
RSSA	• Qualified and trained human resource available (i.e. 25 x LMS exerts, 25 x RS experts, 25 x RS operators/ technicians, 15 x GIS experts/ analysts, 10 x GIS operators/ technicians) • Technical competencies of image acquisition (i.e. download satellite imagery from freely available domains), optical image processing (i.e. geometric/ atmospheric corrections), SAR image processing, Image interpretation/ classification, LULC data production, and temporal LULC data production are available • Technical competencies in Data Verification, Quality Control and Quality Assurance are only limited to Application of statistical method for error assessment, area and uncertainties estimation. • Expertise in use of GIS/ RS tools for spatial and temporal analysis related to assessment of deforestation and forest area changes, dealing with technical challenges of image interpretation (cloud cover, geo-	• Understanding of error sources and estimation and documentation/ reporting of QC/QA and assessment results • Lack of knowledge (IPCC guidance) and understanding of relevant national/ international negotiations (UNFCCC) and decisions (REDD+ strategies and objectives) • Lack of expertise in real time forest monitoring • Lack of human capacity to review, consolidate and integrate existing data and information on LMS • Understanding of UNFCCC/IPCC	• Build/ Enhance knowledge and skills on IPCC methodological guidance (Land representation, Generation of Activity Data, QC/ QA procedures (accuracy assessments and consistency checks), real time forest monitoring, IPCC reporting requirements, FREL Development • Development of national standard guidelines on Land Monitoring system • Develop Training Manual on Sattelite Based Forest Monitoring	3

	referencing etc.) and use of GPS system in the field. • Human capacity for preparation of reports from LMS is only limited to professional report writing skills (1-3) and transform image analysis into reports (1-3)	reporting requirements		
FNC	• Qualified (M.Sc.) and trained human resource available (i.e. 5 x LMS exerts, 5 x RS experts, 5 x RS Analysts, 5 x RS operators/ technicians, 3 x GIS experts/ analysts, 3 x GIS operators/ technicians and 2 x IT experts) • Technical competencies in Data Verification, Quality Control and Quality Assurance are only limited to Field data collection for Ground Truthing and Validation (sampling and use of GPS), • Expertise in use of GIS/ RS tools for spatial and temporal analysis related to assessment of deforestation and forest area changes, dealing with technical challenges of image interpretation (cloud cover, geo-referencing etc.) and use of GPS system in the field.	• In addition to above, limited technical competencies related to image acquisition (i.e. download satellite imagery from freely available domains), optical image processing (i.e. geometric/ atmospheric corrections), Image interpretation/ classification and LULC data production • Lack of expertise in SAR image processing • Lack of human capacity for preparation of reports from LMS (i.e. professional report writing skills, review, consolidate and integrate existing data and information on LMS, understanding of UNFCCC/IPCC reporting requirements, transform image	• Improve technical competancies related to image acquisition, optical image processing, image interpretation/ classification, LULUC data production, SAR image processing • Enhance technical knowledge/ skills on application of statistical methods for uncertainity assessments (QC/QA) • Understanding of IPCC reporting requirements • Improve basic report writing skills	

		analysis into reports)		
MoA	• Qualified (B.Sc) and trained human resource available (i.e. 10 x LMS exerts, 10 x RS experts, 20 x RS operators/ technicians, 6 x GIS experts/ analysts, 10 x GIS operators/ technicians, 20 x MIS/ IT experts, 2 x system developers, 3 x System administrators/ engineers) • Technical competencies in Data Verification, Quality Control and Quality Assurance are available (i.e. Field data collection for Ground Truthing and Validation (sampling and use of GPS), Application of statistical method for error assessment, area and uncertainties estimation, Understanding of error sources and estimation and Documentation/reporting of QC/QA mechanism and assessment results) • Expertise in use of GIS/ RS tools, spatial and temporal analysis (deforestation, forest area changes), dealing with technical challenges of image interpretation (cloud cover, geo-referencing etc.) and use of GPS system in the field • Human capacity for preparation of reports from LMS is only limited to professional report writing skills (1-3) and understanding of UNFCCC/IPCC reporting requirements (1-3)	• Same as above	• In addition to above, improve technical competancies in use of sattelite data for fire monitoring	2
State Level Assessment				
State Forest Departments	Not Available	• Expertise relevant to understanding of processes influencing	• GIS experts for each GIS lab at state level	

		terrestrial carbon stocks are missing.		
		• In-adequate human capacity to analyse the information (i.e. technical report writing skills, review, consolidate and integrate the data and transformation of field data into reports) in context of IPCC/ UNFCCC reporting requirements related to NFI		

Table 5.4: Assessment of Training Facilities for LMS at Federal and State level

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
RSSA	• Training facilities are available and limited to local experts/ trainers (5), and training equipment/ facilities (computers)	• Lack of training unit/ cell and budget allocations for staff training	• Establish a training unit/ cell with in RSSA to keep laison with relevant institutions and provide relevant trainings • Allocation of regular busget for staff trainings that will enable RSSA to get acquaintained with new and emerging Land Mapping/ Monitoring methodologies	1
FNC	Training hall/ room is established with a capacity to accomodate almost 40 participants	• Lack of budget allocations for staff training, • Lack of GIS/ RS related training equipment • Lack of Trainers	• In addition to above, technical experts are required at departmental level to run the GIS lab and keep it functioning • Training equipment (computers, furniture etc)	1

MoA	Non	• Lack of training facilities (training unit/ cell, local experts/ trainers, budget allocations for staff training, training equipment, training rooms)	Same as above,	1
State Level Assessment				
State Forest Departments	Not available	• No budget allocations for trainings • Less opportunities for relevant trainings	Regular budgets need to be allocated for staff trainings and the regional technical sections need to be revived to facilitate such trainings for respective states	

Annex – VII
Assessment of Forest Monitoring Capacities at Federal and State Level

Table 5.17: Assessment of data availability and accessibility for monitoring of government's forest policies

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
HCENR	• National Communication (NC) Document • Sudan's Nationally Determinded Contribution (NDC) document	• Limited availability of GHG monitoring indicators as well as Policy guidance on standard methods/ protocols to report on GHG monitoring indicators	• Monitoring indicators for GHG related policies and measures of AFOLU sector • Policy guidance on standard methods/ protocols to report on GHG monitoring indicators from AFOLU sector	1
FNC	• Draft National REDD+ Strategy • National Forest Policy 1986 (1989) • Draft National Forest Policy (2006) • Past studies on forest monitoring available i.e. FRA (2005, 2010, 2015), NFI (1995-1998) and AfriCover (2000-2012), NFI (2016-2019)	• Limited availability of monitoring tools/ data/ information to monitor the forest policies and measures • Under developed forest monitoring indicators as well as policy guidance on standard methods/ protocols to report on forest monitoring indicators • Action Plan for implementation of REDD+ strategic options is under process	• Action Plan for implementation of REDD+ strategic options • Forest monitoring indicators as well as policy guidance on standard methods/ protocols to report on forest monitoring indicators • Monitoring tools/ data/ information to monitor the forest policies and measures	2
RSSA	• National Land Cover Atlas of Sudan (2000 and 2010) • Sub-national Forest Cover/ Change maps for	• Lack of regular national level sattelite based land cover change monitoring	• Sattelite based Forest monitoring indicators as well as policy guidance on	2

	Blue Nile, El Gadarif and Sinnar	• Lack of sattelite based land use/ forest monitoring indicators • Limited of Policy guidance on standard methods/ protocols to report on sattelite based land use/ forest monitoring indicators	standard methods/ protocols to report on sattelite based forest monitoring indicators	
Wildlife	• Need to be discussed and updated	• Limited Policy guidance and standard protocols/ indicators to monitor extent and distribution of wildlife and protected areas	• Detailed policy guidance on standard methods/ protocols to report on wildlife/ protected areas monitoring indicators	1
State Level Assessment				
State Departments	Forest management plans for reverine and plantation forests	• Management plans are missing for natural forests • Monitoring indicators related to emission reductions are missing in management plans • Sub-national REDD+ strategies and action plans are not available	• Improved management plans for natural forests with national coverage • State level (provincial) REDD+ Action Plans and action plans with defined monitoring indicators to monitor the actions	1

Table 5.18: assessment of technical capabilities for monitoring function

Institution	Existing Capacity	Capacity Gap	Capacity Needs	Ranking
Federal Level Assessment				
HCENR	• AFOLU related institutional functions/ tasks are (i) policy design/ strategy development (i.e. to protect and rehabilitate ecosystems), (ii) policy implementation (in a narrow aspects), (iii) monitoring and evaluation (of national	• Lack of coordination mechanism for inter institutional/ departmental coordination related to SFMS activities • Lack of centralized data	• Inter-institutional/ departmental coordination mechanism • Centralised data base management system to maintain GHG information/	1

	parks and wetlands in coordination with FNC & wildlife department). • Coordinates (i) the institutional linkage between the members of the Council from the institutions involved in the field of environmental issues at the state level (ii) scientific research in all fields of environment and natural resources (iii) build environmental awareness and setting up long-term strategies and programs in the field of environment and natural vision and (iv) coordinating the NGGI and the third National Communication	base to support monitoring process and assess over time the national/ regional/ state level GHG related policies and measures • Lack of monitoring tools/ data/ information to monitor the GHG related policies and measures of AFOLU sector	data (including AFOLU sector) • Monitoring Tools to report on monitoring indicators of AFOLU related policies and measures	
FNC	• Legal basis/ mandate for undertaking monitoring of forest policies and measurements. The specific tasks are (i) policy design/ strategy development (ii) statistical analysis and production of data (i.e. information management, dissemination and planning), (iii) financial planning and budgeting i.e. attract funds for implementation of policies and measures, (iv) policy implementation (i.e. enforcement of laws, develop guidance for trainings etc), and (v) SFMS coordination through participatory institutional arrangements • Monitoring tools to monitor the forest policies and measures are limited to law enforcement checks, staff field visits and/or community monitoring	• Lack of forest web portal and centralised data base management • Lack of regular field inventories • Limited monitoring capacity of communities • Lack of national registries • Weak enforcement of laws	• National Forest Web Portal (See LMS section) • National REDD+ Registry • centralized data base to support monitoring process and assess over time the national/ regional/ state level forest policies and measures (see LMS and NFI section also)	2

	through village committees			
RSSA	•	• In-house satellite data production capacity is limited	• National Land Use Web Portal • Sattelite based monitoring tools to monitor the land use/ forest related policies and measures	2
Wildlife Department	• Legal basis/ mandate for undertaking monitoring of related forest policies and measurements. The specific tasks are (i) policy design/ strategy development (increase network of protected areas by 10%, (ii) statistical analysis and production of data (i.e. cooperative analysis of biodiversity and forest areas), (iii) financial planning and budgeting (i.e. designing projects to attract national/ international funds), (iv) policy implementation (i.e. authority to reserve establish and manage protected area networks), (v) detecting and reporting the changes, and (vi) SFMS i.e. coordination for National REDD+ Strategy	• Lack of monitoring tools (wildlife surveying equipment)	• Wildlife surveying equipment	1
State Level Assessment				
State Departments	Same as above	• Same as above	• Same as above	1

Table 7.1: Logical Framework

Results chain	Performance indicators		Means of verification	Risks/Mitigations measures
	Indicators	**Target**		
Component 1: Land Monitoring System (LMS)				
Global objective: To measure land use and land use changes and to collect activity data				
Intermediate outcome 1: Land use changes are measured				

Output 1: The national level LMS data is available and accessible for generation of Activity Data (AD)				
Activity 1.1 : Organise a national validation workshop to formally endorse national forest definition	Meeting conducted to validate forest definition The National Forest Definition is available	National definition of forest adopted	Validation document, Government notification/ note	Ambiguity about the forest stratification (classes and types) /Develop consensus on the forest stratification based on national circumstances and international reporting guidelines Government notification might get delays due to lengthy government procedures of formal submissions and subsequent comments/ verification by the verifying authorities/ Ensure timely initiation of the process and regular follow up with the reviewing authorities
Activity 1.2: Notify and legally adopt the national forest definition	National forest definition is available	Legal adoption of national forest definition	Government notification	-
Activity 1.3 : Organise a technical Working Group meeting to review the National Land Use and Forest Classification System consistent with IPCC guidance on Land Representation	The Harmonised National Land Use and Forest Classification System Consistent with IPCC guidance on Land Representation is available	Harmonised national land use and forest classification system adopted for Sudan	NFI manual/ MRV document updated	Ambiguity about the land use classes and types /Develop consensus on the land use classes/ types based on national circumstances and international reporting guidelines (IPCC Guidance)
Activity 1.4 : Update and notify the revised national forest/ land use classification system	Revised national forest/ land use classification system available	National Forest/ Land Use Classification System Consistent with IPCC Guidance on Land Representation	NFI Manual Updated	Ambiguity about the land use / forest classes and types /Develop consensus among national institutions based on national/ state level circumstances and international reporting guidelines (IPCC Guidance)

Activity 1.5: Organise consultative meetings in each state to categorize state level land use/ forest types based on national land use/ forest classification system	State level land use/ forest classes (harmonised with national land use/ forest classification) are available	State level land use and forest types are harmonised with national land use/ forest classification	NFI manual/ MRV document updated	Ambiguity about the national and state level land use / forest classes and types /Develop consensus (particularly among state institutions) on national and state level land use forest classes/ types based on national/ state level circumstances and international reporting guidelines (IPCC Guidance)
Activity 1.6: Organise a technical working group meeting to assess and characterize existing satellite data for historical land use/ forest cover changes and future monitoring	List of accessible/ available satellite imagery	Characterization of historical Sattelite data (for land use/ forest cover change assessment) and future Sattelite data for monitoring of land and forests	Review/ Assessment report	Consistency and availability of historical sattelite data / make sure the characteriation is based on consideration of application of national forest definition and Sudan's future access to freely available data acquisition web domains
Activity 1.7: Purchase/ procure/ acquisition of required satellite imagery based on recommendations from Activity 1.5 & 1.6	Sattelite images (high and medium resolution)	Landsat data, very high resolution images (ASTER, SPOT)	Sattelite images are available	Availability of the satellite images from the same sensor in future/ Keep searching for other compatible sensors
Output 2 : The LMS is operational and Functional				
Activity 2.1: Develop Land Use/ Land Use Change and forest cover/ forest cover change Maps for all the states based on national forest definition and national land use/ forest classification system	State level spatially explicit information on land use/ forest cover and change is available	State Level AD data is generated	land use/ forest cover and change maps	Non-availability of data due to no coverage area, clouds and other atmospheric conditions; Accuracy of mapping/RSSA and FAO will be consulted for analysis and mapping support
Activity 2.2: Historical analysis of State level Land Use and Forest Cover Changes	State level data/information on historical land use/ forest cover	Historical land use trends due to human activities	Land use/ forest cover change matrix is available for each state (sub-	Uncertainties associated with feedback mechanism to ensure consistency checks/ ensure

	changes is available		national FREL reports)	participatory feedback process/ mechanism for ground verification
Activity 2.3: Integrate sub-national AD to generate national level AD for Land / Forest Cover Changes	National level data /information on historical land use/ forest cover changes is available	National AD	National Land use/ forest cover change matrix is available (national FREL report)	Uncertainties associated with use feedback mechanism to ensure consistency checks/ develop participatory feedback mechanism for ground verification
Activity 2.4: National Agreement and Validation of Reference Year for National FREL based on historical analysis i.e. activity 2.2 & 2.3	Validation workshop conducted to validate land use/ forest cover change matrices and agree on reference year for national FREL	Agreement on the Baseline (Reference Year) for National FREL	Workshop proceedings, validation statement	The higher authorities of relevant institutions might not participate in validation workshop that might result in conflicts at later stage due to lack of technical understanding/ Coordinator well in time with the higher authorities to ensure their participation in the validation workshop
Activity 2.5: Set up Quality Control/ Quality Assurance procedures for review and validation of LMS results	QA/QC setups with standard protocols of working procedures are established	Quality control/ quality assurance procedures are in place and operational	Established set ups, review committees, allocated budgets Standard QA/QC protocols QA Reports by third party	Hiring of a third party may not happen/ Ensure fair and transparent hiring procedures
Activity 2.6: Publish the results in the form of national report to ensure national ownership and reliability	Publications	National and state level awareness	Published material (articles, brochures, pamphlets, reports)	Target readers may not be focused / publish the awareness contents based on the identification of different target reader groups (public, media, technical, policy etc)
Output 3: The national FREL is defined and developed for Sudan				
Activity 3.1: Develop sub-national FREL for each state (or cluster of states) based on data inputs from historical analysis of AD produced at state level (i.e.	AD and EFs are available for all forest types/ classes of respective states/ regions	Sub-national FRELs for states (or cluster of states)	Land use change matrices for states, forest inventory reports, sub-national FREL reports	Delays in timely completion of mapping activities due to late submission of reports by NFI and LMS units /efficient coordination among various SNFMS units

Activity 2.1 & 2.2) and Emission Factors (EFs) developed through NFI				
Activity 3.2: Integrate sub-national FRELs to develop National FREL for Sudan	AD and EFs are available for national forest types/ classes	National FREL for Sudan	National FREL Report, National Land Use Change Matrix, NFI reports	Difficulties in application of statistical procedures for integration and data proppagation/ get expertise of FREL specialist / statistical analyst
Activity 3.3: Conduct detailed study on national circumstances to identify the future development indicators due to government's planned policies which are likely to impact (directly/ indirectly) deforestation/ forest degradation. The study will help to assess the needs for FREL adjustment	Study conducted	Justification for the adjustment needs of national FREL	Report on national circumstances for FREL adjustment needs with recommendations	Socio-economic indicators, likely to impact deforestation (due to governments future policies and measures), linked to FREL adjustment needs may change due to transitioning political interests/ make realistic assumptions based more on historical trends
Output 4: Technical Capacities for LMS at Federal and State Level are enhanced/ reinforced				
Activity 4.1: Organise high level meetings to define and develop Working Relationships among RSSA, FNC, MoA and HCENR for effective coordination of LMS activities	No of consultative meetings ToRs with clarification of working mandates are available MoUs signed Technical coordinators notified from respective institutions	Well-coordinated LMS working team	ToR document Proceedings of consultative meetings Notifications of technical coordinators MoUs are available	Availability of technical expertise in FNC, HCENR and MoA/ identify, train and retain the technical expertise Ambiguity about the mandate and administrative control of LMS activities between RSSA and FNC/ Conduct joint meetings and develop clarities prior to any decision

Activity 4.2: Allocate space and establish national LMS laboratory	Joint meetings between FNC & RSSA for allocation of space and clarity on mandates and administrative controls LMS Laboratory is operational	Well-functioning national LMS laboratory	Pictures, proceedings of meetings, government notes	Ambiguity regarding office space RSSA and FNC /Agreements with RSSA and FNC regarding office space and staff
Activity 4.3: Purchase of office supplies and equipment for national LMS laboratory	Equipment is available in LMS laboratory	Well-equipped LMS laboratory	Pictures, invoices etc	Slow and lengthy procedures/ Involve FAO in establishment of the LMS laboratory
Activity 4.4: Allocate space and establish small GIS units/ Cells in each state (or sectoral/ regional technical sections)	Consultative meetings with state forest departments GIS units are operational in states	18 small GIS units in states are operational	Proceedings of meetings,; pictures of the labs	Weak coordination between federal and state institutions may result in delays/Process of regular and proactive consultation among state institutions will be adopted.
Activity 4.5: Purchase of office supplies and equipment for state level GIS units/ cells (or sectoral/ regional technical sections)	Equipment is available in GIS units	Fully equipped GIS units	Purchase vouchers; equipment available in the laboratories	Slow and lengthy procedures/ Involve FAO in establishment of the GIS units
Activity 4.6: Hire technical staff (GIS experts) for state level GIS units/ cells (or sectoral/ regional technical sections)	GIS experts are available	Strengthen state level GIS laboratories	Contractual agreements	Personal relations/ interests might jeopardise the hiring of technical skills/ Ensure transparency in hiring process which should purely be based on merit
Output 5: LMS data is centralised, archived and sustainably managed				
Activity 5.1: Define and develop coordination mechanism and facilitate data sharing agreements	Timely flow of information from state to federal institutions	Well-coordinated data sharing mechanism among state and	Consultative meetings, government request letters to relevant institutions for	Lack of involvement of state institutions in the planning process/ efficient coordination and participation of

with clear roles and responsibilities for timely and effective flow of information from state to federal level institution.	through effective coordination	federal institutions	data sharing, data sharing agreements, etc	state institutions in the planning process
Activity 5.2: Develop robust data base management system to centrally archive the information on LMS	Database is available	Robust Database management system	Invoices, pictures ; Signed data sharing agreements; Availability of data	Difficulties in collecting the data, poor or weak coordination and cooperation with partners/negotiations of fair data sharing agreements
Output 6: Training facilities are well established and technical Human capacities (skills/ knowledge/ expertise) relevant to LMS are enhanced and available at both federal and state level				
Activity 6.1: Identify and notify the national training institution for LMS related trainings	WG meeting conducted to identify the training institution	Agreement on the place/ institution to establish national LMS training unit/ cell	Proceedings of the meeting	Ambiguity regarding office space between FNC, UoK and RSSA/Agreement with FNC, UoK and RSSA regarding office space and staff
Activity 6.2: Establish national LMS training unit/ cell	LMS Training unit/ cell is functional	Equip LMS training unit/ cell	Pictures, government notes	Slow and lengthy procedures/ Involve RSSA and UoK in establishment of the LMS lab
Activity 6.3: Purchase modern training Equipment to strengthen national LMS training Unit/ Cell	Training equipment is available	Strengthening of National LMS unit/ cell	Fully equipped training cell/ unit, pictures, invoices etc	Slow and lengthy procedures/ Involve FAO
Activity 6.4: Train technical staff by provision of relevant trainings on (i) UNFCCC's requirements for reporting on land use changes (ii) basic RS/GIS techniques (iii) satellite image corrections, enhancement and interpretation (iv) open source software (e.g. Collect Earth, Open Foris, QGiS etc) to	Number of trainings conducted	7 national trainings	List of participants, attendance sheets	Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants

Trainers of LMS not available in Sudan /International experts will have to be requested |

assess land use and forest cover changes (v) land cover classification and forest stratification (vi) monitoring afforestation, deforestation and forest degradation using RS techniques (vii) statistical methods/ tools to assess uncertainties related to generation of AD and (viii) IPCC reporting requirements relevant to AD.				

Results chain	Performance indicators		Means of verification	Risks/Mitigations measures
	Indicators	**Target**		
Component 2: National Forest Inventory				
Global objective: To assess forest resources and carbon stocks in the different forest types of Sudan				
Intermediate outcome 1: Forest resources and carbon stocks of the different forest types are measured				
Output 1: The National Forest Inventory Data is available and accessible				
Activity 1.1: Stratify the national level forests based on updated national forest classification system and determine the number and distribution of field plots	NFI data is representative of all forest classes/ types with national forest coverage	National forest stratification, harmonised with IPCC guidance on land representation, The number of NFI field plots determined and distributed over nationally harmonised forest strata	National forest stratification scheme, updated NFI manual, field plots distribution map	Ambiguity among federal and state forest departments about distribution of field plots /Develop consensus on the distribution of field plots based on scientific justifications
Activity 1.2: Organise a technical working group meeting and	Updated inventory work	Update inventory forms to include the information on NTFPs, species list	Field data sheets/ survey forms	Information/ knowledge on soil data collection methods/ ensure effective

review and update the forest inventory forms to include the information on NTFPs, and soil carbon data in different forest types	sheets/ forms are available	(to be based on density estimates) and soil carbon data		coordination with MoA and relevant soil department to ensure the right information is incorporated in the field forms
Activity 1.3: Extend, plan and carry out national level forest inventory in all the states covering all forest strata and types following the methodological approach in national NFI manual	Field data available	NFI data collected from all forest strata/ forest types	field pictures, field data sheets Data base	Accuracy issues in operational planning, Inaccessibility of remote field sites, hostile situation of some areas/ verification by field experts. involve local people
Activity 1.4: Analyze and verify data, estimate the variability within forest strata and compile forest carbon data according to forest types	NFI report is available	NFI report	Report	Delays due to late submission of comments by the verifying authorities/ Ensure timely initiation of the process. Regular follow up with the reviewing authorities
Activity 1.5: Carryout Socio-economic surveys as a parallel activity with National Forest Inventory to collect detailed information on socio-economic dependencies on forests	Socio-economic surveys conducted	Collect data on socio-economic dependencies	Survey sheets/ questionnaires, pictures from the field, survey reports	Inaccessibility of remote field sites, hostile situation of some areas/ involve local people
Activity 1.6: Conduct research study to develop allometric equations for all the forest tree species covering all forest types in the country	Research study conducted Allometric equations are available for all forest tree species	Country specific biomass equations for forest tree species	Research studies, pictures from the field etc	Sampling error may be significant when selecting trees or shrubs for harvest to develop allometric models/ increase sample size to avoid sampling errors
Activity 1.7: Conduct research study to assess annual growth rates for different tree species in different forest types, annual	Research study conducted	Country specific removal factors for different forest types of Sudan	Research studies, pictures from the field etc	Lengthy process/ involve FAO for technical guidance

harvest (legal and illegal impacts), and annual disturbance rate (may include fires etc) to develop removal factors for different forest types.	Country specific removal factors are available for different forest types			
Output 2: Technical capabilities related to NFI are improved and well established at federal and state level				
Activity 2.1: Establish and equip a separate NFI unit on regular basis at FNC	NFI unit is functional on regular basis with clear mandates and lines of communication	Dedicated NFI unit on regular basis	ToRs, technical proposal for establishment of NFI unit on regular basis	Lack of political will and allocation of regular budget/ Process of regular and proactive consultation between FNC and political leadership
Activity 2.2: Allocate space and establish central and field NFI laboratories at federal and state level	Joint meetings between FNC & state FDs for allocation of space and clarity on mandates and administrative controls National and state level NFI Laboratories are operational	Well-functioning national and state level NFI laboratory	Pictures, proceedings of meetings, government notes	Ambiguity regarding mandates and Financial allocations between FNC and state forest departments /Agreement between FNC and state FDs regarding mandates and financial allocations
Activity 2.3: Equip the federal and state forest departments with adequate number of modern NFI tools (i.e. computers, digital callipers, laser vertex etc)	Modern NFI tools and equipment are available	Well-equipped NFI laboratories at federal and state level	Equipment pictures, purchase invoices etc	Slow and lengthy procedures/ Involve FAO
Activity 2.4: Purchase Vehicles for NFI field activities	Vehicles are available	Facilitate field inventory	Purchase invoice, pictures of vehicles, vehicle allotment notices	Vehicles may not be used for NFI/ ensure the permanent allotment retention of vehicles for NFI purposes only
Activity 2.5: Purchase field tents, first boxes, equipment storage boxes, field kits (shoes, jackets rain	NFI field logistic support i.e. field tents, first boxes, equipment storage boxes, field kits (shoes,	Facilitate field inventory teams	Purchase invoice, pictures, distribution notes etc	Mishandling/ ensure proper storage and maintenance

coats etc) for field staff	jackets rain coats etc) is available			
Activity 2.6: Procure/ purchase modern licenced statistical software tools (PSS, R etc) for data analysis	Statistical software tools available	Improve technical skills on data analysis	Software tools installed, purchase invoices,	Lack of understanding to use software tools/ involve UoK/ UoS to provide initial trainings
Activity 2.7: Centralise and archive the existing data by designing a comprehensive data base management system	Database is available	Robust NFI Database management system	Invoices, pictures ; Signed data sharing agreements; Availability of data	Difficulties in collecting the data, poor or weak coordination and cooperation with partners/negotiations of fair data sharing agreements
Output 3: Human capacity to analyse and process the information related to NFI is improved and available both at national and state level				
Activity 3.1: Identify team leaders and trainers from provincial forest departments and other related departments and train them on NFI methodology guided by National NFI manual.	No. of trainings conducted

No. of persons trained | 5 sectoral trainings to

enhance/ improve skills and knowledge on NFI | Pictures, training proceedings, participants lists, attendance sheets | Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants |
| **Activity 3.2: Train technical staff/ trainers on the measurement of forest carbon stocks by delivering the trainings on (i) forest inventories (inventory design and field sampling techniques for forest carbon inventory, plot design, configuration and data collection from carbon pools, use of latest equipment i.e. vertex, densitometer, high accuracy handled GPS), (ii) IPCC Good Practice Guidance for the** | No. of trainings conducted

No. of persons trained | 5 sectoral trainings to

enhance/ improve skills and knowledge | Pictures, training proceedings, participants lists, attendance sheets | Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants |

measurement of forest carbon stocks, (iii) descriptive statistics, (iv) development of allometric equations, (v) processing and analysis of inventory data (including the use of open source software)				
Output 4: NFI training facilities are well established at federal and state level				
Activity 4.1: Establish and Strengthen national NFI training Unit on regular basis	Joint meetings with finance department Technical proposal for establishment of central NFI training unit Training unit is functional	Provision of regular training facilities at national level	Allocation of space of training unit, pictures, equipment purchase invoices etc	Maintenance issues/ ensure proper maintenance checks
Activity 4.2: Provision of regular budget for staff trainings on annual basis	Joint meetings with finance department Technical proposal for allocation of regular training budget for federal and state forest departments Budget for staff training is available	Allocation of regular budget for staff trainings	Annual budget plans	Training budget might be misused/ develop criteria for proper utilization of training budget
Activity 4.3: Strengthen the central, sectoral technical sections and state forest departments with	Training equipment are available	Well-equipped training facilities at sectoral technical sections and state forest departments	Equipment pictures, purchase invoices etc	Slow and lengthy procedures/ involve FAO

provision of necessary training equipment (multimedia projectors, projection screens, lap tops, furniture etc)		24 multimedia projectors, 24 projection screens, 24 lap tops, 24 sets of furniture etc)		
Activity 4.4: Organise regular (six months basis) trainings for field staff on NFI	Number of trainings conducted Number of field staff trained	Well trained up to date NFI field staff	List of participants, training proceedings, attendance sheets, pictures etc	Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants
Output 5: Quality control/ quality assurance procedures are developed and implemented at federal, regional and state level				
Activity 5.1: Identify all potential data partners (governmental, NGOs, universities, etc.)	List of information needs and instituions available	The information needs and relevant institutions with requisite information are identified	List of information needs	Lack of understanding and over estimation of needs/ Cross checking and triangulation
Activity 5.2: Facilitate the sending of a letter [from the Minister] to all data partners regarding data sharing agreements/ followed by joint meetings	Letter sent to all data partners	Data sharing agreements	Proceedings of meetings, Data sharing agreements	Difficulties in collecting the data, poor or weak coordination and cooperation with partners/negotiations of fair data sharing agreements
Activity 5.3: Identify the 3rd party review institution(s) and establish a technical scientific committee for review and internal validation of inventory results/ reports.	3rd party reviews are available Technical scientific committee is functional	Institutionalization of quality control process	Proceedings of joint meetings, Review reports, government notification of scientific committee, ToRs	Develop criteria and get approval from relevant stakeholders for selection of 3rd party review institution and nomination of members of scientific committee to avoid conflict of interest
Activity 5.4: Establish and carry out quality control and harmonization of data	QA-QC Protocols defined and implemented	Regular implementation of QA-QC protocols	QA-QC protocols; QA reports by third party;	Hiring of a third party may not happen/Ensure fair and transparent hiring procedures

Results chain	Performance indicators

	Indicators	Target	Means of verification	Risks/Mitigations measures
Component 3: Green House Gas Inventory				
Global objective: To measure GHG emissions and removal for the LULUCF sector				
Intermediate outcome 1: GHG emissions and removals of the LULUCF sector are assessed				
Output 1: Country specific GHG inventory data of AFOLU sector is available to update the GHG chapter information in Sudan's NC document				
Activity 1.1: Conduct a research study on national livestock population count for each livestock group, type and amount of feed consumed by livestock	Research study conducted Information/ data on national livestock population count and feeding statistics available	Country specific information on livestock count and amount of feed consumed	ToR of research study, pictures from the field etc, published results/ report	Lengthy process/ involve FAO, MoA and Directorate of Pasture and Range Management
Activity 1.2: Develop emission factor for enteric fermentation	Emission factors for enteric fermentation are available	Country specific emission factors for enteric fermentation	Analysis results, updated tables in GHG chapter information in Sudan's NC	Local expertise might not understand the statistical procedures and use of IPCC guidance to develop emission factors/ Seek technical guidance from FAO
Activity 1.3: Conduct a research study on the extent, application and management of manure on crop lands. The expected results of the study will give country specific emission factors of manure application on crop lands.	Research study conducted Country specific Emission Factors are available	Country specific emission factors for manure application	Research studies, pictures from the field etc, published results/ report	Lengthy process/ involve FAO, MoA and Directorate of Pasture and Range Management
Activity 1.4: Develop country specific Emission Factors for rice cultivated areas, biomass burning and urea application on crop lands	Country specific Emission Factors are available	Country specific emission factors for rice cultivation, biomass burning and urea application	Analysis results, updated tables in GHG chapter information in Sudan's NC	Local expertise might not understand the statistical procedures and use of IPCC guidance to develop emission factors/ Seek technical guidance from FAO
Activity 1.5: Conduct a national level comparative research study on soil disturbances in forest lands, crop lands and grass lands	Country specific Soil Emission	Country specific soil emission factors for forest land,	Analysis results, updated tables in GHG chapter	Local expertise might not understand the statistical procedures and use of IPCC guidance to develop

and its impact on soil carbon. The expected results of the study will give country specific soil emission factors for the three land use categories (i.e. Forest land, Crop Land and Grassland).	Factors and available	crop lands, and grass lands	information in Sudan's NC	emission factors/ Seek technical guidance from FAO
Activity 1.6: Generate Activity Data (AD) for savannah burning areas, biomass burning on crop lands and rice cultivated areas,	AD for emissions from biomass burning is available	Develop AD for emissions from biomass burning	Produced maps and change matrix	-
Activity 1.7: Update national GHG inventory of AFOLU sector based on country specific data that will be generated through implementation of aforementioned activities as well as activities in LMS and NFI sections	GHG inventory information is updated in relevant tables	Ensure the use of Tier 2 level information in national GHG inventory	Updated GHG chapter information for AFOLU sector in Sudan's NC	-

Output 2: Technical capacities on National GHG inventory of AFOLU sector established, strengthened and improved at federal and state level

See implementation framework for LMS, NFI and Monitoring Function

Output 3: Human Capacities on National GHG inventory preparations and reporting are enhanced

Activity 3.1: Recruit technical GHG inventory and reporting experts (forest and agriculture) for AFOLU sectors at HNCER	Forests and Agriculture experts are available	Strengthen the GHG inventory unit of HCENR	Contractual agreements	Personal relations/ interests might jeopardise the hiring of technical skills/ Ensure transparency in hiring process which should purely be based on merit
Activity 3.2: Identify trainers at federal and state level and conduct TOT workshops on the following required knowledge and skills: • **GHG-I of AFOLU Sector using Tier 2 & 3 methodological approach** • **Development of emission Factors for enteric fermentation, application of manures and savannah burning** • **Technical report writing skills**	Number of trainings conducted Number of master trainers trained	05 ToTs to ensure local availability of master trainers/ technical expertise	List of participants, training proceedings, attendance sheets, pictures etc	Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants

• **IPCC reporting requirements for Forest, Grass and Cropland Category** • **Development of emission Factors for rice cultivated areas, biomass burning on crop lands, urea application and soil disturbances relevant to croplands**				
Output 4: Training facilities for national GHG inventory of AFOLU sector established and strengthened				
See Implementation framework of LMS, NFI and Monitoring function				

Results chain	Performance indicators		Means of verification	Risks/Mitigations measures
	Indicators	**Target**		
Component 4: Monitoring Function				
Global objective: To assess the results of REDD+ policies and measures				
Intermediate outcome 1: Results of REDD+ policies and measures are assessed				
Output 1: National Forest Monitoring Indicators and tools to monitor forest related policies and measures are available				
Activity 1.1: Review and update a national REDD+ strategy to define and include actions and monitoring indicators (to monitor the actions) against REDD+ strategic options	List of monitoring indictors is available	The Indicators are identified and described	List of indicators validated and published in updated REDD+ strategy document	Limited knowledge and understanding of indicators/ organize lecture and presentations, develop guidelines on monitoring indicators
Activity 1.2: Organise a national workshop to prioritise strategic options and actions, finalise forest monitoring indicators and tools	Workshop organised Monitoring indicators and tools are prioritized	Prioritization of actions, monitoring indicators and monitoring tools	Workshop proceedings, list of participants, attendance sheets	Nomination of irrelevant and non technical persons / Develop proper guidelines regarding nomination of suitable candidates
Activity 1.3: Develop Policy Guidance on standard methods/ protocols to report on wildlife and AFOLU	Consultative meetings organised	Policy guidance to monitor wildlife and GHG of AFOLU	Proceedings of the meetings, Technical manual on policy guidance for	Lack of coordination among provincial and federal level organizations/ regular coordination

sector GHG monitoring indicators	Technical manual on policy guidance for monitoring of forests is available		monitoring of forests of Sudan	meetings and sessions
Activity 1.4: Review and update the MRV document to include the nationally agreed forest related monitoring indicators and tools	Updated MRV document available	Availability of standardised forest monitoring indicators and tools	Updated MRV document	-
Output 2: Provincial REDD+ action plans and state level forest management plans for all forest types are developed and available for regular forest monitoring				
Activity 2.1: Develop provincial (individual states or cluster of states) REDD+ Action Plans guided by national REDD+ strategy	Action plans available	State level REDD+ Action Plans developed	Action Plans	Limited in-country expertise/ FAO will be requested for the services of an international consultant
Activity 2.2: Review and improve the existing forest management plans for riverine and planation forests to align them with national and relevant sub-national REDD+ strategic objectives and actions	Revised management plans available	Improve and update management plans for reverine and plantation forests	Updated management plans	The state forest departments may take time to become used to the new system/suitable capacity building plan will be developed
Activity 2.3: Develop forest management plans for natural forests guided by national REDD+ strategy and relevant provincial REDD+ action plan	Management plans available	Natural forests are management under proper guiding management plans	Management Plans	Same as above
Output 3: The Technical capabilities of relevant federal and state level institutions for monitoring (Sattelite based) of government's land use/ forest related policies and measures are enhanced and operational				
Activity 3.1: Develop inter-institutional / departmental coordination and communication mechanism among HCENR, RSSA, FNC, MoA, General Directorate of Pasture and Range	Regular coordination meetings Joint monitoring activities	Well-coordinated communication mechanism for joint forest monitoring	Proceedings of meetings, communication strategy document	Delays in data sharing between technical units and administrative levels /Regular coordination meetings and appropriate communication

Management and Academia (UoK and UoS) for information sharing on monitoring of AFOLU sector policies and measures				
Activity 3.2: Develop Land Use Web Portal (maintained by RSSA and supported and coordinated by AFOLU sector institutions) to ensure regular monitoring of land use changes and accessibility of information	Lan use web portal is online	Develop the national land use web portal; Launch, maintain and update the web portal	Web portal is functioning and regularly updated	Staff turnover and transfers/ Full time staff will be hired
Activity 3.3: Develop SNFMS/ forest web portal (maintained by FNC and supported/ coordinated by RSSA) to ensure regular monitoring of forest changes due to government policies and measures	SNFMS/ Forest Web portal is online	Develop the national forest web portal; Launch, maintain and update the web portal	Web portal is functioning and regularly updated	Staff turnover and transfers/ Full time staff will be hired
Activity 3.4: Procure/ purchase monitoring (fire and wildlife) equipment for Agriculture and wildlife department	Wildlife and fire monitoring equipment is available	Regular monitoring of fire events and wildlife	Purchase invoice, pictures etc	Limited capacity and expertise of staff/ Develop capacity building plan and organize regular trainings

Results chain	Performance indicators		Means of verification	Risks/Mitigations measures
	Indicators	**Target**		
Component 5: Institutional Arrangements				
Global objective: To make Sudan REDD+ Ready through robust institutional arrangements for SNFMS				
Intermediate outcome 1: Results of REDD+ policies and measures are assessed				
Output 1: Sustainable and participatory network of institutions with necessary range of expertise and clearly documented roles and responsibilities are established for SNFMS				
Activity 1.1: Create consensus/ agreements on the identified and proposed	National workshop conducted	Finalise institutional arrangements for SNFMS	Government Notes, Validation Statement	The higher authorities of relevant institutions might not participate in validation workshop that might result in conflicts at later stage

institutional arrangements	Letters of agreement from proposed institutions			due to lack of technical understanding of role of relevant institution/ Coordinator well in time with the higher authorities to ensure their participation in the validation workshop
Activity 1.2: Identify joint working relationships and develop joint working teams pertaining to different technical components of SNFMS functions i.e. monitoring and MRV (LMS, NFI, GHG-I)	ToR available Working teams notified	Establish well-coordinated technical working relationships for implementation of Monitoring and MRV functions of SNFMS	Notification of working teams	Non-technical personnel might be included in working teams, In-effective communication/ Develop selection criteria for members of working team, ensure time frame for regular meetings of working teams
Activity 1.3: Develop clear and detailed ToR on the relevant roles and responsibilities (with necessary definitions of SNFMS coordination, communication, LMS, NFI, GHG-I as well as quality assurance and quality control) of relevant proposed institutions/ organizations/ departments	Mandates, lines of communication and QC protocols are defined for each relevant institution	Identification of institutional roles and responsibilities for implementation and operationalization of SNFMS	ToRs/ MoUs	Conflict might arise among institutions to take non-relevant roles/ responsibilities to tap maximum funds/ Involve FAO to seek technical guidance on allocation of relevant roles and responsibilities based on institutional capacities.
Activity 1.4: Enact legally-binding institutional arrangements for the implementation and operation of SNFMS	National REDD+ strategy updated and validated	To legally embed the operationalization of SNFMS with in the national permanent institutional structure	Proposal for the allocation of regular institutional budgets, Government Notes/Legal Notification	The capacity to develop Proposal for regular budget allocations may not be available/ Involve FAO for technical guidance on writing such technical proposals
Activity 1.5: Undertake consultations on the design and type of REDD+ demonstration activities that will be implemented as a testing ground for	Consultative meetings organised	Identification of REDD+ Pilot Sites and Activities	Proceedings of the meetings, List of Participants, List of Pilot Sites/ Activities available	Conflict among different states for selection of demonstration sites/ Parallel technical awareness sessions on criteria for selection of pilot sites/ activities

the implementation of the SNFMS				
Output 2: SNFMS funding arrangements are assesses and clarified				
Activity 2.1: Carry out a detailed assessment of the funding needed to ensure the long-term sustainability of an SNFMS.	Inventory of available needed funds available	financial gap analysis of SNFMS implementation	Report	Coordination among different departments involved; Lack of understanding and interest of high level authorities; challenges in collecting the information regarding funding opportunities/ Constitute a special task force with representatives from all relevant departments to urgently deal with this matter. Also involve relevant NGOs.
Activity 2.2: Assess domestic financing needs and timeline and modalities for delivery of these funds	The resource mobilization strategy is available	A detailed strategy with clear needs and timelines	Report	Government may not understand the importance of the SNFMS and may not allocate sufficient funds for the implementation of SNFMS/ An awareness raising campaign specifically designed for Gov. representatives to explain the importance and utility of the SNFMS and the potential benefits of the REDD+ mechanism
Activity 2.3: Assess the levels, sources and work areas of initial donor funding and the process required to transition to a sustainable self-financing arrangement	List of prioritized working areas/ activities (short term and long term) List of potential short term and long term donors (government, private sector, INGOs) available	Ensure funding arrangements and process for smooth transition to sustainable self-financing	Report	Establish a taskforce to initiate dialogue with potential government and international donors
Activity 2.4: Develop a timeline of funding allocations and implementation	A funding allocation mechanism is available	Proposal for Funding allocation mechanism	Proposal for Funding allocation	Conflicts between institutions or administrative levels; lack of clarity regarding REDD+ funding

			mechanism available	mechanism/ Arrange presentations for higher management to develop clarity about REDD+ funding mechanism
Activity 2.5: Implement a national validation workshop of SNFMS funding allocations and the implementation process	Workshop conducted	Create national consensus on SNFMS funding allocations	List of participants, workshop proceedings	The higher authorities of relevant institutions might not participate in validation workshop that might result in conflicts at later stage due to lack of technical understanding/ Coordinator well in time with the higher authorities to ensure their participation in the validation workshop
Activity 2.6: Formally adopt the mechanism for allocating funds and the process of implementation (legal enactment where possible)	The financial arrangements are enacted	The financial arrangements are enacted	Legal notification	Slow procedures, Lack of interest of high level authorities, Conflicts between national and provincial levels/ hold special meetings to speed up the process. Organize regular coordination meetings between relevant state and federal level institutions.

Annex – VIII
LOGICAL FRAMEWORK

Table 7.1: Logical Framework

Results chain	Performance indicators		Means of verification	Risks/Mitigations measures
	Indicators	**Target**		
Component 1: Land Monitoring System (LMS)				
Global objective: To measure land use and land use changes and to collect activity data				
Intermediate outcome 1: Land use changes are measured				
Output 1: The national level LMS data is available and accessible for generation of Activity Data (AD)				
Activity 1.1 : Organise a national validation workshop to formally endorse national forest definition	Meeting conducted to validate forest definition The National Forest Definition is available	National definition of forest adopted	Validation document, Government notification/ note	Ambiguity about the forest stratification (classes and types) /Develop consensus on the forest stratification based on national circumstances and international reporting guidelines Government notification might get delays due to lengthy government procedures of formal submissions and subsequent comments/ verification by the verifying authorities/ Ensure timely initiation of the process and regular follow up with the reviewing authorities
Activity 1.2: Notify and legally adopt the national forest definition	National forest definition is available	Legal adoption of national forest definition	Government notification	-
Activity 1.3 : Organise a technical Working Group meeting to review the National Land Use and Forest Classification System consistent with IPCC guidance on Land Representation	The Harmonised National Land Use and Forest Classification System Consistent with IPCC guidance on Land Representation is available	Harmonised national land use and forest classification system adopted for Sudan	NFI manual/ MRV document updated	Ambiguity about the land use classes and types /Develop consensus on the land use classes/ types based on national circumstances and international reporting guidelines (IPCC Guidance)

Activity 1.4 : Update and notify the revised national forest/ land use classification system	Revised national forest/ land use classification system available	National Forest/ Land Use Classification System Consistent with IPCC Guidance on Land Representation	NFI Manual Updated	Ambiguity about the land use / forest classes and types /Develop consensus among national institutions based on national/ state level circumstances and international reporting guidelines (IPCC Guidance)
Activity 1.5: Organise consultative meetings in each state to categorize state level land use/ forest types based on national land use/ forest classification system	State level land use/ forest classes (harmonised with national land use/ forest classification) are available	State level land use and forest types are harmonised with national land use/ forest classification	NFI manual/ MRV document updated	Ambiguity about the national and state level land use / forest classes and types /Develop consensus (particularly among state institutions) on national and state level land use forest classes/ types based on national/ state level circumstances and international reporting guidelines (IPCC Guidance)
Activity 1.6: Organise a technical working group meeting to assess and characterize existing satellite data for historical land use/ forest cover changes and future monitoring	List of accessible/ available sattelite imagery	Characterization of historical Sattelite data (for land use/ forest cover change assessment) and future Sattelite data for monitoring of land and forests	Review/ Assessment report	Consistency and availability of historical sattelite data / make sure the characteriation is based on consideration of application of national forest definition and Sudan's future access to freely available data acquisition web domains
Activity 1.7: Purchase/ procure/ acquisition of required satellite imagery based on recommendations from Activity 1.5 & 1.6	Sattelite images (high and medium resolution)	Landsat data, very high resolution images (ASTER, SPOT)	Sattelite images are available	Availability of the satellite images from the same sensor in future/ Keep searching for other compatible sensors
Output 2 : The LMS is operational and Functional				
Activity 2.1: Develop Land Use/ Land Use Change and forest cover/ forest cover change Maps for all	State level spatially explicit information on land use/ forest cover and	State Level AD data is generated	land use/ forest cover and change maps	Non-availability of data due to no coverage area, clouds and other atmospheric conditions; Accuracy of

the states based on national forest definition and national land use/ forest classification system	change is available			mapping/RSSA and FAO will be consulted for analysis and mapping support
Activity 2.2: Historical analysis of State level Land Use and Forest Cover Changes	State level data/information on historical land use/ forest cover changes is available	Historical land use trends due to human activities	Land use/ forest cover change matrix is available for each state (sub-national FREL reports)	Uncertainties associated with feedback mechanism to ensure consistency checks/ ensure participatory feedback process/ mechanism for ground verification
Activity 2.3: Integrate sub-national AD to generate national level AD for Land / Forest Cover Changes	National level data /information on historical land use/ forest cover changes is available	National AD	National Land use/ forest cover change matrix is available (national FREL report)	Uncertainties associated with use feedback mechanism to ensure consistency checks/ develop participatory feedback mechanism for ground verification
Activity 2.4: National Agreement and Validation of Reference Year for National FREL based on historical analysis i.e. activity 2.2 & 2.3	Validation workshop conducted to validate land use/ forest cover change matrices and agree on reference year for national FREL	Agreement on the Baseline (Reference Year) for National FREL	Workshop proceedings, validation statement	The higher authorities of relevant institutions might not participate in validation workshop that might result in conflicts at later stage due to lack of technical understanding/ Coordinator well in time with the higher authorities to ensure their participation in the validation workshop
Activity 2.5: Set up Quality Control/ Quality Assurance procedures for review and validation of LMS results	QA/QC setups with standard protocols of working procedures are established	Quality control/ quality assurance procedures are in place and operational	Established set ups, review committees, allocated budgets Standard QA/QC protocols QA Reports by third party	Hiring of a third party may not happen/ Ensure fair and transparent hiring procedures
Activity 2.6: Publish the results in the form of national report to ensure national ownership and reliability	Publications	National and state level awareness	Published material (articles, brochures, pamphlets, reports)	Target readers may not be focused / publish the awareness contents based on the identification of different target reader

				groups (public, media, technical, policy etc)
Output 3: The national FREL is defined and developed for Sudan				
Activity 3.1: Develop sub-national FREL for each state (or cluster of states) based on data inputs from historical analysis of AD produced at state level (i.e. Activity 2.1 & 2.2) and Emission Factors (EFs) developed through NFI	AD and EFs are available for all forest types/ classes of respective states/ regions	Sub-national FRELs for states (or cluster of states)	Land use change matrices for states, forest inventory reports, sub-national FREL reports	Delays in timely completion of mapping activities due to late submission of reports by NFI and LMS units /efficient coordination among various SNFMS units
Activity 3.2: Integrate sub-national FRELs to develop National FREL for Sudan	AD and EFs are available for national forest types/ classes	National FREL for Sudan	National FREL Report, National Land Use Change Matrix, NFI reports	Difficulties in application of statistical procedures for integration and data proppagation/ get expertise of FREL specialist / statistical analyst
Activity 3.3: Conduct detailed study on national circumstances to identify the future development indicators due to government's planned policies which are likely to impact (directly/ indirectly) deforestation/ forest degradation. The study will help to assess the needs for FREL adjustment	Study conducted	Justification for the adjustment needs of national FREL	Report on national circumstances for FREL adjustment needs with recommendations	Socio-economic indicators, likely to impact deforestation (due to governments future policies and measures), linked to FREL adjustment needs may change due to transitioning political interests/ make realistic assumptions based more on historical trends
Output 4: Technical Capacities for LMS at Federal and State Level are enhanced/ reinforced				
Activity 4.1: Organise high level meetings to define and develop Working Relationships among RSSA, FNC, MoA and HCENR for effective	No of consultative meetings ToRs with clarification of working mandates are available	Well-coordinated LMS working team	ToR document Proceedings of consultative meetings Notifications of technical coordinators	Availability of technical expertise in FNC, HCENR and MoA/ identify, train and retain the technical expertise Ambiguity about the mandate and administrative control

coordination of LMS activities	MoUs signed Technical coordinators notified from respective institutions		MoUs are available	of LMS activities between RSSA and FNC/ Conduct joint meetings and develop clarities prior to any decision
Activity 4.2: Allocate space and establish national LMS laboratory	Joint meetings between FNC & RSSA for allocation of space and clarity on mandates and administrative controls LMS Laboratory is operational	Well-functioning national LMS laboratory	Pictures, proceedings of meetings, government notes	Ambiguity regarding office space RSSA and FNC /Agreements with RSSA and FNC regarding office space and staff
Activity 4.3: Purchase of office supplies and equipment for national LMS laboratory	Equipment is available in LMS laboratory	Well-equipped LMS laboratory	Pictures, invoices etc	Slow and lengthy procedures/ Involve FAO in establishment of the LMS laboratory
Activity 4.4: Allocate space and establish small GIS units/ Cells in each state (or sectoral/ regional technical sections)	Consultative meetings with state forest departments GIS units are operational in states	18 small GIS units in states are operational	Proceedings of meetings,; pictures of the labs	Weak coordination between federal and state institutions may result in delays/Process of regular and proactive consultation among state institutions will be adopted.
Activity 4.5: Purchase of office supplies and equipment for state level GIS units/ cells (or sectoral/ regional technical sections)	Equipment is available in GIS units	Fully equipped GIS units	Purchase vouchers; equipment available in the laboratories	Slow and lengthy procedures/ Involve FAO in establishment of the GIS units
Activity 4.6: Hire technical staff (GIS experts) for state level GIS units/ cells (or sectoral/ regional technical sections)	GIS experts are available	Strengthen state level GIS laboratories	Contractual agreements	Personal relations/ interests might jeopardise the hiring of technical skills/ Ensure transparency in hiring process which should purely be based on merit

Output 5: LMS data is centralised, archived and sustainably managed				
Activity 5.1: Define and develop coordination mechanism and facilitate data sharing agreements with clear roles and responsibilities for timely and effective flow of information from state to federal level institution.	Timely flow of information from state to federal institutions through effective coordination	Well-coordinated data sharing mechanism among state and federal institutions	Consultative meetings, government request letters to relevant institutions for data sharing, data sharing agreements, etc	Lack of involvement of state institutions in the planning process/ efficient coordination and participation of state institutions in the planning process
Activity 5.2: Develop robust data base management system to centrally archive the information on LMS	Database is available	Robust Database management system	Invoices, pictures ; Signed data sharing agreements; Availability of data	Difficulties in collecting the data, poor or weak coordination and cooperation with partners/negotiations of fair data sharing agreements
Output 6: Training facilities are well established and technical Human capacities (skills/ knowledge/ expertise) relevant to LMS are enhanced and available at both federal and state level				
Activity 6.1: Identify and notify the national training institution for LMS related trainings	WG meeting conducted to identify the training institution	Agreement on the place/ institution to establish national LMS training unit/ cell	Proceedings of the meeting	Ambiguity regarding office space between FNC, UoK and RSSA/Agreement with FNC, UoK and RSSA regarding office space and staff
Activity 6.2: Establish national LMS training unit/ cell	LMS Training unit/ cell is functional	Equip LMS training unit/ cell	Pictures, government notes	Slow and lengthy procedures/ Involve RSSA and UoK in establishment of the LMS lab
Activity 6.3: Purchase modern training Equipment to strengthen national LMS training Unit/ Cell	Training equipment is available	Strengthening of National LMS unit/ cell	Fully equipped training cell/ unit, pictures, invoices etc	Slow and lengthy procedures/ Involve FAO
Activity 6.4: Train technical staff by provision of relevant trainings on (i) UNFCCC's requirements for reporting on land use changes (ii) basic RS/GIS techniques (iii) satellite image corrections,	Number of trainings conducted	7 national trainings	List of participants, attendance sheets	Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants Trainers of LMS not available in Sudan /International experts

enhancement and interpretation (iv) open source software (e.g. Collect Earth, Open Foris, QGiS etc) to assess land use and forest cover changes (v) land cover classification and forest stratification (vi) monitoring afforestation, deforestation and forest degradation using RS techniques (vii) statistical methods/ tools to assess uncertainties related to generation of AD and (viii) IPCC reporting requirements relevant to AD.				will have to be requested

Results chain	Performance indicators		Means of verification	Risks/Mitigations measures
	Indicators	Target		
Component 2: National Forest Inventory				
Global objective: To assess forest resources and carbon stocks in the different forest types of Sudan				
Intermediate outcome 1: Forest resources and carbon stocks of the different forest types are measured				
Output 1: The National Forest Inventory Data is available and accessible				
Activity 1.1: Stratify the national level forests based on updated national forest classification system and determine the number and distribution of field plots	NFI data is representative of all forest classes/ types with national forest coverage	National forest stratification, harmonised with IPCC guidance on land representation, The number of NFI field plots determined and distributed over nationally harmonised forest strata	National forest stratification scheme, updated NFI manual, field plots distribution map	Ambiguity among federal and state forest departments about distribution of field plots /Develop consensus on the distribution of field plots based on scientific justifications

Activity 1.2: Organise a technical working group meeting and review and update the forest inventory forms to include the information on NTFPs, and soil carbon data in different forest types	Updated inventory work sheets/ forms are available	Update inventory forms to include the information on NTFPs, species list (to be based on density estimates) and soil carbon data	Field data sheets/ survey forms	Information/ knowledge on soil data collection methods/ ensure effective coordination with MoA and relevant soil department to ensure the right information is incorporated in the field forms
Activity 1.3: Extend, plan and carry out national level forest inventory in all the states covering all forest strata and types following the methodological approach in national NFI manual	Field data available	NFI data collected from all forest strata/ forest types	field pictures, field data sheets Data base	Accuracy issues in operational planning, Inaccessibility of remote field sites, hostile situation of some areas/ verification by field experts. involve local people
Activity 1.4: Analyze and verify data, estimate the variability within forest strata and compile forest carbon data according to forest types	NFI report is available	NFI report	Report	Delays due to late submission of comments by the verifying authorities/ Ensure timely initiation of the process. Regular follow up with the reviewing authorities
Activity 1.5: Carryout Socio-economic surveys as a parallel activity with National Forest Inventory to collect detailed information on socio-economic dependencies on forests	Socio-economic surveys conducted	Collect data on socio-economic dependencies	Survey sheets/ questionnaires, pictures from the field, survey reports	Inaccessibility of remote field sites, hostile situation of some areas/ involve local people
Activity 1.6: Conduct research study to develop allometric equations for all the forest tree species covering all forest types in the country	Research study conducted Allometric equations are available for all forest tree species	Country specific biomass equations for forest tree species	Research studies, pictures from the field etc	Sampling error may be significant when selecting trees or shrubs for harvest to develop allometric models/ increase sample size to avoid sampling errors
Activity 1.7: Conduct research study to assess annual	Research study conducted	Country specific removal factors for	Research studies, pictures	Lengthy process/ involve FAO for technical guidance

growth rates for different tree species in different forest types, annual harvest (legal and illegal impacts), and annual disturbance rate (may include fires etc) to develop removal factors for different forest types.	Country specific removal factors are available for different forest types	different forest types of Sudan	from the field etc	
Output 2: Technical capabilities related to NFI are improved and well established at federal and state level				
Activity 2.1: Establish and equip a separate NFI unit on regular basis at FNC	NFI unit is functional on regular basis with clear mandates and lines of communication	Dedicated NFI unit on regular basis	ToRs, technical proposal for establishment of NFI unit on regular basis	Lack of political will and allocation of regular budget/ Process of regular and proactive consultation between FNC and political leadership
Activity 2.2: Allocate space and establish central and field NFI laboratories at federal and state level	Joint meetings between FNC & state FDs for allocation of space and clarity on mandates and administrative controls National and state level NFI Laboratories are operational	Well-functioning national and state level NFI laboratory	Pictures, proceedings of meetings, government notes	Ambiguity regarding mandates and Financial allocations between FNC and state forest departments /Agreement between FNC and state FDs regarding mandates and financial allocations
Activity 2.3: Equip the federal and state forest departments with adequate number of modern NFI tools (i.e. computers, digital callipers, laser vertex etc)	Modern NFI tools and equipment are available	Well-equipped NFI laboratories at federal and state level	Equipment pictures, purchase invoices etc	Slow and lengthy procedures/ Involve FAO
Activity 2.4: Purchase Vehicles for NFI field activities	Vehicles are available	Facilitate field inventory	Purchase invoice, pictures of vehicles, vehicle allotment notices	Vehicles may not be used for NFI/ ensure the permanent allotment retention of vehicles for NFI purposes only

Activity 2.5: Purchase field tents, first boxes, equipment storage boxes, field kits (shoes, jackets rain coats etc) for field staff	NFI field logistic support i.e. field tents, first boxes, equipment storage boxes, field kits (shoes, jackets rain coats etc) is available	Facilitate field inventory teams	Purchase invoice, pictures, distribution notes etc	Mishandling/ ensure proper storage and maintenance
Activity 2.6: Procure/ purchase modern licenced statistical software tools (PSS, R etc) for data analysis	Statistical software tools available	Improve technical skills on data analysis	Software tools installed, purchase invoices,	Lack of understanding to use software tools/ involve UoK/ UoS to provide initial trainings
Activity 2.7: Centralise and archive the existing data by designing a comprehensive data base management system	Database is available	Robust NFI Database management system	Invoices, pictures ; Signed data sharing agreements; Availability of data	Difficulties in collecting the data, poor or weak coordination and cooperation with partners/negotiations of fair data sharing agreements
Output 3: Human capacity to analyse and process the information related to NFI is improved and available both at national and state level				
Activity 3.1: Identify team leaders and trainers from provincial forest departments and other related departments and train them on NFI methodology guided by National NFI manual.	No. of trainings conducted No. of persons trained	5 sectoral trainings to enhance/ improve skills and knowledge on NFI	Pictures, training proceedings, participants lists, attendance sheets	Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants
Activity 3.2: Train technical staff/ trainers on the measurement of forest carbon stocks by delivering the trainings on (i) forest inventories (inventory design and field sampling techniques for forest carbon inventory, plot design, configuration and data collection from carbon pools, use of latest equipment	No. of trainings conducted No. of persons trained	5 sectoral trainings to enhance/ improve skills and knowledge	Pictures, training proceedings, participants lists, attendance sheets	Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants

i.e. vertex, densitometer, high accuracy handled GPS), (ii) IPCC Good Practice Guidance for the measurement of forest carbon stocks, (iii) descriptive statistics, (iv) development of allometric equations, (v) processing and analysis of inventory data (including the use of open source software)				
Output 4: NFI training facilities are well established at federal and state level				
Activity 4.1: Establish and Strengthen national NFI training Unit on regular basis	Joint meetings with finance department Technical proposal for establishment of central NFI training unit Training unit is functional	Provision of regular training facilities at national level	Allocation of space of training unit, pictures, equipment purchase invoices etc	Maintenance issues/ ensure proper maintenance checks
Activity 4.2: Provision of regular budget for staff trainings on annual basis	Joint meetings with finance department Technical proposal for allocation of regular training budget for federal and state forest departments Budget for staff training is available	Allocation of regular budget for staff trainings	Annual budget plans	Training budget might be misused/ develop criteria for proper utilization of training budget
Activity 4.3: Strengthen the central, sectoral technical sections and state forest departments with	Training equipment are available	Well-equipped training facilities at sectoral technical sections and state forest departments	Equipment pictures, purchase invoices etc	Slow and lengthy procedures/ involve FAO

provision of necessary training equipment (multimedia projectors, projection screens, lap tops, furniture etc)		24 multimedia projectors, 24 projection screens, 24 lap tops, 24 sets of furniture etc)		
Activity 4.4: Organise regular (six months basis) trainings for field staff on NFI	Number of trainings conducted Number of field staff trained	Well trained up to date NFI field staff	List of participants, training proceedings, attendance sheets, pictures etc	Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants
Output 5: Quality control/ quality assurance procedures are developed and implemented at federal, regional and state level				
Activity 5.1: Identify all potential data partners (governmental, NGOs, universities, etc.)	List of information needs and instituions available	The information needs and relevant institutions with requisite information are identified	List of information needs	Lack of understanding and over estimation of needs/ Cross checking and triangulation
Activity 5.2: Facilitate the sending of a letter [from the Minister] to all data partners regarding data sharing agreements/ followed by joint meetings	Letter sent to all data partners	Data sharing agreements	Proceedings of meetings, Data sharing agreements	Difficulties in collecting the data, poor or weak coordination and cooperation with partners/negotiations of fair data sharing agreements
Activity 5.3: Identify the 3rd party review institution(s) and establish a technical scientific committee for review and internal validation of inventory results/ reports.	3rd party reviews are available Technical scientific committee is functional	Institutionalization of quality control process	Proceedings of joint meetings, Review reports, government notification of scientific committee, ToRs	Develop criteria and get approval from relevant stakeholders for selection of 3rd party review institution and nomination of members of scientific committee to avoid conflict of interest
Activity 5.4: Establish and carry out quality control and harmonization of data	QA-QC Protocols defined and implemented	Regular implementation of QA-QC protocols	QA-QC protocols; QA reports by third party;	Hiring of a third party may not happen/Ensure fair and transparent hiring procedures

Results chain	Performance indicators	

	Indicators	Target	Means of verification	Risks/Mitigations measures
Component 3: Green House Gas Inventory				
Global objective: To measure GHG emissions and removal for the LULUCF sector				
Intermediate outcome 1: GHG emissions and removals of the LULUCF sector are assessed				
Output 1: Country specific GHG inventory data of AFOLU sector is available to update the GHG chapter information in Sudan's NC document				
Activity 1.1: Conduct a research study on national livestock population count for each livestock group, type and amount of feed consumed by livestock	Research study conducted Information/ data on national livestock population count and feeding statistics available	Country specific information on livestock count and amount of feed consumed	ToR of research study, pictures from the field etc, published results/ report	Lengthy process/ involve FAO, MoA and Directorate of Pasture and Range Management
Activity 1.2: Develop emission factor for enteric fermentation	Emission factors for enteric fermentation are available	Country specific emission factors for enteric fermentation	Analysis results, updated tables in GHG chapter information in Sudan's NC	Local expertise might not understand the statistical procedures and use of IPCC guidance to develop emission factors/ Seek technical guidance from FAO
Activity 1.3: Conduct a research study on the extent, application and management of manure on crop lands. The expected results of the study will give country specific emission factors of manure application on crop lands.	Research study conducted Country specific Emission Factors are available	Country specific emission factors for manure application	Research studies, pictures from the field etc, published results/ report	Lengthy process/ involve FAO, MoA and Directorate of Pasture and Range Management
Activity 1.4: Develop country specific Emission Factors for rice cultivated areas, biomass burning and urea application on crop lands	Country specific Emission Factors are available	Country specific emission factors for rice cultivation, biomass burning and urea application	Analysis results, updated tables in GHG chapter information in Sudan's NC	Local expertise might not understand the statistical procedures and use of IPCC guidance to develop emission factors/ Seek technical guidance from FAO
Activity 1.5: Conduct a national level comparative research study on soil disturbances in forest lands, crop lands and grass lands	Country specific Soil Emission	Country specific soil emission factors for forest land,	Analysis results, updated tables in GHG chapter	Local expertise might not understand the statistical procedures and use of IPCC guidance to develop

and its impact on soil carbon. The expected results of the study will give country specific soil emission factors for the three land use categories (i.e. Forest land, Crop Land and Grassland).	Factors and available	crop lands, and grass lands	information in Sudan's NC	emission factors/ Seek technical guidance from FAO
Activity 1.6: Generate Activity Data (AD) for savannah burning areas, biomass burning on crop lands and rice cultivated areas,	AD for emissions from biomass burning is available	Develop AD for emissions from biomass burning	Produced maps and change matrix	-
Activity 1.7: Update national GHG inventory of AFOLU sector based on country specific data that will be generated through implementation of aforementioned activities as well as activities in LMS and NFI sections	GHG inventory information is updated in relevant tables	Ensure the use of Tier 2 level information in national GHG inventory	Updated GHG chapter information for AFOLU sector in Sudan's NC	-
Output 2: Technical capacities on National GHG inventory of AFOLU sector established, strengthened and improved at federal and state level				
See implementation framework for LMS, NFI and Monitoring Function				
Output 3: Human Capacities on National GHG inventory preparations and reporting are enhanced				
Activity 3.1: Recruit technical GHG inventory and reporting experts (forest and agriculture) for AFOLU sectors at HNCER	Forests and Agriculture experts are available	Strengthen the GHG inventory unit of HCENR	Contractual agreements	Personal relations/ interests might jeopardise the hiring of technical skills/ Ensure transparency in hiring process which should purely be based on merit
Activity 3.2: Identify trainers at federal and state level and conduct TOT workshops on the following required knowledge and skills: • **GHG-I of AFOLU Sector using Tier 2 & 3 methodological approach** • **Development of emission Factors for enteric fermentation, application of manures and savannah burning** • **Technical report writing skills**	Number of trainings conducted Number of master trainers trained	05 ToTs to ensure local availability of master trainers/ technical expertise	List of participants, training proceedings, attendance sheets, pictures etc	Inappropriate nominations/ develop clear TOR's and requirements for the nomination of suitable participants

• **IPCC reporting requirements for Forest, Grass and Cropland Category** • **Development of emission Factors for rice cultivated areas, biomass burning on crop lands, urea application and soil disturbances relevant to croplands**				
Output 4: Training facilities for national GHG inventory of AFOLU sector established and strengthened				
See Implementation framework of LMS, NFI and Monitoring function				

Results chain	Performance indicators		Means of verification	Risks/Mitigations measures
	Indicators	Target		
Component 4: Monitoring Function				
Global objective: To assess the results of REDD+ policies and measures				
Intermediate outcome 1: Results of REDD+ policies and measures are assessed				
Output 1: National Forest Monitoring Indicators and tools to monitor forest related policies and measures are available				
Activity 1.1: Review and update a national REDD+ strategy to define and include actions and monitoring indicators (to monitor the actions) against REDD+ strategic options	List of monitoring indictors is available	The Indicators are identified and described	List of indicators validated and published in updated REDD+ strategy document	Limited knowledge and understanding of indicators/ organize lecture and presentations, develop guidelines on monitoring indicators
Activity 1.2: Organise a national workshop to prioritise strategic options and actions, finalise forest monitoring indicators and tools	Workshop organised Monitoring indicators and tools are prioritized	Prioritization of actions, monitoring indicators and monitoring tools	Workshop proceedings, list of participants, attendance sheets	Nomination of irrelevant and non technical persons / Develop proper guidelines regarding nomination of suitable candidates
Activity 1.3: Develop Policy Guidance on standard methods/ protocols to report on wildlife and AFOLU	Consultative meetings organised	Policy guidance to monitor wildlife and GHG of AFOLU	Proceedings of the meetings, Technical manual on policy guidance for	Lack of coordination among provincial and federal level organizations/ regular coordination

sector GHG monitoring indicators	Technical manual on policy guidance for monitoring of forests is available		monitoring of forests of Sudan	meetings and sessions
Activity 1.4: Review and update the MRV document to include the nationally agreed forest related monitoring indicators and tools	Updated MRV document available	Availability of standardised forest monitoring indicators and tools	Updated MRV document	-
Output 2: Provincial REDD+ action plans and state level forest management plans for all forest types are developed and available for regular forest monitoring				
Activity 2.1: Develop provincial (individual states or cluster of states) REDD+ Action Plans guided by national REDD+ strategy	Action plans available	State level REDD+ Action Plans developed	Action Plans	Limited in-country expertise/ FAO will be requested for the services of an international consultant
Activity 2.2: Review and improve the existing forest management plans for riverine and planation forests to align them with national and relevant sub-national REDD+ strategic objectives and actions	Revised management plans available	Improve and update management plans for reverine and plantation forests	Updated management plans	The state forest departments may take time to become used to the new system/suitable capacity building plan will be developed
Activity 2.3: Develop forest management plans for natural forests guided by national REDD+ strategy and relevant provincial REDD+ action plan	Management plans available	Natural forests are management under proper guiding management plans	Management Plans	Same as above
Output 3: The Technical capabilities of relevant federal and state level institutions for monitoring (Sattelite based) of government's land use/ forest related policies and measures are enhanced and operational				
Activity 3.1: Develop inter-institutional / departmental coordination and communication mechanism among HCENR, RSSA, FNC, MoA, General Directorate of Pasture	Regular coordination meetings Joint monitoring activities	Well-coordinated communication mechanism for joint forest monitoring	Proceedings of meetings, communication strategy document	Delays in data sharing between technical units and administrative levels /Regular coordination meetings and

and Range Management and Academia (UoK and UoS) for information sharing on monitoring of AFOLU sector policies and measures				appropriate communication
Activity 3.2: Develop Land Use Web Portal (maintained by RSSA and supported and coordinated by AFOLU sector institutions) to ensure regular monitoring of land use changes and accessibility of information	Lan use web portal is online	Develop the national land use web portal; Launch, maintain and update the web portal	Web portal is functioning and regularly updated	Staff turnover and transfers/ Full time staff will be hired
Activity 3.3: Develop SNFMS/ forest web portal (maintained by FNC and supported/ coordinated by RSSA) to ensure regular monitoring of forest changes due to government policies and measures	SNFMS/ Forest Web portal is online	Develop the national forest web portal; Launch, maintain and update the web portal	Web portal is functioning and regularly updated	Staff turnover and transfers/ Full time staff will be hired
Activity 3.4: Procure/ purchase monitoring (fire and wildlife) equipment for Agriculture and wildlife department	Wildlife and fire monitoring equipment is available	Regular monitoring of fire events and wildlife	Purchase invoice, pictures etc	Limited capacity and expertise of staff/ Develop capacity building plan and organize regular trainings

Results chain	Performance indicators		Means of verification	Risks/Mitigations measures
	Indicators	**Target**		
Component 5: Institutional Arrangements				
Global objective: To make Sudan REDD+ Ready through robust institutional arrangements for SNFMS				
Intermediate outcome 1: Results of REDD+ policies and measures are assessed				
Output 1: Sustainable and participatory network of institutions with necessary range of expertise and clearly documented roles and responsibilities are established for SNFMS				
Activity 1.1: Create consensus/ agreements on the identified and proposed	National workshop conducted	Finalise institutional arrangements for SNFMS	Government Notes, Validation Statement	The higher authorities of relevant institutions might not participate in validation workshop that might result in

institutional arrangements	Letters of agreement from proposed institutions			conflicts at later stage due to lack of technical understanding of role of relevant institution/ Coordinator well in time with the higher authorities to ensure their participation in the validation workshop
Activity 1.2: Identify joint working relationships and develop joint working teams pertaining to different technical components of SNFMS functions i.e. monitoring and MRV (LMS, NFI, GHG-I)	ToR available Working teams notified	Establish well-coordinated technical working relationships for implementation of Monitoring and MRV functions of SNFMS	Notification of working teams	Non-technical personnel might be included in working teams, In-effective communication/ Develop selection criteria for members of working team, ensure time frame for regular meetings of working teams
Activity 1.3: Develop clear and detailed ToR on the relevant roles and responsibilities (with necessary definitions of SNFMS coordination, communication, LMS, NFI, GHG-I as well as quality assurance and quality control) of relevant proposed institutions/ organizations/ departments	Mandates, lines of communication and QC protocols are defined for each relevant institution	Identification of institutional roles and responsibilities for implementation and operationalization of SNFMS	ToRs/ MoUs	Conflict might arise among institutions to take non-relevant roles/ responsibilities to tap maximum funds/ Involve FAO to seek technical guidance on allocation of relevant roles and responsibilities based on institutional capacities.
Activity 1.4: Enact legally-binding institutional arrangements for the implementation and operation of SNFMS	National REDD+ strategy updated and validated	To legally embed the operationalization of SNFMS with in the national permanent institutional structure	Proposal for the allocation of regular institutional budgets, Government Notes/Legal Notification	The capacity to develop Proposal for regular budget allocations may not be available/ Involve FAO for technical guidance on writing such technical proposals
Activity 1.5: Undertake consultations on the design and type of REDD+ demonstration activities that will be implemented as a testing ground for	Consultative meetings organised	Identification of REDD+ Pilot Sites and Activities	Proceedings of the meetings, List of Participants, List of Pilot Sites/ Activities available	Conflict among different states for selection of demonstration sites/ Parallel technical awareness sessions on criteria for selection of pilot sites/ activities

the implementation of the SNFMS				
Output 2: SNFMS funding arrangements are assesses and clarified				
Activity 2.1: Carry out a detailed assessment of the funding needed to ensure the long-term sustainability of an SNFMS.	Inventory of available needed funds available	financial gap analysis of SNFMS implementation	Report	Coordination among different departments involved; Lack of understanding and interest of high level authorities; challenges in collecting the information regarding funding opportunities/ Constitute a special task force with representatives from all relevant departments to urgently deal with this matter. Also involve relevant NGOs.
Activity 2.2: Assess domestic financing needs and timeline and modalities for delivery of these funds	The resource mobilization strategy is available	A detailed strategy with clear needs and timelines	Report	Government may not understand the importance of the SNFMS and may not allocate sufficient funds for the implementation of SNFMS/ An awareness raising campaign specifically designed for Gov. representatives to explain the importance and utility of the SNFMS and the potential benefits of the REDD+ mechanism
Activity 2.3: Assess the levels, sources and work areas of initial donor funding and the process required to transition to a sustainable self-financing arrangement	List of prioritized working areas/ activities (short term and long term) List of potential short term and long term donors (government, private sector, INGOs) available	Ensure funding arrangements and process for smooth transition to sustainable self-financing	Report	Establish a taskforce to initiate dialogue with potential government and international donors
Activity 2.4: Develop a timeline of funding allocations and implementation	A funding allocation mechanism is available	Proposal for Funding allocation mechanism	Proposal for Funding allocation	Conflicts between institutions or administrative levels; lack of clarity regarding REDD+ funding

			mechanism available	mechanism/ Arrange presentations for higher management to develop clarity about REDD+ funding mechanism
Activity 2.5: Implement a national validation workshop of SNFMS funding allocations and the implementation process	Workshop conducted	Create national consensus on SNFMS funding allocations	List of participants, workshop proceedings	The higher authorities of relevant institutions might not participate in validation workshop that might result in conflicts at later stage due to lack of technical understanding/ Coordinator well in time with the higher authorities to ensure their participation in the validation workshop
Activity 2.6: Formally adopt the mechanism for allocating funds and the process of implementation (legal enactment where possible)	The financial arrangements are enacted	The financial arrangements are enacted	Legal notification	Slow procedures, Lack of interest of high level authorities, Conflicts between national and provincial levels/ hold special meetings to speed up the process. Organize regular coordination meetings between relevant state and federal level institutions.

Annex – IX
Budget and Work Plan

Outputs and activities		Year	1		2		3	
		Semester	**1**	**2**	**1**	**2**	**1**	**2**
		budget (k$)						
	COMPONENT 1: LAND MONITORING SYSTEM (LMS)							

Output 1 : The national level LMS data is available and accessible for generation of Activity Data (AD)		**312.5**		**312.5**		**0.0**		**0.0**
1.1	Organise a national validation workshop to formally endorse national forest definition	3.5		3.5				
1.2	Notify and legally adopt the national forest definition	0		0.0				
1.3	Organise a technical Working Group meeting to review the National Land Use and Forest Classification System consistent with IPCC guidance on Land Representation	1.5		1.5				
1.4	Update and notify the revised national forest/ land use classification system	0		0.0				
1.5	Organise consultative meetings in each state to categorize state level land use/ forest types based on national land use/ forest classification system	36		36				
1.6	Organise a technical working group meeting to assess and characterize existing satellite data for historical land use/ forest cover changes and future monitoring	1.5		1.5				
1.7	Purchase/ procure/ acquisition of required satellite imagery based on recommendations from Activity 1.5.	270			270			
Output 2: The LMS is operational and Functional		**92.5**		**64.5**		**2.5**		**25.5**
2.1	Develop Land Use/ Land Use Change and forest cover/ forest cover change Maps for all the states based on national forest definition and national land use/ forest classification system	18			18			
2.2	Historical analysis of State level Land Use and Forest Cover Changes	10			10			
2.3	Integrate sub-national AD to generate national level AD for Land / Forest Cover Changes	5			5			
2.4	National Agreement and Validation of Reference Year for National FREL based on historical analysis i.e. activity 2.2 & 2.3 (National Workshop)	3.5			3.5			
2.5	Set up Quality Control/ Quality Assurance procedures (quality management plan, quality assurance by third party, quality control) for review and validation of LMS results	46			23			23
2.6	Publish the results in the form of national report to ensure national ownership and reliability	10			5		2.5		2.5
Output 3: The national FREL is defined and developed for Sudan		**85**		**50**		**0.0**		**35**
3.1	Develop sub-national FREL for each state (or cluster of states) based on data inputs from historical analysis of AD produced at state level (i.e. Activity 2.2) and Emission Factors (EFs) developed through NFI	40			20			20
3.2	Integrate sub-national FRELs to develop National FREL for Sudan	30			15			**15**
3.3	Conduct detailed study on national circumstances to identify the future development indicators due to government's planned policies which are likely to impact (directly/ indirectly) deforestation/ forest degradation. The study will help to assess the needs for FREL adjustment	15			15			
Output 4: Technical Capacities for LMS at Federal and State Level are enhanced/ reinforced		**672.7**		**139.9**		**446.4**		**86.4**

No.	Activity	Total						
4.1	Organise high level meetings to define and develop Working Relationships among RSSA, FNC, MoA and HCENR for effective coordination of LMS activities	3.5	3.5					
4.2	Allocate space and establish national LMS laboratory (renovation)	10		10				
4.3	Purchase of office supplies and equipment for national LMS laboratory	40		40				
4.4	Allocate space and establish small GIS units/ Cells in each state (renovation)	90			90			
4.5	Purchase of office supplies and equipment for state level GIS units/ cells (or sectoral/ regional technical sections)	270			270			
4.6	Hiring of GIS Experts for GIS units/ cells in each state	259.2	43.2	43.2	43.2	43.2	43.2	43.2
Output 5: LMS data is centralized, archived and sustainably managed		**46**	**36**		**10**		**0.00**	
5.1	Organise state level consultative meetings to define and develop coordination mechanism and facilitate data sharing agreements with clear roles and responsibilities for timely and effective flow of information from state to federal level institution.	36	36					
5.2	Develop robust data base management system to centrally archive the information on LMS	10			10			
Output 6: Training facilities are well established and technical Human capacities (skills/ knowledge/ expertise) relevant to LMS are enhanced and available at both federal and state level		**69**	**36**		**19**		**14**	
6.1	Identify and notify the national training institution for LMS related trainings	0.0						
6.2	Establish national LMS training unit/ cell (renovation)	5.0			5.0			
6.3	Purchase modern training Equipment to strengthen national LMS training Unit/ Cell	15		15				
6.4	Train technical staff by provision of relevant trainings on (i) UNFCCC's requirements for reporting on land use changes (ii) basic RS/GIS techniques (iii) satellite image corrections, enhancement and interpretation (iv) open source software (e.g. Collect Earth, Open Foris, QGiS etc) to assess land use and forest cover changes (v) land cover classification and forest stratification (vi) monitoring afforestation, deforestation and forest degradation using RS techniques (vii) statistical methods/ tools to assess uncertainties related to generation of AD and (viii) IPCC reporting requirements relevant to AD. (total 7 trainings)	49		21		14		14
Sub-Total for LMS Component		**1277.7**	**638.9**		**477.9**		**160.9**	
	COMPONENT 2: NATIONAL FOREST INVENTORY							
Output 1 : The National Forest Inventory Data is available and accessible		**606.5**	**1.5**		**340**		**265**	
1.1	Stratify the national level forests based on updated national forest classification system and determine the number and distribution of field plots	0.0		0.0				

1.2	Organise a technical working group meeting and review and update the forest inventory forms to include the information on NTFPs, and soil carbon data in different forest types	1.5	1.5				
1.3	Extend, plan and carry out national level forest inventory in all the states covering all forest strata and types following the methodological approach in national NFI manual (USD 200/ plot x estimated 1000 plots)	200				100	100
1.4	Analyze and verify data, estimate the variability within forest strata and compile forest carbon data according to forest types	25					25
1.5	Carryout Socio-economic surveys as a parallel activity with National Forest Inventory to collect detailed information on socio-economic dependencies on forests	40				20	20
1.6	Conduct research study to develop allometric equations for all the forest tree species covering all forest types in the country	240		120	120		
1.7	Conduct research study to assess annual growth rates for different tree species in different forest types, annual harvest (legal and illegal impacts), and annual disturbance rate (may include fires etc) to develop removal factors for different forest types.	100		100			
Output 2 : Technical capabilities related to NFI are improved and well established at federal and state level		**725**	**308**	**417**		**0.0**	
2.1	Establish a separate NFI unit on regular basis at FNC	0.0	0.0				
2.2	Allocate space and establish central and field NFI laboratories at federal and state level (renovation)	100	100				
2.3	Equip the federal and state forest departments with adequate number of modern NFI tools (i.e. computers, digital callipers, laser vertex etc)	200		20 0			
2.4	Purchase Vehicles (18 for states + one for FNC) for NFI field activities	380		38 0			
2.5	Purchase field tents, first boxes, equipment storage boxes, field kits (shoes, jackets rain coats etc) for field staff	27		27			
2.6	Procure/ purchase modern licensed statistical software tools (PSS, R etc) for data analysis	8	8				
2.7	Centralize and archive the existing data by designing a comprehensive data base management system	10			10		
Output 3 : Human capacity to analyse and process the information related to NFI is improved and available both at national and state level		**45**	**24**	**21**		**0.0**	
3.1	Identify team leaders and trainers from provincial forest departments and other related departments and train them on NFI methodology guided by National NFI manual. (ToT)	10		10			
3.2	Train technical staff/ trainers on the measurement of forest carbon stocks by delivering the trainings on (i) forest inventories (inventory design and field sampling techniques for forest carbon inventory, plot design, configuration and data collection from carbon pools, use of latest equipment i.e. vertex, densitometer, high accuracy handled GPS), (ii)	35		14	14	7	

	IPCC Good Practice Guidance for the measurement of forest carbon stocks, (iii) descriptive statistics, (iv) development of allometric equations, (v) processing and analysis of inventory data (including the use of open source software) (total 5 trainings)							
Output 4 : NFI training facilities are well established at federal and state level		**173**		**129**		**22**		**22**
4.1	Establish and Strengthen national NFI training Unit on regular basis (renovation)	7		7				
4.2	Provision of regular budget for staff trainings on annual basis (first three years from SNFMS AP)	45			15		15	15
4.3	Strengthen the central, sectoral technical sections and state forest departments with provision of necessary training equipment (multimedia projectors, projection screens, lap tops, furniture etc)	100			100			
4.4	Organise regular (annual basis) trainings for field staff on NFI	21			7		7	7
Output 5 : Quality control/ quality assurance procedures are developed and implemented at federal, regional and state level		**90**		**40**		**25**		**25**
5.1	Identify all potential data partners (governmental, NGOs, universities, etc.)	0.0		0.0				
5.2	Facilitate the sending of a letter [from the Minister] to all data partners regarding data sharing agreements/ followed by joint meetings	0.0		0.0				
5.3	Identify the 3rd party review institution(s) and establish a technical scientific committee for review and internal validation of inventory results/ reports.	55			25		15	15
5.4	Establish and carry out quality control and harmonization of data	35			15		10	10
Sub-Total NFI Component		**1639.5**		**502.5**		**825**		**312**
	COMPONENT 3: GREEN HOUSE GAS INVENTORY							
Output 1 : Country specific GHG inventory data of AFOLU sector is available to update the GHG chapter information in Sudan's NC document		**130**		**105**		**10**		**15**
1.1	Conduct a research study on national livestock population count for each livestock group, type and amount of feed consumed by livestock	25		25				
1.2	Develop emission factor for enteric fermentation and manure management	5			5			
1.3	Conduct a research study on the extent, application and management of manure on crop lands. The expected results of the study will give country specific emission factors of manure application on crop lands.	30		30				
1.4	Develop country specific Emission Factors for rice cultivated areas, biomass burning and urea application on crop lands	5			5			
1.5	Conduct a national level comparative research study on soil disturbances in forest lands, crop lands and grass lands and its impact on soil carbon. The expected results of the study will give country specific soil emission factors for the three land use categories (i.e. Forest land, Crop Land and Grassland).	40		40				

1.6	Generate Activity Data (AD) for savannah burning areas, biomass burning on crop lands and rice cultivated areas,	10		10				
1.7	Update national GHG inventory of AFOLU sector based on country specific data that will be generated through implementation of aforementioned activities as well as activities in LMS and NFI sections	15					15	
Output 2: Technical capacities on National GHG inventory of AFOLU sector established, strengthened and improved at federal and state level								
	See budget section for Components of LMS, NFI and Monitoring							
Output 3: Human Capacities on National GHG inventory preparations and reporting are enhanced		**104**	**32**	**40**		**32**		
3.1	Recruit technical GHG inventory and reporting experts (forest and agriculture) for AFOLU sectors at HCENR (USD 1000/ month/ expert)	72	12	12	12	12	12	12
3.2	Identify trainers at federal and state level and conduct TOT workshops on (i) GHG-I of AFOLU Sector using Tier 2 & 3 methodological approach, (ii) Development of emission Factors for enteric fermentation, application of manures and savannah burning (iii) Technical report writing skills (iv) IPCC reporting requirements for Forest, Grass and Cropland Category and (v) Development of emission Factors for rice cultivated areas, biomass burning on crop lands, urea application and soil disturbances relevant to croplands (total 5 trainings)	32		8	8	8	8	
Output 4: Training facilities for national GHG inventory of AFOLU sector established and strengthened								
	See budget section for Components of LMS, NFI and Monitoring							
Sub-Total GHG-I Component		**234**	**137**	**50**		**47**		
	COMPONENT 4: MONITORING FUNCTION							
Output 1: National Forest Monitoring Indicators and tools to monitor forest related policies and measures are available		**68.5**	**28.5**	**40**		**0.0**		
1.1	Review and update a national REDD+ strategy to define and include actions and monitoring indicators (to monitor the actions) against REDD+ strategic options (hiring of consultant)	25	25					
1.2	Organise a national workshop to prioritise strategic options and actions, finalise forest monitoring indicators and tools	3.5		3.5				
1.3	Develop Policy Guidance on standard methods/ protocols to report on wildlife and AFOLU sector GHG monitoring indicators (hiring of consultant)	25			25			
1.4	Review and update the MRV document to include the nationally agreed forest related monitoring indicators and tools (hiring of consultant)	15				15		
Output 2: Provincial REDD+ action plans and state level forest management plans for all forest types are developed and available for regular forest monitoring		**153**	**26**	**127**		**0.0**		

2.1	Develop provincial (individual states or cluster of states) REDD+ Action Plans guided by national REDD+ strategy (hiring of consultant)	78		26	26	26		
2.2	Review and improve the existing forest management plans for riverine and planation forests to align them with national and relevant sub-national REDD+ strategic objectives and actions (hiring of consultant)	35			35			
2.3	Develop forest management plans for natural forests guided by national REDD+ strategy and relevant provincial REDD+ action plan (hiring of consultant)	40			40			
Output 3: The Technical capabilities of relevant federal and state level institutions for monitoring (Sattelite based) of government's land use/ forest related policies and measures are enhanced and operational		**155**	**115**		**20**		**20**	
3.1	Develop inter-institutional / departmental coordination and communication mechanism among HCENR, RSSA, FNC, MoA, General Directorate of Pasture and Range Management and Academia (UoK and UoS) for information sharing on monitoring of AFOLU sector policies and measures	15	15					
3.2	Develop and maintain Land Use Web Portal (maintained by RSSA and supported and coordinated by AFOLU sector institutions) to ensure regular monitoring of land use changes and accessibility of information	50		30		10		10
3.3	Develop SNFMS/ forest web portal (layout, functions, data etc, train operators, technical parameters, national workshop to present the web portal), maintained by FNC and supported/ coordinated by RSSA, to ensure regular monitoring of forest changes due to government policies and measures	50		30		10		10
3.4	Procure/ purchase monitoring (fire and wildlife) equipment for Agriculture and wildlife department	40		40				
Sub-Total Monitoring Function		**376.5**	**169.5**		**187**		**20**	
	COMPONENT 5: INSTITUTIONAL ARRANGEMENTS							
Output 1: Sustainable and participatory network of institutions with necessary range of expertise and clearly documented roles and responsibilities are established for SNFMS		**71**	**29.5**		**41.5**		**0.0**	
1.1	Organise a national workshop to formally agree/ endorse the proposed institutional arrangements	3.5	3.5					
1.2	Organise consultative meetings to identify joint working relationships and develop joint working teams pertaining to different technical components of SNFMS functions i.e. monitoring and MRV (LMS, NFI, GHG-I)	16	8	8				
1.3	Develop clear and detailed ToR on the relevant roles and responsibilities (with necessary definitions of SNFMS coordination, communication, LMS, NFI, GHG-I as well as quality assurance and quality control) of relevant proposed institutions/ organizations/ departments	10	5	5				

1.4	Enact legally-binding institutional arrangements for the implementation and operation of SNFMS	1.5			1.5				
1.5	Undertake federal and state level consultations on the design and type of REDD+ demonstration activities that will be implemented as a testing ground for the implementation of the SNFMS	40			40				
Output 2: SNFMS funding arrangements are assesses and clarified		**23**	**23**		**0.0**		**0.0**		
2.1	Carry out a detailed assessment of the funding needed to ensure the long-term sustainability of an SNFMS.	15	15						
2.2	Assess domestic financing needs and timeline and modalities for delivery of these funds								
2.3	Assess the levels, sources and work areas of initial donor funding and the process required to transition to a sustainable self-financing arrangement								
2.4	Develop a timeline of funding allocations and implementation								
2.5	Implement a national validation workshop of SNFMS funding allocations and the implementation process	8		8					
2.6	Formally adopt the mechanism for allocating funds and the process of implementation (legal enactment where possible)	0.0		0.0					
Sub-Total Institutional Arrangements		**94**		**52.5**		**41.5**		**0.0**	
Annual budget(k$)				**1500.4**		**1581.4**		**539.9**	
Total budget (k$)		**3,621.8**							

ACTION PLAN FOR THE IMPLEMENTATION OF THE SUDAN'S NATIONAL FOREST MONITORING SYSTEM (SNFMS)

FINAL SUBMISSION

With technical support of:

FAO Food and Agriculture Organization of the United Nations

With financial support of:

FOREST CARBON PARTNERSHIP FACILITY

WORLD BANK GROUP