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UN-REDD PROGRAMME

KENYA Forest Service

Roadmap for the establishment of Forest Reference levels and the National Forest Monitoring System

Roadmap for the establishment of Forest Reference levels and the National Forest Monitoring System

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The preparation of this Road Map has utilised the work that has been done previously in Kenya. In some cases the material in this document has been used directly as is, or edited to suit as required. This publication was written by the following authors: Mr Peter Moore (consultant) and Mr James Mwangi Kinyanjui (consultant). The authors would like to acknowledge the Government Officials of Kenya and especially Mr Alfred Gichu, REDD+ National Coordinator, as well as Mr Philippe Crête, Mr Remi D'Annunzio, Ms Nina Lande, Ms Mino Randrianarison and the UN-REDD team members for their comments and insights on the document.

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- Forest Preservation Project supported by the Government of Japan:
  - Main Report Volume 1,
  - Main Report Volume 2,
- Report on the Analysis of the Drivers of Deforestation for Kenya.

LIST OF ACRONYMS

ACS	African Conservation Centre
AEZ	Agro Ecological zones
AFOLU	Agriculture, Forestry and Other Land Use
AGB	Above-ground biomass
AG	Attorney General
ALU	Agriculture and Land Use
AWF	African Wildlife Foundation
BAU	Business-as-usual
BGB	Below-ground biomass
CCS	Climate Change Secretariat
CEOS	Committee on Eath Observation Satellites
CFA	Community Forest Association
CDTF	Community Development Trust Fund
CH4	Methane
CIFOR	Center for International Forestry Research
CO2	Carbon dioxide
CO2e	CO2-equivalent
CoP	Conference of the Parties to the UNFCCC
CRF	Common Reporting Format
CTF	Common Tabular Format
DBH	Diameter at breast height
DOM	Dead organic matter
DRSRS	Department of Resource Survey and Remote Sensing
EWG	Element Working Group
FAN	Forest Action Network
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
FIS	Forest Information System
FLINT	Full Integration Model of the SLEEK
FOMAWA	Friends of the Mau Watershed
FPP	Forest Preservation Programme
FRA	Forest Resource Assesment
FREL	Forest Reference Emission Level
GFOI	Global Forest Observation Initiative
GHG	Greenhouse gas
GIS	Geo Information Systems
GoK	Government of Kenya
GPG	Good Practice Guidance
GPS	Global Positioning System
GWP	Global Warming Potential
HWP	Harvested wood products
ICFRA	Improving Capacity for Forest Resource Assessment
IIN	Indigenous Information Network
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KEFRI	Kenya Forestry Research Institute
KEMFRI	Kenya Marine and Fisheries Research institute
KFS	Kenya Forest Service
KIFCON	Kenya Indigenous Forest Conservation
KNBS	Kenya National Bureau of Statistics
KNSDI	Kenya National Spatial Data Infrastructure
KWS	Kenya Wildlife Service
LAPSSET	Lamu Port South Sudan Ethiopia Terminal

LCCS	Land Cover Classification System
LULUCF	Land Use, Land Use Change and Forestry
M&E	Monitoring and Evaluation
MENR	Ministry of Environment and Natural Resources
MGD	Methods and Guidance Document of the GFOI
MMMB	Miti Mingi Maisha Bora
MODIS	Moderate Resolution Imaging Spectroradiometer
MoU	Memorandum of Understanding
MRV	Measurement, Reporting and Verification
N2O	Nitrous oxide
NACOFA	National Alliance of Community Forest Associations
NAMA	Nationally Acceptable Mitigation Action
NASA	National Aeronautics and Space Administration of the US
NCCRS	National Climate change Response Strategy
NEMA	National Environment Management Authority
NFI	National forest Inventory
NFMS	National forest Monitoring System
NGO	Non-governmental organization
NIR	National Inventory Report
NMK	National Museums of Kenya
NOx	Nitrogen oxides
NRCO	National REDD+ Coordination Office
NRM	Natural Resource Management, a project of KFS
PAMs	Plicies and Measures
PCM	Participatory carbon monitoring
PDF	Probability density function
PFM	Participatory forest monitoring
PMU	Project Management Unit
PSP	Permanent sample plot
QA	Quality Assurance
QC	Quality Control
RCMRD	Regional Center for Mapping of Resources for Development
REDD+	Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks
REL	Reference Emission Level
RL	Reference level
RPP	Readiness Preparation Proposal
SDMS	Space Data Management System
SESA	Strategic Environmental and Social Assesment
SLEEK	System for Land Based Emission Estimation in Kenya
SO2	Sulphur dioxide
SoC	Soil Organic Carbon
SoK	Survey of Kenya
SOM	Soil organic matter
TWG	Technical working Group
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UTM	Universal Transverse Mercator
WMO	World Meteorological Organization
WWF	World wildlife Fund

EXECUTIVE SUMMARY

The Government of Kenya is in the process of establishing a National REDD+ Programme through the Kenya Forest Service (KFS). Two critical elements of the National REDD+ Programme are forest reference levels (FRL) and a National Forest Monitoring System (NFMS). This document describes the steps towards establishing the design of the NFMS and reference levels, through an enumeration and description of required tasks.

The current document builds upon the first roadmap developed in 2012 bringing in updates and enhancing the tasks based on current needs and the United Nations Framework Convention on Climate Change (UNFCCC) guidance. This is the result of a series of Technical Working Group meetings involving active stakeholders from REDD+ implementation agencies from Government Ministries and Departments, Universities, Non-Governmental Organizations, International Research Institutes and the UN-REDD supporting organizations.

The development of this Road Map has assessed past and current land sector emissions estimation efforts in Kenya including experiences from ongoing and recently concluded projects like the Improving Capacity in Forest Resource Assessments (ICFRA), the System for Land-Based Emission Estimation in Kenya (SLEEK) and the Forest Preservation Project (FPP). The document identifies results that have been delivered, or will be delivered, through other ongoing initiatives such as ICFRA and the SLEEK program. Further, the work relied on the key documents on National Forest Monitoring System and Reference Levels from the UNFCCC, the UN-REDD and other global initiatives.

Activities under this roadmap have been developed and implemented to be consistent with a number of key principles that comply with Kenya's legal and customary systems and with decisions from the Conference of the Parties (CoP) to the UNFCCC. This Road Map for the NFMS provides background and a description of technical guidance including key concepts from the IPCC and REDD+ documentation in Appendix 1: Concepts of National Forest Monitoring Systems and Reference Levels.

In the past few years there has been significant support to the KFS and other agencies in relation to the provision of software, hardware, related training, investment in data collection and related equipment and capacity building to create the capacity for implementing REDD+ and other climate change initiatives. The projects providing this support include the Forest Preservation Program supported by the Japanese International Cooperation Agency (JICA), ICFRA pilot project supported by the Government of Finland and the Natural Resources Management (NRM) Project supported by USAID. The ongoing SLEEK program has also been investing in hardware and software and significant capacity building on aspects of the estimation of GHG from the land sector. In 2015 the FAO under the UN-REDD has supported specific efforts in capacity building to evaluate the land cover maps for different epochs that are available in Kenya and has developed the appropriate techniques for change detection, critical to emissions estimation for forests.

The engagement in these projects has included relevant agencies with skills and expertise such as the Kenya Forest Research Institute (KEFRI), Department of Resource Surveys and Remote Sensing (DRSRS), Survey of Kenya, Kenya Wildlife Service (KWS), academia and research institutions as well as KFS. As a result to a large extent the 'physical' requirements for supporting and enabling the NFMS in KFS and its partner institutions have been put in place.

The challenges that persist are related to the skills, experience, understanding and grasp of the concepts of GHG emissions from LULUCF and the international context of relevant staff in the responsible agencies. The full time roles of individuals compete with additional tasks and assignments that are needed for responding to climate change policy settings and demands of initiatives, projects and programs such as REDD+. Additionally the underlying knowledge and exposure to the related concepts and context has not been feasible to date. There is a need to boost the exposure, strengthen insights and deepen the understanding of technical managers and mid-management staff across the relevant agencies. A sensible first grouping to work with would be the REDD+ Technical Working Group, which represents the relevant stakeholders well.

Building this capacity in the understanding of the requirements, the process, the context and the tasks for REDD+ is not only conventional 'training' but also 'learning by doing' under guidance. This approach would require the participants to be significantly focused and committed to grasping

some basic to complex concepts through 'structured' working through the ideas, requirements and the methods of REDD+ and emissions estimation for the land sector. An approach that addressed capacity building in this way would also improve understanding of the processes essential to a functioning NFMS that include standardized setting, decision making and documentation, planning, data agreements and project management.

Following a mapping of tasks and components of the NFMS, REL and MRV being developed or already from the FPP, KFS, ICFRA, SLEEK the tasks of the NFMS are set out in tabular form, one task per table. Based on consultation with existing projects, examination of past projects, REDD+ Technical Working Group inputs; a timeline and budget was developed for the National Forest Monitoring System development. Very detailed planning has not been undertaken for each aspect but indications of timing and funding requirements have been prepared. These are contained in a spreadsheet, the summary of which is contained in Figure 1.

The total budget is estimated at US$5 788 000 noting that this includes US$3 500 000 for the National Forest Resource Assessment as designed by the ICFRA Pilot Project. The costs for implementation based on these preliminary estimates for the non-FRA is US$2 288 000.

The duration of the work envisaged is four years. Many of the tasks will be completed within three years and a year of implementation is included to enable adjustments to scheduling and duration that may arise or be needed for further refinement and a year of operational use to assess sustainability and enable incorporation of the tasks into routine operations by the agencies with the relevant mandates. Some activities are ongoing in nature or continuous.

1. Introduction

a. Objectives

The Government of Kenya is in the process of establishing a National REDD+ Programme. Two critical elements of the National REDD+ Programme are forest reference levels and a national forest monitoring system. This document describes the steps towards establishing the design of the national forest monitoring system and reference levels, through an enumeration and description of required tasks.

b. Principles

Activities under this roadmap have been developed and implemented to be consistent with a number of key principles that comply with Kenya's legal and customary systems and with decisions from the Conference of the Parties (CoP) to the United Nations Framework Convention on Climate Change (UNFCCC). Kenya is seeking to apply these in all REDD+ efforts:

- **Inclusive of all relevant aspects of a National REDD+ Programme.** The roadmap considers how the national forest monitoring system and reference levels fit into a larger picture of REDD+ implementation and national accounting of greenhouse gas emissions;
- **Alignment with UNFCCC decisions.** The roadmap recognizes all relevant decisions of the CoP with regards to a national forest monitoring system and reference levels;
- **Consultation with all relevant stakeholders.** Consultations on the development and implementation of this roadmap were done within the government agencies responsible for REDD+ implementation, but also with stakeholders in other areas of government and County governments, lower administrative levels in forestry, universities and research institutions, non-governmental organizations, private sector parties and local communities living in or near forests;
- **Recognizing cross-cutting issues.** Governance in forestry is considered a crucial element for the successful implementation of a National REDD+ Programme and it permeates all areas of intervention. Gender equality will be respected and fostered throughout the development and implementation of this roadmap and the National REDD+ Programme itself;
- **Recognizing secondary benefits.** A successful National REDD+ Programme will recognize the need to sustain the livelihoods of the communities living in or near the forest, as well as the overall economic development of Kenya. Many secondary benefits in timber and non-timber forest products can be received from the results of the National REDD+ Programme that supplement the core benefits that will accrue to the local communities for their efforts in implementing REDD+;
- Other, non-tangible or non-monetary benefits can be obtained as well, such as enhanced protection of water towers and the preservation and enhancement of biodiversity. The NFMS must facilitate the monitoring and quantification of these benefits.

c. Development approach

The development of this roadmap was coordinated by the Office of the National REDD+ Coordination, NRCO[1] hosted at the Kenya Forest Service. In the development of the Roadmap the following key considerations were applied:

- **Strategic.** This roadmap is a document that drives further design, development and implementation activities. It is intended to draw the outlines of what needs to be done, by whom, when and how. It will recognize the Kenya Constitution 2010 and the process of restructuring the administration of the forestry sector;
- **Cooperative.** The Government of Kenya will work closely together with all relevant stakeholders to develop and implement the roadmap. These stakeholders include the international community, multi-lateral agencies and the donor community at the international level and all interested parties in Kenya;
- **Multi-phased.** The roadmap and its activities will be developed and implemented over three key phases, in accordance with the decision of the Conference of the Parties to the UNFCCC
    1. Formulating policies for the national forest monitoring system and reference levels and building capacity for designing and implementing these;

[1] Described in the FCPF R-PP - "National REDD+ Coordination Office (NRCO): The NRCO will be constituted immediately upon approval of the R-PP by the FCPF with the designation of an Interim National REDD+ Coordinator.

2. Implementation of the national forest monitoring system and construction of the reference levels and capacity building for operators at all levels of stakeholders;
3. Full operation of the national forest management system;

- **Action-oriented**. Activities will be designed to deliver concrete and tangible outcomes and will be supported with capacity building initiatives to ensure effective on-the-ground implementation; (Decision 1/CP.16, paragraph 73):
- **Realistic.** Activities will be designed and implemented in a practical and realistic manner that reflects the national priorities and institutional capacity of Kenya;
- **Time-bound.** Each activity will be given an indicative timeframe, where possible, to track and monitor the implementation of the roadmap.

d. Task details

The current document builds upon the first roadmap developed in 2012 bringing in updates and enhancing the tasks based on current needs and UNFCCC guidelines and guidance. This is the result of a series of Technical Working Group meetings involving active stakeholders from REDD+ implementation agencies from Government Ministries and Departments, Universities, Non-Governmental Organizations, International Research Institutes and the UN-REDD supporting organizations. The document identifies results that have been delivered, or will be delivered, through other ongoing initiatives like the Improving Capacity for Forest Resource Assessment (ICFRA) and the System for Land Based Emission Estimation (SLEEK).

The tasks for the NFMS are described showing the current status of each issue as discussed by the TWG, the implementation budgets and schedules noting the aspects below.

- **Stakeholders.** The list of stakeholders is based on a comprehensive stakeholder analysis done in parallel to this roadmap. Due to the changing government administrative guidelines that relate to line ministries, and government departments, the roadmap identifies the group of institutions responsible for implementing the specific task and it is expected that the TWG will give the technical guidance under the coordination of the NRCO. The implementation of the tasks will however be guided by the mandates of the institutions and their capacity to deliver;
- **Schedule.** The schedule is indicative only, as implementation is dependent upon external support for design and implementation and also the available capacity. Of more interest than the specific timing of individual tasks is the sequence in which certain tasks need to be implemented. For example, the definition of “forest” and the preparation of a set of standards and protocols for data collection, processing and management are critical for the design and implementation of many other tasks;
- **Budget.** For design and especially implementation of many of the tasks it is difficult to determine the required budget, as this is dependent upon design decisions and a capacity building needs assessment of the stakeholders implementing and operating the task. For purposes of generating realistic estimates, the budgets were developed based on experiences from ongoing and recently concluded projects like the ICFRA, the SLEEK and the Forest Preservation Project (FPP).

2. Key documents on the National Forest Monitoring System and Reference Levels

Kenyan context

- Kenya Constitution 2010, with devolution of authority to lower levels of government and engagement of local communities in resource management
- Kenya Vision 2030, the long-term strategy of the Government of Kenya
- The Forest Conservation and management Bill 2014
- The Kenya Climate Change Response Strategy
- Kenya REDD+ Readiness Preparation Proposal
- The ICFRA field manual - Field Manual Tree analyses data for modelling biomass and volume
- The ICFRA field manual – Biophysical manual
- The SLEEK manual for land cover and land cover change mapping

3. System Settings and Decisions

All reports on greenhouse gas emissions and removals that countries submit to the UNFCCC have to follow the methodology adopted by the IPCC. The UNFCCC has formally adopted the "1996 IPCC Guidelines for National Greenhouse Gas Inventories" for the reporting of National Communications. In more recent Decisions, the UNFCCC has encouraged *"to use the most recent Intergovernmental Panel on Climate Change guidance and guidelines, as adopted or encouraged by the Conference of the Parties*[2]*"*, being the "2006 IPCC Guidelines for National Greenhouse Gas Emissions". The guidelines can be downloaded for free from the internet [3].

a. IPCC Guidelines key con cepts

The key concepts that the IPCC Guidelines use in the estimation of emissions and removals of greenhouse gases from anthropogenic origin are adhered to in order to apply the same principles in REDD+, guaranteeing consistency with the national forest monitoring system for REDD+ and the National Communications to the UNFCCC. The decisions Kenya has made in respect of those concepts and requirements and progress on them where decisions are in process are set out below. The discussions and documentation of these decisions was undertaken by the Technical Working Group for REDD+ convened by the KFS and supported by FAO under the UN-REDD Programme. The TWG for REDD+ has membership from across the agencies that have a role in emissions estimation and includes representatives of the ICFRA pilot project and SLEEK program as well as international actors such as CIFOR.

Tiers

In order to accommodate different levels of information, knowledge and inventory capacity in different countries, the IPCC defines three Tiers for the estimation of emissions and removals of greenhouse gases. Increase in Tiers implies increasing accuracy of the estimates due to an increased use of local data and more evolved estimation methods. Estimates based on higher Tier methods and parameters have a higher (implied) confidence and are thus able to generate higher amounts of results-based benefits.

Tier 1 estimates – using default parameter values given in the IPCC Guidelines – should only be used if there is no other option. For Kenya's REDD+ programme, this may apply in the case of litter which is a largely stable pool, with insignificant emissions and where not much research has been done and may not be justifiable. Application of Tier 1 default parameters is assumed to result in a conservative estimate of the size of the carbon pool – meaning that the size of the pool is estimated in such a way that the actual, but unknown, amount of the carbon pool is likely to be larger.

Tier 2 estimates apply nationally-appropriate methods and/or parameters. This is the recommended minimum Tier for REDD+. It implies that there is detailed information on the forest land and the forest types in the country and that at least basic information is available about species composition and merchantable timber volume for the different forest types.

Tier 3 methods are the most complex in terms of monitoring of status and processes, changes in land use in a spatially-explicit manner, knowledge of biophysical processes and required data to make the estimates. The IPCC Guidelines do not present any methods for Tier 3 estimation, only good practice guidance. For REDD+ purposes, a Tier 3 method could be the development and application of an allometric equation for the estimation of one or more carbon pool(s) on the basis of the measurement of a few key properties of a tree or a forest stand.

Estimation methods from different tiers may be freely combined within a reporting period or over time, as long as proper documentation of estimation methods is provided.

[2] UNFCCC Decision 4/CP.15 "Methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries", paragraph 1(c). UNFCCC document FCCC/CP/2009/11/Add.1.

[3] http://www.ipcc-nggip.iges.or.jp/

Status

The national system for Kenya is identified in documentation for the SLEEK program to be developed with the intention to improve step-wise for national GHG reporting from Tier 1 level 1 to tier 2 level 2 and ultimately Tier 3 level 3 as recommended by the IPCC guidelines. In the Kenya R-PP, it was identified that "Kenya will use at least a Tier 2 level of data for its estimate of historic emissions/ removals".

The formal documentation of a decision on Tiers and Levels is not yet complete.

Land-use categories

The IPCC identifies six land-use categories for estimation of emissions and removals of greenhouse gases of anthropogenic origin:

1. Forest Land
2. Cropland
3. Grassland
4. Wetlands
5. Settlements
6. Other Land

Estimation of emissions and removals of greenhouses gases is only done for areas of managed land, that is land which is subject to human impacts for production, ecological or social functions. This implies that REDD+ can only be applied to those areas of forest land which are classified as managed. In general, any forest which is generally accessible to people can be classified as managed since "management" is not restricted to formal types of management under control or license of the state or by private ownership.

Status

Kenya has adopted these land-use categories.

The land-use categories may be further subdivided for estimation of emissions and removals and reporting purposes. Kenya has undertaken further sub-division of the land-use categories including forests, which is reported below.

In Kenya, all Forest Land can be classified as managed.

Stratification

Land-use (sub) categories can be stratified in order to obtain more homogeneous units for which separate estimation methodologies or conversion factors exist. The IPCC suggests a stratification of the Forest Land category along ecological zones and climatic domains (between which one may expect a large variance). Further stratifications can be made on forest type – e.g. broad-leaf, needle leaf, deciduous, evergreen, mangrove, plantation. Stratification should strike a careful balance between the overhead costs of having to estimate emissions and removals of greenhouses gases from every stratum, with its concomitant burden of establishing an estimation method and/or set of conversion parameters for each stratum, and the (assumed) higher accuracy of the estimate that is obtained.

Status

Kenya has discussed and decided on a stratification of land as follows:

1. Forest Land
   Level II
   - Dense (>65% Canopy)
   - Moderate (40%-65% Canopy)
   - Open Forest (15-40% Canopy)

   Level III (Requires stratification data and Ancillary data)
   - Montane and Western Rain Forests
   - Mangroves and Coastal Forest
   - Plantations
   - Dryland Forest

2. Cropland
   Level II
   - Perennial Cropland
   - Annual Cropland

   Level III (Requires Ancillary data)
   - Tea
   - Coffee
   - Sugarcane
   - Rice
   - Wheat
   - Maize
   - Other agricultural land

3. Grassland
   - Wooded Grassland
   - Open Grassland

4. Wetland
   Level II
   - Vegetated Wetland
   - Water Body

5. Settlements

6. Other Lands

Land-use Conversion

Over time, land use can change from one category to another. The IPCC identifies separate methodologies for land staying within a certain land-use category between reporting periods and land converted to another land-use category during a reporting period. For REDD+ purposes one land-use category and two land-use conversions are of interest:

- Forest Land Remaining Forest Land
- Other Land uses Converted to Forest Land
- Forest Land Converted to other Land use (any of the other land-use categories)

After a conversion the area is counted under the new land-use category, but in a “transition period” specific estimation methods for the carbon pools are used to properly estimate the carbon dynamics until a new equilibrium is reached. The IPCC default period for such an equilibrium lasts for 20 years.

There has been ongoing discussion at the technical level on methodologies for remote sensing

to detect forest cover change (SLEEK and FAO). FAO has been providing Technical Support (TS) to KFS on identifying a method to detect change. Training has been provided and testing of potential approaches has been undertaken.

The estimation of area change under each land use category has been progressed under the technical support being provided by FAO UN-REDD building on its global insights and experience and previous work by F-PP. The results of the accuracy assessment led by FAO of the KFS Forest Resource Maps showed that the 1990-2010 stable layers were reliable to use as a forest / non-forest mask, but that the change layers (loss and gains) could not be used to reliably locate areas of change and estimate deforestation, degradation and/or reforestation. The estimates of changes could still be used as an indicator, but the levels of uncertainty around them were very high.

The change detection efforts will need to move into field work on degradation to improve processes to capture emissions from forest degradation. Canopy cover is limited as a factor as the canopy class can vary due within the class range due to degradation which is not readily detectable using current methodologies. Two maps of land cover have been developed by the automated system for the years 2010 and 2014. The 2012 map will be out very soon.

From the two maps several points:

- Mapping of forests looks consistent over time and the system may capture forest accurately over the time;
- The mapped forest areas for 2010 were not significantly different from what was mapped by the PASCO-JICA-FPP project for the same year. The forest area in PASCO project was 6.99% while the current mapping gives it about 7%;
- The three strata of forests (dense, moderate, and open) will be captured by remote sensing but the second level of strata (plantation, western rain and montane, coastal, and dryland forests) will be captured using auxiliary data;
- There is a need to identify the auxiliary data that will be needed, who collects it, how can it be made available, what needs to be done to ensure consistency over time.

Status

The assessment of land cover is being contributed to by DRSRS as lead in the relevant Element Working Group of the SLEEK program and includes participation from KFS, KEFRI, universities and RCMRD.

- The work at DRSRS will create sustainable approaches for:
  - Land Cover Classification of forest and non-forest provided on an annual basis since 1990. For now only the 2010 and 2014 analyses are completed. The work includes developing a manual on Land Cover Classification and a process manual,
  - Land Cover Change Detection for deforestation/reforestation. A pixel based land cover change method is being piloted including an attribution algorithm. Once complete, these have to be verified to ensure accuracy and applicability across the time series and among land cover classes.
- KFS for the NFMS needs to deal with the other aspects of REDD+ which will need to be developed for the NFMS in terms of working out the measurement, recording and reporting, namely:
  - Reducing emissions from forest degradation;
  - Conservation of forest carbon stocks;
  - Sustainable management of forests;
  - Enhancement of forest carbon stocks.

Greenhouses gases

In the 1996 Guidelines the IPCC identifies a number of greenhouse gases, from the well-known carbon-dioxide (CO_2) to complex molecules such as the family of halocarbons (used in refrigerators, air conditioners and power transformers). All of these gases have what is termed Global Warming Potential (GWP) in the atmosphere, which is expressed in CO_2-equivalent units (CO_2e). For the AFOLU sector, and thus REDD+, carbon dioxide is the principal greenhouse gas of consideration, with a few notable exceptions, which must be estimated and reported and include:

- In mangroves and seasonally flooded forests, a non-negligible amount of methane (CH_4) and nitrous oxide (N_2O) may be formed in and released from the soil[4],
- If soils in plantations are being fertilized, nitrogen oxides (NO_x) will be released, which are a precursor to the greenhouse gas nitrous oxide,
- Forest fires release nitrous-oxides and sulfur-dioxide (SO_2).

Status

The TWG for REDD+ considered the gases for reporting and noted Ethiopia and the Congo only reported on CO_2. For Kenya the potential importance of changes to agriculture, decomposition of organic matter, mangroves and fires suggests that reporting on Methane should be considered. There could also be N_2O emissions from fertilization especially in plantation forests where trees are raised together with crops through the Plantation Establishment and Livelihood Scheme (PELIS).

Kenya should try to maintain consistency with their GHG inventory and should provide a justification for omissions if any gases are not going to be included in the REDD+ estimations.

Carbon pools

The IPCC recognizes five carbon pools for the AFOLU sector; Above-ground biomass (AGB), Below-ground biomass (BGB), Dead wood, Litter and Soil organic matter (SOM). The 2006 IPCC Guidelines saw the addition of a new carbon pool: Harvested Wood Products (HWP), components of trees that are converted into timber, board, paper/pulp, etc. which store carbon after removal from the forest. The TWG for REDD+ discussed the five carbon pools and noted that in time it may be that all five pools will be reported as capacity and data increases. In the discussion it was noted:

- The countries that have submitted a Reference Emission Level, 15 to 20, most are opting to report only on Above Ground Biomass (AGB) with Below Ground Biomass (BGB) being a ratio to the AGB. Zambia is reporting all pools except Soil Organic Carbon (SOC). This suggests that Kenya should do at least AGB;
- Kenya may experience significant fluxes in SOC with forest clearing. At present dead wood is removed for local use or as charcoal and fuelwood; so any transition will mean little or no contribution to emissions from that pool (it is already being fully consumed – emitted);
- In Kenya there is little value in litter as it is 'cycling' and may not be a significant flux;
- SOC is difficult to measure and monitor so setting up a system of monitoring is a challenge. The SLEEK EWG on Soil Carbon is progressing and as their work matures the inclusion of SOC could be considered.

Status

The decision on pools to be measured and reported by Kenya requires finalisation and documenting. Discussion has confirmed that Kenya should do at least AGB. The ICFRA programme piloted the collection of data on the different pools and also developed manuals for collection of data on the specific pools. However sampling for SOC still needs agreements with the KARLO where the soil research mandate is domiciled. The report of the piloting has not been finalised.

[4] The IPCC Guidelines provide estimation methodologies for these greenhouse gases under the land-use category of Wetlands. In many countries, however, mangroves and particularly seasonally flooded forests are accounted as forests and reported as Forest Land in the National Communications. The Guidelines allows for such deviations from the categories listed, but these need to be clearly documented and applied consistently in subsequent National Communications. In practice this means that the methodology for Wetlands can be applied to estimate emissions for Forest Land.

Key categories

In order to reduce the effort in compiling National Communications and focusing resources on those areas where the majority of emissions and removals take place, the IPCC identifies key categories. A key category is "one that is prioritised within the national inventory system because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level, the trend, or the uncertainty in emissions and removals". As such, key category analysis is a task for the national authority that compiles the National Communications, to be applied on each sector individually. Key category analysis aims to identify those categories within the sectoral scope – such as AFOLU – that have a significant influence on the inventory. For Forest Land this implies that the following questions need to be answered:

- Which management activities are significant?
- Which CO_2 emissions or removals from various carbon pools are significant?
- Which non-CO_2 gases are significant?

Typical key categories in forestry are:

- AGB for all forests that have undergone or are undergoing human impacts. For managed forests that have not suffered such impacts – such as National Parks or wildlife reserves – AGB does not necessarily have to be estimated because the carbon dynamics from human impacts will be minimal, unless there are special management actions such as fire management;
- If there is a significant amount of deforestation: SOC and dead wood in Forest Land converted to some other category (BGB is instantly converted to dead wood upon deforestation);
- If there is a significant amount of forest regeneration: SOC, AGB and BGB on LandConverted to Forest Land;
- SOC in mangroves and peatlands.

Other key categories may be identified based on national circumstances. The key categories should jointly comprise a substantial part of emissions and removals – 95% as established by the IPCC.

Status

A key category analysis is a task to be accomplished after data collection and analysis. The task can also be tied to the 1st and 2nd national communications but these have been much generalised specifically in the LULUCF sector.

b. Approaches to Calculation: Stock-Difference and Gain-Loss[5]

There are two methods described by (IPCC, 2006) to estimate changes in carbon stock[6].

- Stock-Difference method; estimation of difference in carbon stocks of a land unit by comparing carbon stocks for the same location at time 1 and 2. It generally requires comparing measurements from national forest inventory cycles;
- Gain-Loss method. This method is applicable at all IPCC Tiers and subtracts biomass carbon loss from biomass carbon gain.

Section 2.1 of the GFOI Methods and Guidance Document (GFOI, 2014) discusses gain-loss and stock-difference (or stock change) methods as applied to REDD+ activities and has a decision tree on the choice between them. In the methods and guidance the GFOI identifies that the IPCC notes that the stock change method provides good results where there are relatively large increases or

[5] This topic was the subject of a briefing note to the TWG that sets out the issue more clearly. This was discussed in the TWG meeting in November 2015.
[6] UN-REDD 2015. Technical considerations for Forest Reference Emission Level and/or Forest Reference Level construction for REDD+ under the UNFCCC.

decreases in estimated biomass, or where countries have very accurate forest inventories. Since not all countries possess an NFI, this restricts application of the stock change method, and so the advice in the MGD focuses more on the gain-loss method[7].

The gain-loss method estimates annual emissions or removals of CO_2 as the sum of gains and losses in carbon pools occurring on areas of land subject to human activities. Changes in the carbon pools are often estimated as the product of an area of land and an emission or removal factor that describes the rate of gain or loss in each carbon pool per unit of land area. The gain-loss method does not require an NFI, although information from an NFI can be used to derive emission and removal factors, as well as provide insights into the causes of gains or losses of carbon pools.

Status

The decision on Approaches to Calculation remains to be further discussed and finalised. The TWG discussed the Stock-Difference and Gain-Loss methods and noted:

- SLEEK is developing the Gain-Loss method as it was not feasible to conduct an inventory for each time period to assess the difference as would be required for the Stock-Difference method. It was further noted that the changes to be detected were not necessarily very large and the certainty of identifying them with an inventory approach was not high;
- In regard to inventory an option would be to implement a national inventory and then use Permanent Sample Plots (PSPs) to re-measuret and reduce the costs and effort;
- It was suggested that REDD+ requires an inventory to develop the baseline;
- For the Gain-Loss method most of the activities that create forest change are not under the control of the KFS or other government land managers, being degradation activities, fires, charcoal, encroachment and so on; much of it in dry land forests. Most losses are in areas outside the government managed lands on non-gazetted lands so the monitoring approach needs to include those changes. In particular techniques are required for degradation activities.

The discussion was engaging and dynamic with a range of contributions but a clear decision was not made.

c. REDD+ activities and sampling[8]

If a country decides to participate in the REDD+ mechanism of the UNFCCC, all the managed Forest Land in that country needs to be included in REDD+ accounting. In this sampling, a number of issues should be clarified including:

1. The design, of the inventory to include the strata
2. The number of plots to be measured
3. The sizes of the plot and their orientation in reference to one another
4. The attributes to be measured at different levels within the plot
5. The repeatability of measurement in cases of permanent sample plots

The Kenya Indigenous Forest Conservation Program (KIFCON) provides the earliest systematic forest inventory in Kenya and extensively covered 15 blocks of indigenous forests of Kenya in the period 1990 - 1994. The SLEEK program is digitising these inventory datasets to allow their integration into the national forest inventory datasets and possibly use them for defining the forest stocking levels of the country.

Apart from the periodic inventories for commercial purposes done in plantation forests of Kenya, an NRM funded project carried out a national inventory of all plantation forests in the country in the period 2009 – 2011 which has been used to characterise plantation forest stocking by species, management type and age.

[7] GFOI (2013) Integrating remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests: Methods and Guidance from the Global Forest Observations Initiative: Pub: Group on Earth Observations, Geneva, Switzerland, 2014.
[8] The material in this section is partially drawn from the manuals and reports of the Improving Capacity for Forest Resource Assessment Pilot Project (ICFRA).

A pilot of a National Forest Inventory focused on the REDD+ objectives has been done through the ICFRA programme and a sampling scheme prepared to implement the full NFI including the marking of permanent sample plots. The inventory has been done based on the nationally adopted manuals and covers the five carbon pools. It also defines sampling for unique forests like mangroves, natural forests and bamboo forests. The pilot project has produced field manuals and laboratory manuals and a proposal for the National Forest Resources Assessment.

Status

The National Forest Resources Assessment requires funding. No likely funding sources for the forest and biomass inventory have been identified at this stage.

d. Data Quality Assessment and Internal Verification

All the information that is reported to the UNFCCC in the National Communications needs to be assessed for its quality and an estimate of accuracy and associated uncertainty is highly encouraged. The sampling design enables the computation of an estimate with a known error for the number of samples, given the average and standard deviation of the parameter under consideration (biomass, litter, dead wood, etc.) and an established confidence interval.

Assessment of data quality can take place in the temporal domain – cross-reference repeated measurements over time – and in the spatial domain – compare estimates with those from other REDD+ areas in the same forest stratum.

Data quality analysis should therefore not be a last step before data is inserted into national accounts of greenhouse gases; instead it should be used to provide feed-back to practitioners of REDD+ on potential improvements in procedures and implementation.

The REDD+ TWG noted the progress in development of quality assurance procedures through development of process manuals in land cover mapping and forest inventory. Such manuals have been developed using the IPCC good practice guidance and the MDG document of the GFOI. The manuals have also been developed in consultation with international experts in mapping forest (FAO UN-REDD, SLEEK and JICA) inventory (FAO UN-REDD, SLEEK and ICFRA) and soil analysis (SLEEK and ICFRA). These manuals comprise a Quality Assurance component for REDD+ reporting that has been used in the preparation of the two years of land cover assessment.

Status

The TWG noted the role of KEFRI as a Quality Control unit in the FPP and ICFRA programmes being the lead institution in forest research. Support can also be provided by the universities offering forestry programmes and JKUAT can also provide quality control support to the remotes sensing and mapping processes.

4. National Strategies and Action Plans for REDD+ implementation

Countries wishing to participate in the REDD+ programme need to develop strategies and action plans for the implementation of REDD+ activities. These describe how emissions will be reduced, how forest carbon stocks will be enhanced, conserved and sustainably managed. Such strategies are derived from an analysis of the national circumstances, policies and stakeholders engagements.

The Kenya government launched its national climate change response strategy during COP 15 at Copenhagen in December 2009, which was developed using a consultative process that included seeking views from participatory regional workshops. Kenya's resulting national strategy incorporates areas of response such as adapting agriculture, energy and infrastructure to climate change. The Kenya Forest Service (KFS) was designated as the body responsible for coordinating REDD+ readiness activities in Kenya and established a secretariat for the purpose.

In the period since in the REDD+ processes Kenya has produced a series of reports and products that frame up and consider some of the key issues of drivers of deforestation and forest degradation; forest governance issues, gender considerations and ensuring full and effective participation of all relevant stakeholders.

The documentation to date includes:

- Social inclusion in REDD+ -workshop Report - Nairobi Dec 2012
- Roadmap for Establishing REDD+ RL and NFMS
- Kenya's REDD+ Readiness Preparation Proposal (R-PP)
- Kenya R-PP Annex
- Kenya Water Towers , Forests and Green Economy- A National Dialogue
- Forest Governance, REDD+ and Sustainable Development in Kenya
- Draft SESA Road Map -Sep 2013
- Charcoal Value Chain Analysis
- Analytical Study on Corruption Risk Assessment for REDD+ in Kenya
- Analytical Study on Carbon Rights and Benefit Sharing for REDD+ in Kenya
- Analysis of Demand and Supply of Wood Products in Kenya
- Analysis of Drivers of Deforestation & Forest Degradation in Kenya

The R-PP has not been implemented, however more broadly under the Constitution 2010 Kenya is also addressing land tenure issues, gender and full and effective participation of all relevant stakeholders. This is being implemented in part with the devolution process to the County level.

Related issues include:

- Policies and Measures for REDD+ implementation – the actions and strategies that the government identifies to guide the implementation of REDD+ activities;
- Information on Safeguards - measures designed to mitigate risks. The process of REDD+ is expected to be beneficial to livelihoods and ecosystems. Every implementation country willing to participate in the REDD+ programme is expected to document safeguards associated with the implementation;
- Benefit sharing mechanisms - REDD+ implementation may be associated with the benefits or incentives assigned to the implementers. Therefore policies and measures associated with REDD+ implementation should identify incentives that encourage specific actions from stakeholders.

The Road Map notes these issues and allocates resources so that as they are developed the inputs and interaction required from the NFMS and during its development can be enabled.

5. Capacity Building for NFMS/RL for REDD+ in Kenya

a. Introduction

The analysis and discussion with institutions in Kenya identified the following strengths and challenges.

- **Strengths**
  - The issues of REDD+ and climate change are growing in profile and the capacity to work on them is increasing. Previous projects have provided both infrastructure and capacity building but also created some interactions between agencies that are ongoing;
  - The capacity for land cover mapping and preparing basic maps is in place and the procedures and skills are better understood. The basic trends around land management have been identified and gathering of more information has been planned;
  - There is an emerging insight on the roles of institutions such as KFS and awareness of the need for political will to support the efforts of REDD+ and related initiatives. There is a need for the managers in those institutions to have an improved understanding of the climate change aspects of land including REDD+.

- **Challenges**
  - The information and data exchange between agencies is only enabled on a case by case basis, generally difficult to achieve and remains a major challenge;
  - Some skills are limiting among institutions such as data handling and data transformation skills;
  - Communication need – the decisions informed by appropriate technical input (such as Forest Definition) are not being communicated and properly appreciated and understood by the participants and stakeholders;
  - Devolution from national to county level has potential to pressure the transfer of forest land to county control and possible risks to management effectiveness and of conversion to other uses;
  - KFS has relatively weak and poorly supported units in the field specifically at the forest station level;
  - Majority of CFAs have low capacity, institutional arrangements are poorly implemented, they are short of their potential to be local providers of data and information on forests and land;
  - Traditional arrangements are declining with the eroding of cultural values and religious traditions of forest protection.

b. Participatory Community Monitoring

The REDD+ guidance notes that local communities – including indigenous peoples – have demonstrated in many ways that they are effective custodians and managers of the forest that makes up part of their daily life and livelihoods. They are often knowledgeable about the forest in aspects that are not covered by professional forest inventory and, through their physical and socio-economic condition, well placed to manage the forest on a daily basis. In Participatory Carbon Monitoring (PCM) the National REDD+ Coordinating Office, forestry agencies, forest owners and local communities collaborate to collect data on the carbon stored in the forest.

The Forest Act recognizes the roles of communities and other stakeholders in the management and conservation of forests. The legal entity is the Community Forest Association which is registered under the Society's Act and normally has user groups. Such user groups comprise of communities with different uses and interests in the forest. Some of the user groups are also interested in on farm tree planting to reduce overdependence on the forest.

The National Alliance of Community forest Associations (NACOFA) which is a network of Community Forest Associations (CFA) in Kenya do no formal data collection but could provide information from a CFA perspective, which could include basic information on effects, impacts and management of natural forests. The network receives uncoordinated information on illegal activities taking place in different forests of the country. There is a project underway at present, funded by GTZ and

implemented by WWF, in the Transmara forest block of the Mau Forest Complex that seeks to provide a case study of monitoring illegal activities.

People have been engaged as "scouts" with some training to report their geo-referenced observations. Such observations include encroachment, legal and illegal extractions, forest regeneration characteristics and community interactions with forests.

The data collection for REDD+ will be relatively straightforward, focusing on easily measured properties of the forest such as species name, DBH and density (number of trees per sampling plot). Local communities need to be trained on measurement protocols, data recording and management and analysis (review) of results. Initial establishment of the sampling plots needs to be supported by professional foresters or a certified implementing partner.

PCM could be presented as part of the broader Participatory Forest Management. KFS has to develop procedures for measurement of forest properties with the local communities or owners taking primary responsibility and KFS providing support to this process and undertaking more complicated tasks. The data that is thus collected should be available to the communities/owners and feedback should be given on quality of the data and amount of carbon stored.

There are some activities under REDD+ that do not directly relate to measurement of trees, but which would require the involvement of communities, such as patrolling for encroachment, fires, illegal grazing and illegal logging; assessment of biodiversity and other ecosystem properties. Such activities should be an integral part of PCM/PFM and likewise be recorded in the information system.

Challenges to Participatory Community Monitoring

It was noted that Community organizations face many challenges as a consistent data source for the NFMS. A number of the CFAs have management plans and have signed a management agreement with KFS. However, this has only been possible through support from agencies and institutions such as Nature Kenya, KFS and NMK who house the CFA offices at the Forest stations. Other major problems facing communities include governance. Some CFAs do not hold elections and leaders tend to remain in power. There were efforts to train communities on governance initiated by the forest Action Network and Kenya Forest Working Group and these efforts are now spearheaded by the Community Development Trust Fund (CDTF) which has funded most of the forest management plans in the country.

There is a need to formulate a strategy for CFAs to be able to effectively fulfil their potential to contribute to the NFMS and to participate in REDD+ more broadly. Steps to implement this have been included in the Road Map; notably a review of community based monitoring approaches that have been applied, trialled or considered for Kenya; identification of the preferred approach(es) and methods to use for participatory monitoring, a plan to pilot the preferred method for participatory monitoring in Kenya that accounts for the forest stratification and then implement the pilots on participatory monitoring.

Status

The opportunity to review, confirm and pilot PCM has been included in the NFMS Road Map.

c. Capacity Building

Following discussion with stakeholders and review of the materials and documentation of past projects and ongoing efforts a list of the 'ideal' situation was set out under suitable descriptors. This included physical, human, processes and institutional considerations.

In the past few years there has been significant support to the KFS and other agencies in relation to the provision of software, hardware, related training, investment in data collection and related equipment and capacity building. The projects providing this support include the Forest Preservation Program supported by the Japanese International Cooperation Agency (JICA), the Improving Capacity

for Forest Resource Assessment (ICFRA) pilot project supported by the Finnish Government and the Natural Resources Management (NRM) Project supported by USAID.

The support from the Government of Japan under the Forest Preservation Program had assessed capacity in respect of physical assets and infrastructure of KFS and stakeholder organizations and then made strong contributions to meet those needs.

The ongoing System for Land-sector Emissions Estimation of Kenya (SLEEK) has also been investing in hardware and software and significant capacity building on aspects of the estimation of GHG from the land sector. The emphasis for hardware for land cover classification and forest monitoring was with DRSRS but the staff involved came from KFS, DRSRS, SoK, RCMRD, AWF and universities. This work has included forest categorization and monitoring and the collection and collation of existing land sector related data sets. SLEEK has also supported development of methodologies and techniques for soil organic carbon, forest biomass, crop biomass and integration of the data for estimates of emissions through modelling. In 2015 the FAO UN-REDD has supported specific efforts in capacity building to evaluate the land cover maps for different epochs that are available in Kenya and has developed the appropriate techniques for change detection, critical to emissions estimation for forests.

The engagement in these projects has included relevant agencies with skills and expertise such as the Kenya Forest Research Institute (KEFRI), Department of Resource Surveys and Remote Sensing (DRSRS), Survey of Kenya, Kenya Wildlife Service (KWS), academia and research institutions as well as KFS.

As a result to a large extent the 'physical' requirements for supporting and enabling the NFMS in KFS and its partner institutions have been put in place and are sufficient as demonstrated by their current use to prepare a time series of land cover maps for Kenya. This includes:

1. **Infrastructure and Physical Assets**
   - Buildings
   - Hardware and software
   - Communications – internet access and band width
   - Equipment for field work
   - Laboratories and analytical equipment for remote sensing, biomass assessment and soils

2. **Human capacity**
   - Capacity for data collection
   - Capacity for land cover mapping and change detection
   - Capacity for documentation and publication of field work results to allow access and peer review
   - Capacity for information Dissemination e.g. maintaining active and updated

The current infrastructure and human capacity are sufficient for the aspects noted above and the residual needs are for maintenance and operations only. The capacity needs are largely for consistency and sustainability of processes as set out below.

d. Addressing Challenges by Building Capacity

The challenges, gaps and needs that persist are related to the skills, experience, understanding and grasp of the international context of relevant staff in the responsible agencies. The full time roles of individuals compete with additional tasks and assignments that are needed for responding to climate change policy settings and demands of initiatives, projects and programs such as REDD+. Additionally the underlying knowledge and exposure to the related concepts and context has not been feasible to date. There is a need to boost the exposure, strengthen insights and deepen the understanding of technical managers and mid-management staff across the relevant agencies. A sensible first grouping to work with would be the REDD+ Technical Working Group, which represents the relevant stakeholders well.

The needs included elements that are in most cases general management and organization skills and procedures. This sort of capacity is created through staff implementing existing systems of filing, recording and reporting, policy development, data handling, quality assurance and contract administration. As required the continuous improvement of these systems and approaches also contributes to building capacity. These systems are in large measure in place in the key agencies, certainly in KFS.

The building up of capacity over time for KFS as the lead agency for REDD+ includes:

1. **Human capacity needs such as:**
   - Capacity for biometrical and other analysis of data collected
   - Capacity for Planning, contract administration, management
   - Capacity for strategy development and coordination of policy needs
   - Capacity for documentation and publication of field work results to allow access and peer review
   - Capacity for QA both internal for data collection, processing, analysis and compilation
   - Capacity for community based forest monitoring
   - Human Resources and Succession Planning
   - Identify, arrange and structure opportunities to optimise the delivery of the skills and experience necessary for the NFMS.

2. **NFMS and Project Processes such as:**
   - Data availability and exchange to strengthen inter-agency and external to government data transfers and support.
     - MOUs and agreements for data supply and access in specific situations as appropriate
   - Project and contract management

While there were no specific technical and scientific needs identified in the analysis as they are identified during planning, implementation and continuous improvement of the NFMS they should be addressed by targeted specialist capacity building.

Building this capacity in the understanding of the requirements, the process, the context and the tasks for REDD+ is not conventional 'training' but rather 'learning by doing' under guidance. This approach would require the participants to be significantly focused and committed to grasping some basic to complex concepts through a 'structured' working through the ideas, requirements and the methods of REDD+ and emissions estimation from the land sector. An approach that addressed capacity building in this way would also improve understanding of the processes essential to a functioning NFMS that include standard setting, decision making and documentation planning, data agreements and project management.

The mobilisation and activation of existing systems with a focus on NFMS requirements does not require particular or specific support. There may be value in providing additional resources to agency systems for the appropriate staffing levels to be established that support effective system and administrative processes.

6. Mapping Tasks and Components: NFMS, REL, MRV and SLEEK

The efforts being undertaken in Kenya to track GHG emissions in the land sector have been initiated at different points in time, by different donors and in partnership with different institutions. The R-PP was submitted in 2010 and the SLEEK Program commenced implementation in April of 2013. The ICFRA funded by the Government of Finland and supported technically by the Natural Resources Institute of Finland (Luke) has completed its pilot phase including field plots, sampling design and a "National Forest Resources Assessment Field Manual Biophysical Survey Kenya". These efforts have overtaken some of the requirements for the NFMS and refined others with much of the work to develop the NFMS remaining. The linkages that are formed tend to be ad hoc and largely based on individuals. In response to this, there is a need to bring coherence to work taking place across Kenya, including SLEEK, ICFRA, FAO UN-REDD, other projects and relevant stakeholders. REDD+ has a focus on forest land only, while SLEEK is working across the whole land sector including forest land as well as grassland, cropland and other land uses. There is a need to avoid duplication, avoid repetition and increase efficiency.

The NFMS is built on three 'pillars' that support the development of REDD+ NFMSs under the UNFCCC:

- Pillar 1: A Satellite Land Monitoring System (SLMS) to collect and assess, over time, the Activity Data (AD) related to forest;
- Pillar 2: National Forest Inventory (NFI/FRA) to collect information on forest carbon stocks and changes, relevant for estimating emissions and removals and to provide emissions factors;
- Pillar 3: A national GHG Inventory as a tool for reporting on anthropogenic forest-related GHG emissions by sources and removals by sinks to the UNFCCC Secretariat.

Kenya is fortunate in having significant elements of these pillars already developed or in development or planned through the efforts of past projects (F-PP, FCPF RPP) and present projects (SLEEK for Pillar 1 and ICFRA for Pillar 2). UNEP has been supporting capacity building and development for Pillar 3.

SLEEK is planned as a highly integrated system that will compile information from Kenya's forestry and agricultural sectors providing monitoring capabilities for existing emissions and sinks and create the measurement, reporting, and verification capacity for Kenya to predict future Green House Gas (GHG) emissions and sinks.

The SLEEK, through DRSRS the mandated Kenyan agency, will provide MRV capability for: long term annual monitoring of land cover change; a multi-temporal, fine resolution data series; identifying land cover change through time; a comprehensive and credible account of Kenya's land based emissions and sinks; meeting the reporting requirements under international and other protocols.

SLEEK will be a comprehensive system for the Measurement Reporting and Verification (MRV) of emissions of GHGs resulting from Land Use, Land Use Change and Forestry (LULUCF) that will also support REDD+ readiness activities and reporting requirements. Notably it will not provide all of the requirements for REDD+ in its initial phase and so those needs have to be provided through the implementation of the NFMS Road Map. SLEEK draws participation from key Government agencies with institutions that have mandates for carrying out the specific activities being given the lead roles to implement those activities. For example the Department of Resource Surveys and Remote Sensing leads the land cover mapping while KFS and KEFRI lead the biomass estimation.

A series of collaboration meetings were held with the assistance of the FAO UN-REDD Technical Support and identified that in respect of the NFMS:

1. SLEEK **WILL** create the sustainable approaches for:
    - Land Cover Classification of forest and non-forest is being delivered with 2010 and 2014 completed and each two years from 1990 contracted to be completed by November 2016 – 17 maps in all. The work includes a manual on Land Cover Classification and a process manual;
    - Land Cover Change Detection for deforestation/reforestation through assessment of non-forest, forest and classification into strata.

2. The work of SLEEK in remote sensing analysis **WILL NOT** deal with the other aspects of REDD+ which will need to be developed for the NFMS in terms of working out the measurement, recording and reporting, namely:
   - Reducing emissions from forest degradation
   - Conservation of forest carbon stocks
   - Sustainable management of forests
   - Enhancement of forest carbon stocks

3. Other aspects **NOT** being delivered by SLEEK are:
   Reference Level for forests
   - Establish the historic time period during which emissions will be estimated,
   - Consider REDD+ requirements for identifying areas of deforestation and forest degradation,
   - Identify significant pools using Key Category Analysis,
   - Calculate the carbon stock change on areas defined as deforestation,
   - Calculate the carbon stock change on areas defined as degradation,
   - Assess the uncertainty related to the Reference Level,

   Conduct in-depth analysis, description and decisions on:
   - Drivers of deforestation,
   - National circumstances,
   - Historical reference emission level,
   - Land use and forestry policies for reference levels.

More specifically the SLEEK and other projects have not finalised the work related to emissions factors including:

1. Partitioning of carbon into various tree sections
2. Allocation of carbon losses to various management activities (what is removed during 1st pruning, 2nd pruning, 1st thinning etc.)
3. Litter decomposition rates
4. Disturbance processes and their effects on the carbon balances
5. Growth curves for the various forest strata specifically in natural forests, establishment of baseline stocks on which the model will run etc.

As such, some global data sets will be used in the interim.

7. Status of the Three Pillars: NFMS, ICFRA and SLEEK

	Notes	Documentation and Sources
Pillar 1: A Satellite Land Monitoring System		
	SLEEK has been the lead on this Pillar with DRSRS having the mandate and taking over the work of procesing and preparing the satellite data for use. Land Cover Classification of forest and non-forest is being delivered with 2010 and 2014 completed and each two years from 1990 contracted to be completed by November 2016 – 17 maps in all. The work includes a manual on Land Cover Classification and a process manual. Land Cover Change Detection for deforestation/ reforestation through assessment of non-forest, forest and classification into strata.	DRSRS has the data and the products as the mandated agency. SLEEK is preparing final reports, status updates and an improvement strategy for the system. Those products are anticitpated to set out the information on progress, data sets and custodianship.
Pillar 2: National Forest Inventory (NFI/FRA)		
	The Kenya Indigenous Forest Conservation Program (KIFCON) provides the earliest systematic forest inventory in Kenya and extensively covered 15 blocks of indigenous forests of Kenya in the period 1990 - 1994. An NRM funded project carried out a national inventory of all plantation forests in the country in the period 2009 – 2011 which has been used to characterise plantation forest stocking by species, management type and age. The ICFRA has completed its pilot phase including field plots, sampling design and a "National Forest Resources Assessment Field Manual Biophysical Survey Kenya". It also defines sampling for unique forests like mangroves, natural forests and bamboo forests. The pilot project has produced a proposal for the National Forest Resources Assessment.	KFS is the mandated agency for the NFI/FRA KIFCON Data sets being digitised by SLEEK KFS has inventory data from NRM KFS has the data from pilot plots put in by ICFRA KFS has the FRA proposal
Pillar 3: A national GHG Inventory as a tool for reporting		
	UNEP has been supporting Kenya in the development and training for the national GHG inventory. The project was at the national level and not specific to LULUCF.	NEMA is the agency with the mandate for compiling and reporting the national GHG inventory and related reports (NC, BUR)

8. NFMS Tasks and Requirements

The NFMS Road Map is set out below in the form of one table for each task. For each table, the responsible institution is identified and other involved institutions if needed. The Tasks are also reflected in the NFMS Road Map spreadsheet where each task has a tab that contains the steps proposed, indicative budget and timeline.

a. Forest Definition

Description	The UNFCCC requires every party to its convention to have a clear definition of forests that will consitently be used for reporting forestlands and associated land use changes. The definition can be based on country circumstances, the nature of forests in the country, the country's developmental objectives and the anticipated REDD+ programme.
Remarks	Kenya has decided upon a definition of forest for reporting to the UNFCCC. The forest definition for Kenya has been through various discussions since 2011. Guided by these consultations, the REDD+ TWG adopted the agreed definition that defines forests as follows[9]. Forestlands are areas occupied by forests and characterised by tree crown cover ≥ 15%, an area ≥ 0.5 ha and a tree height ≥ 2m. Forestlands also include areas managed for forestry where trees have not attained 2m height but with potential to do so, and areas that are temporarily destocked. Linear arangements of continous trees exceeding 50m are also classified as forests. Forestlands will include plantation forests, natural forests (mangrove forests, bamboo forests, dry land forests, montane and western rain forests), categories which describe forests with different carbon dynamics. The forest lands could be in any of the three land tenure systems described in the Kenya constitution 2010; public land (these are mainly gazetted forests managed by Kenya Forest Service but also include parks and national reserves), private land (refers to forests on parcels owned by people) or communal land (refers to county forests and forests found in communal ranches). This definition captures legends that have been used in other mapping activities (like shrubland, bushland, woodland etc which have been identified in mapping legends of SoK, AFRICOVER and DRSRS.) to fit into the adopted forest definition. This version of the forest definition for Kenya was considered and approved by a Technical Liaison Committee, made up of the agencies with roles and responsibilities for forests and with potential roles in REDD+.
Lead	KFS
Stakeholders	KEFRI, KWS, Ministry of Environment, NEMA, NMK, DRSRS, AWF, CIFOR, Universities, SoK
Schedule	COMPLETED
Budget	NIL
Current status and actions required	1. Definition should be adopted at project level to support future mapping activities and allow adoption of results into NFMS. 2. An adoption of the definition in all sectors will also harmonise reporting on the trends of Kenya including among the media and in the County governments

[9] This definition of forests has been adopted in the Land Cover Change process of SLEEK and also the ICFRA forest inventory project.

b. Land Use Categorization

Description	The 2006 IPCC Guidelines require that GHG emissions and removals from Agriculture, Forestry and Other Land Use (AFOLU) are reported in six land use categories: Forest Land, Cropland, Grassland, Wetlands, Settlements and Other Land. REDD+ can be applied only in those areas classified as Forest Land either in public or private lands. For REDD+ a clear understanding of the various land categories (the six classes) and the subcategories in each land use class are important in describing specific forestland transitions and the associated emission or sinking equivalents/factors.
Remarks	The REDD+ TWG has adopted the use of the land use categories defined by IPCC to identify land use transitions associated with forestlands. In Kenya, Forestlands have been subcategorised as described in the forest definition and forest stratification sections. Croplands and grasslands have also been subcategorised: Sub categories of Croplands are perennial shrub crops (e.g tea and coffee), agroforestry and annual herbaceous crops (e.g. monocultures of maize and wheat) while for grasslands open grasslands and wooded grasslands have been defined. Noting the agricultural policies that seek to enhance tree cover on farms[10], the REDD+ TWG discussed extensive cropping of tree crops like mangoes, cashewnuts and avocadoes and noted that the land management objective is to enhance food security and sustainability of agricultural lands but not forestry expansion. It was agreed that tree only pPlantations on farms that are not for agriculture that meet the forest definition shall be included in forestlands. Only if the vegetation has a 'value' in terms of REDD+ can it be considered as a forestland. In respect of tea and coffee which are managed purely for agriculture, they should not be included in REDD+. The TWG also noted that the separation of the sub-classes is currently being done by a semi-automated computer programme that uses a supervised classification algorithm based on similarity of features on a satellite image. The accuracy of this method depends on the technical skills of the mapping team and also the ground information
Lead	NRCO
Stakeholders	KFS, KEFRI, KWS, Ministry of Agriculture, NMK, DRSRS
Schedule	Initiated Q2 for completion end Q4 of Yr1
Budget	US$10 000
Current status and actions required	The basis for land use categorization is the difference in carbon stocks among land uses and the associated fluxes due to land use conversions. An analysis of the Key categories of emissions will guide on a cost effective but accurate system of the stratification

[10] Agriculture (Farm Forestry) Rules, 2009 (Cap. 318).

c. Forest Stratification

Description	The IPCC 2006 guidelines[11] propose that forest lands may be stratified further in order to obtain more homogeneous forest units for which separate estimation/inventory methodologies and conversion factors exist. The stratification may be guided by species, vegetation types, management or agro climatic zones.
Remarks	The REDD+ Technical Working Group, has adopted a stratification that is hierachical. First, Forests are divided into plantations and natural forests. Secondly, the natural forests are categorised into Coastal forests (including mangroves), Dry land forests and Montane (including bamboo) and Western rain forests. Finally the forest are categorised by canopy closure as either dense (canopy closure ≥ 65%), moderately dense (canopy closure between 40% and 65%) and open forests (canopy closure ≥ 15% but less than 40%). These forests can be in any of the three land tenure systems defined by the Constitution of Kenya[12]. The hierachichal stratification allows capturing of the specific details but also allows for generalisation where some levels of stratification may be eliminated. The proposed hierachical stratification is expensive and detailed. Testing of differences among the general and specific strata should be initiated using the currently available inventory datasets to justify the further categorization or generalisation of forests
Lead	KFS
Stakeholders	KEFRI, KWS, Ministry of Agriculture, NMK, DRSRS, REDD+ TWG
Schedule	Initiated Q2 for completion end Q4 Yr 1
Budget	US$20 000
Current status and actions required	Research should be immediately initiated to identify sources of variation among forest strata e.g., does a montane forest differ from a western rain forest or a dry land forest in terms of carbon stocks? Or does stocking in forests differ among canopy classes?

[11] 2006 IPCC guidelines for NGGI: chapter 3- consistent representation of lands
[12] Kenya constitution 2010.

d. Mapping Standards

Description	The IPCCC guidelines for reporting Green House Gas inventories define three approaches for representing land use changes[13]. The spatially explicit land use conversion approach which Kenya wishes to adopt requires a consistent mapping system. All mapping needs to be done in conformance with national standards. This includes attributes of coordinate reference system, legends, sysmbols, scale and resolution, system for ground control points, and also standards related to data collection, analysis, processing and verification.
Remarks	The Survey of Kenya is the institution mandated to verify all maps produced in Kenya based on standards gazetted by the Director of Surveys. These standards have been domesticated from interanational standards. The projection system adopted for mapping in Kenya is the Universal Transverse Mercator (UTM) on the Arc 1960 reference surface. This system divides the country into two zones; 36 and 37. This kind of mapping allows accurate assigning of features into their specific ground positions, therefore minimizing scale distortion. However, the zones do not allow production of a national map unless the zones are harmonised into one. Therefore, the system requires a reprojection of the mapping products to fit into the global data sets or vice versa. The TWG however noted that the Survey of Kenya has proposed a change in Kenya's data projection system to enhance compatibility with regional maps and this may call for an adjustment of all the NFMS datasets. The country is in the process of finalizing a land cover mapping manual to support the estimation of the GHG emissions from the land sector (through the SLEEK programme). The manual captures standards of mapping and also the processes.
Lead	SoK
Stakeholders	REDD+ TWG, KFS, DRSRS
Schedule	COMPLETED. Update Q4 each year
Budget	US$20 000 for finalising manuals
Current status and actions required	Research should be immediately initiated to identify sources of variation among forest strata e.g., does a montane The land cover mapping manual should be finalised and piloted to allow an agreement on the country's mapping procedures

[13] 2006 IPCC guidelines for NGGI: chapter 3- consistent representation of lands

e. Inventory Standards

Description	To facilitate comparison of inventory results spatially and over time, it is advisable for a country to adopt a uniform sampling scheme for forest inventory. A variety of sampling schemes have been proposed internationally[14] and countries adopt a scheme that is suitable to their forest conditions. Such a harmonised scheme may allow integration of different sets of forest inventory data into the NFMS since they have all been collected based on a harmonised scheme and methodology.
Remarks	Kenya, through a consultative process spearheaded by KFS has developed manuals for collection of inventory data for the five carbon pools; soils, below ground biomass, litter, deadwood and above ground biomass, for different forest types. There are also manuals for collection data to develop allometric equations. The ICFRA programme has been instrumental in this support and the manuals have been piloted in a variety of vegetation types and proposed for continous updating. These manuals have also been adopted in the proposed SLEEK inventory processes. In addition, a national forest inventory scheme that defines the major categories of forests and the number of plot data to be generated has been proposed and adopted by the REDD TWG.
Lead	KFS
Stakeholders	REDD+ TWG, KEFRI, KEMFRI, KWS, University of Eldoret, Karatina University, NMK
Schedule	COMPLETED. Update Q4 each year
Budget	US$10 000 per year to update manuals based on need
Current status and actions required	1. The developed manuals should be marketed to all research institutions to allow integration of their inventory data into the NFMS. 2. A process to continuously update of the manuals will ensure they do not get outdated.

[14] FAO - IUFRO, 2004: Knowledge reference for national forest assessments - Sample designs.

f. Land Use Category Mapping Processes

Description	A consistent method of mapping the agreed land cover categories is required for consistent national planning and UNFCCC reporting. Since Kenya has adopted a spatially explicit wall-wall approach on land use categories, there is need for development of a platform that captures information about the land uses of all units of land in the country and such information should be generated using a reliably accurate method at manageable costs. Globally, satellite data of medium resolution (e.g. Landsat) has been proposed as ideal for identification of the six broad categories while ensuring manageable costs.
Remarks	There are initiatives spearheaded by the SLEEK programme of the Ministry of Environment to generate time series, wall-wall maps based on satellite datasets. A complete set of landsat satellite data has been provided free by the GFOI for the period 2000 – 2014. In addition, high resolution imagery from SPOT has been used to update the Google earth images for areas of higher interest (e.g. the forested areas of the high potential zones of Kenya where deforestation and degradation and also afforestation activities are concentrated). There were also wall-wall satellite data sets from the Japanese ALOS AVNIR images for 2010 provided to KFS through the FPP programme. MODIS data though low resolution is also available for download on daily basis. In addition to the present support from the GFOI, a few Kenyan's have been trained on methods of reviewing global libraries of satellite data coverage using the COVE tool developed by CEOS, and dowloading them and also processing them into formats that can generate land cover maps. Ancillary datasets that have been used for supporting mapping have been availed from the mapping institutions in Kenya such as DRSRS, RCMRD and KFS but some have been sourced from Global datasets like those of the FAO and WRI. In terms of tools and software for processing land cover maps, the TWG noted that there has been bias towards using open source and freely available software, an approach that will support sustainability of the mapping programme. Already a few people have been trained on the use of Quantum GIS and R software and these have been used for producing the 2010 and 2014 maps under the SLEEK programme. The TWG noted that there were maps developed by KFS through the FPP programme for the years 1990, 2000 and 2010 but these were done using a manual procedure that may be too expensive and difficult to sustain. The maps were assessed by the FAO UN-REDD project in support ot KFS and confirmed as accurate representations of forest cover for the years mapped but inadequate for change detection. Such maps have been incorporated as part of the ancillary data for the ongoing mapping. With the available tools and datasest, the TWG noted that the REDD+ programme can obtain time series verified maps that can be used to generate transition matrices associated with forestlands. The TWG also noted that the process of separation of the sub-classes is being done by a semi-automated computer programme that uses a supervised classification algorithm based on similarity of features on a satellite image. What appears on the image is confirmed through ground truthing to validate tha maps. The maps are also peer reviewed by a team of experts. The TWG noted that preliminary maps for 2010 and 2014 have been generated and the process of ground truthing is ongoing.
Lead	DRSRS
Stakeholders	REDD+ TWG, KFS, KEFRI, KWS, Ministry of Environment, NMK, JKUAT

f. Land Use Category Mapping Processes

Schedule	Continuous for Yr 1 then update Q1 each year
Budget	US$100 000 per year
Current status and actions required	1. There is need to train more people in mapping to ensure there is a pool of mapping technicians in the government to ensure the sustainability of the programme. 2. There is need to carry out extensive research and verification exercise that certifies the produced maps based on ground data.

g. Mapping Land Use Change

Description	A system for consitent representation of lands estimates GHG emissions based on the land use conversions and the ground forest change data[15]. A method that accurately detects changes in land use informs the areas of transition. For purposes of REDD+, relevant transitions include forestlands remaining forestlands, forest lands converted to other land use types and other land use types converted to forest lands.
Remarks	The TWG noted that the SLEEK programme of the Ministry of Environment has proposed a land cover change monitoring system that uses time series land cover maps. Under the SLEEK programme, a pixel based land cover monitoring has been proposed and this monitors each pixel over time and assigns it a land use code. Changes in these codes imply a change in the land use. It was noted that through the FAO support and the SLEEK programme, a number of officers have been trained on the use of open source methods (such as collect earth) in detecting changes and enhancing production of accurate land cover change maps. Guided by the SLEEK land cover mapping programme, the REDD+ TWG adopted year 2014 as the base year for monitoring changes due to the possibility of doing an accurate ground truthing. This is the year on which changes will be based chronologically both historically and in future. It was noted that realistic changes in forest cover should be monitored since 1990. However, noting the technolocal requirements year 2000 may be adopted to ensure use of a consitent set of satellite imagery. The TWG proposed a 4 year cycle of land cover change mapping which follows the international requirements for reporting to the UNFCCC. The TWG adopted the method of extrapolating or interpolating of information in years where mapping cannot be done but also appreciates the SLEEK vision of a yearly wall-wall annual pixel based analysis from 2000.
Lead	DRSRS
Stakeholders	REDD+ TWG, KFS, KEFRI, KWS, Ministry of Environment, NMK, JKUAT
Schedule	Continuous process throughout the 4 years
Budget	US$100 000 per year
Current status and actions required	1. There is need to explore the various techniques of change detection to ensure accurate emissions are reported. 2. There is need to consider products from initiatives like GFOI/NASA data cube for Kenya and the FAO cloud based Space Data Management System (SDMS) for forest change detection.

[15]NFMS Chapter 5 of the FREL. UN REDD Academy learning journal

h. National Forest Inventory

Description	A National Forest inventory provides information about a country's forests and their stocks and is important for decision making (at national and sub-national levels) and for monitoring in forestry and other land use sectors. An NFI involves the collection of forest data and their attributes and can be the basis on which monitoring of such forests is anchored. When done periodically, a NFI helps in determining forest stock changes, change attributes over time and over space and can help identify drivers of such changes. This information is important for REDD+. However, an NFI is expensive ad may not be sustainable for Kenya. The IPCC guidelines propose forest stratification for sampling. In addition use of a combination of temporary and permanent plots enhances accuracy while reducing cost.
Remarks	The Kenya Indigenous Forest Conservation Program (KIFCON) provides the earliest systematic forest inventory in Kenya and extensively covered 15 blocks of indigenous forests of Kenya in the period 1990 - 1994. The SLEEK program is digitising these inventory datasets to allow their integration into the national forest inventory datasets and possibly use them for defining the forest stocking levels of the country. Apart from the periodic inventories for commercial purposes done in plantation forests of Kenya, an NRM funded project carried out a national inventory of all plantation forests in the country in the period 2009 – 2011 which has been used to characterise plantation forest stocking by species, management type and age. The availability and quality of the data has been difficult to determine. Much of the data has been lost or appears to be poor quality. A pilot of a National Forest Inventory focused on the REDD+ objectives has been done through the ICFRA programme and a sampling scheme prepared to implement the full NFI including the marking of permanent sample plots. The inventory has been done based on the nationally adopted manuals and covers the five carbon. It also defines sampling for unique forests like mangroves, natural forests and bamboo forests. The REDD+ TWG noted that an NFI is important in the country's NFMS and FREL. It also noted that preparations for an NFI are adequate and funding to implement these activities should be sourced.
Lead	KFS
Stakeholders	REDD+ TWG, KEFRI, KWS, University of Eldoret, Karatina University
Schedule	UNSCHEDULED - This should be commenced as soon as funding is available
Budget	US$3 000 000 Based on ICFRA budget
Current status and actions required	1. A sampling scheme has been adopted and is documented in the Manual and Proposal prepared through the ICFRA Pilot Project[16]. 2. Sourcing for funding should be initiated immediately (there is no clear interest from existing donors). 3. Collection of data from the permanent sample plots should set a basis for carbon change calculations.

[16] Natural Resources Institute Finland (Luke), Kenya Forest Service (KFS), Kenya Forestry Research Institute (KEFRI), Department of Resource Surveys and Remote Sensing (DRSRS), University of Eldoret (UoE), 2015. National Forest Resources Assessment Field Manual Biophysical Survey Kenya;
Natural Resources Institute Finland (Luke), Kenya Forest Service (KFS), Kenya Forestry Research Institute (KEFRI), Department of Resource Surveys and Remote Sensing (DRSRS), University of Eldoret (UoE), 2015Proposal for National Forest Resources Assessment (NFRA) in Kenya

i. Development of Allometric Equations

Description	In calculating emissions associated with forest area changes, specific values of forest forest carbon per unita area are needed[17]. Allometric equations give relationships between easily measurable tree or forest parameters with difficult to measure variables like Carbon and biomass[18]. There are generalised global equations that refer to regions but these can only be used in Tier 1 reporting. A country like Kenya wishing to report at Tier 2 and 3 is encouraged to use locally developed and verified allometric equations.
Remarks	The REDD+ TWG noted that there are many allometric equations that have been developed or used in Kenya. Many such equations are available in publications and at least 52 are listed in the Globallometree dataset. There are also some equations that have historically been used by KFS for commercial timber valuation. Some equations have been used in carbon projects specifically in Kasigau and in the Mangroves of the South Coast. There is also a wealth of data on tree density that is available at KFS and other research institutions. Some of the limitations identified with the allometric equations include lack of meta data that defines their agro ecological range, the sample size used to develop them, the tree components they represent and the range of diameter sizes applicable for their use. Under the ICFRA programe, a manual for collecting data for developing allometric equations has been finalised and piloted. Officers from KFS and stakeholder institutions have also been trained on the process of analysing data for developing equations but such capacity is also resident in forestry training institutions and universities. The TWG noted that, due to the many species found in the natural forests of Kenya and the variety of stratification levels that have been proposed an effort to develop representative allometric equations may be very taxing and expensive. It was proposed that generalised equations should be explored for application into the specified forest strata as opportunities for widescale research are being explored. In plantation forests, it was agreed that effort should be focused towards the major plantation species: *Cuppressus lusitanica, Pinus patula and Eucalyptus.*
Lead	KEFRI
Stakeholders	KFS, KEMFRI, KWS, University of Eldoret, Karatina University
Schedule	Immediate start and continuous work for years 1,2 and 3
Budget	US$500 000 Based on ICFRA budget for a rigorous research programme
Current status and actions required	Research institutions to prioritise to provide data for new allometric equations and pooling into generalised equations

[17] NFMS Chapter 5 of the FREL. UN REDD Academy learning journal
[18] Henry, M., Picard, N., Trotta, C., Manlay, R.J., Valentini, R., Bernoux, M. and Saint-André, L. (2011) Estimating Tree Biomass of Sub-Saharan African Forests: A Review of Available Allometric Equations. Silva Fennica, 45, 477-569. http://dx.doi.org/10.14214/sf.38

j. Internal Verification (QA/QC)

Description	The information reported to the UNFCCC has to be accompanied by an estimate of the uncertainty that indicates the accurateness of the provided statistics. The Good Practice Guidance of the UNFCCC[19] aims at ensuring that the reported values of GHG fluxes have some levels of confidence by a QA/QC system. Internally, the procedure of data collection follows a Quality Assurance process which ensures that data is collected using properly described procedures developed using a combination of sound scientific basis and field conditions. Such data is also quality controlled by an independent dataset to ensure that it is neither biased nor exergerated.
Remarks	The REDD+ TWG noted the progress in development of quality assurance procedures through development of process manuals in land cover mapping and forest inventory. Such manuals have been developed using the IPCC good practice guidance and the MDG document of the GFOI. The manuals have also been developed in consultation with international experts in mapping forest (SLEEK and JICA) inventory (SLEEK and ICFRA) and soil analysis (SLEEK and ICFRA). These manuals comprise a Quality Assurance compent for REDD+ reporting. The TWG noted the role of KEFRI as a Quality Control unit in the FPP and ICFRA programmes since this is the expert institution in forest research. Such support can also be provided by the universities offering forestry programmes. It was noted that universities offering Remote Sensing and GIS courses could also provide the quality control support to the mapping processes.
Lead	KEFRI
Stakeholders	REDD+ TWG, KFS, JKUAT, University of Eldoret , Karatina University, KNBS, KARI, KEMFRI
Schedule	Information analysis and internal verification are continuous activities throughout the 4 years.
Budget	US$50 000 for each set of mapping and inventory
Current status and actions required	1. The manuals for land cover mapping have not been finalised. 2. Manuals for biomass data need periodic updating.

[19] GPG for Lulucf: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/GPG_LULUCF_FULL.pdf

k. Prepare Carbon Map

Description	Monitoring carbon fluxes can only be possible if information on the carbon stocks in a base year are known. The fluxes are then calculated based on what has changed from this base year or the subsequent years. Therefore, there has been a global effort to generate carbon maps which stratify areas based on stocking. Such maps have been done for different pools, using different methodologies and are either global, regional or country specific[20].
Remarks	Kenya like the rest of the world is a beneficiary of the several global efforts to generated carbon/biomass maps[21] . For example the UNEP WCMC has generated such a map for Kenya[22] using global data sets. The TWG noted that such maps have not been domesticated in Kenya using ground truthed information and their applicability is not verified. The TWG noted regional initiatives and research teams have developed carbon maps for specific regions which may have higher accuracy but are only applicable for the specific year of data collection and for the study area only. Such maps include the map of Kakamega done by Glenday[23] and the FPP biomass mapping in the Mau forest ecosystem[24]. The TWG noted the need to develop a carbon map for the country to allow a general estimation of the carbon stocks in different land use strata. Such a map would most appropriately be for a base year that can be ground truthed e.g using the 2014 map generated by SLEEK and for which ICFRA and FPP data among others can be used for ground truthing. Such a map could also be for the year 1990 for which we have extensive KIFCON inventory data. In addition such a map can be generated in future and the ICFRA proposed system of PSPs used to ground truth it.
Lead	DRSRS
Stakeholders	REDD+ TWG, KFS, KEFRI, Universities, KARI, KEMFRI
Schedule	A one off activity undertaken throughout Yr 1 on which future carbon maps can be based
Budget	US$100 000 for carbon mapping
Current status and actions required	A discussion on the development of a carbon map should be initiated immediately

[20] Example Saatchi, S., M. Marlier, D. Clark, R. Chazdon, and A. Russell. 2009. Impact of spatial variability of forest structure on radar estimation of aboveground biomass in tropical forests, Remote Sens. Environ.
[21] Example - http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MOP_CO_M
[22] Carbon, biodiversity & ecosystem services: exploring co-benefits http://www.carbon-biodiversity.net/Content/ShortProfiles/Kenya%20Profile%20110408_final.pdf
[23] Glenday, J. 2006. Carbon Storage and Emissions Offset Potential in an East African Tropical Rainforest. Forest Ecology and Management, 235, 72-83. http://dx.doi.org/10.1016/j.foreco.2006.08.014
[24] Kinyanjui, M.J., Latva-Käyrä, P., Bhuwneshwar, P.S., Kariuki, P., Gichu, A. and Wamichwe, K. 2014. An Inventory of the Above Ground Biomass in the Mau Forest Ecosystem, Kenya. Open Journal of Ecology, 4, 619-627. http://dx.doi.org/10.4236/oje.2014.410052

I. Carbon Change Calculation

Description	Two methods have been proposed for calculating changes in net carbon from a unit of land at two instances in time[25] for the total carbon from all the five pools. The "stock change" method uses data from two inventories done at two time instances. The difference between carbon stocks at the two instances is either the emission or the sink. The "gain loss" method uses data from a base year and models carbon changes based on processes of emission and removal. In developing countries where NFI are not done periodically, the gain loss method is preferred. However, the method may require many inputs based on biotic and abiotic factors.
Remarks	Kenya, like other developing countries does not have historical data from periodic forest inventories. Where such data exists, the sampling schemes differ and this may be the cause of variations in the results of the inventories. The REDD+ TWG noted that the most intensive forest inventory was by KIFCON in the early 1990s and this forms a basis for identifying changes on a stock differenc approach if a similar sampling was to be done on the same data points. In the forest plantations, the NRM data collected tree ages and this also forms a basis for monitoring tree carbon gains among species and agroecological zones. The TWG noted that there are diverse processes that influence changes in forests and other land uses of Kenya. Such factors like land ownership, legal and illegal removals, wildlfe damage and contrasting management objectives make it complex to model or automate changes using a process based approach. The TWG discussed the use of a stock change approach for REDD+ which may provide more accurate results but may be more expensive to actualise. It was noted that the NFI has proposed a scheme of PSPs which should provide data at least at 4 year intervals and this data should be adequate to develop a stock change approach to carbon calculation.
Lead	NRCO
Stakeholders	KFS, KEFRI, DRSRS, REDD+ TWG, University of Eldoret, Karatina University, JKUAT
Schedule	Development and calculation considering the existing work by SLEEK throughout Yrs 1,2 & 3.
Budget	US$100 000 yearly for Capacity buidling and monitoring the PSPs
Current status and actions required	The process of setting up PSPs as proposed in the ICFRA programme should be initiated and initial data collected to allow for time series monitoring

[25] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Chapter 4 forestland.

m. Developing National Accounts

Description	Accounting is the compilation of datasets from various sources to show GHG fluxes by sources and sinks. In forestry, this is often the compilation of land use change information with the forest inventory data that associates emission factors to each unit of land use change. For purposes of REDD+ the UNFCCC principle of completeness should ensure coverage all land units, data from all sources and sinks and coverage of all possible gases. Noting that though emissions of all GHGs are important, and most emissions from the Land Use, Land Use Change and Forestry (LULUCF) sector are Carbon Dioxide (CO_2), EFs are measured in tonnes of CO_2 equivalent (tCO_2e)[26]. The other UNFCCC principle of accounting Transparency, Consistency, Comparability, and Accuracy should also be ensured when upscaling national estimates estimates. The data should then be summarised in the specific formats e.g. the Common Reporting Format (CRF) tables used in GHG inventory summaries or the Common Tabular Formats (CTF) used in National Communications and Biennial reporting. A periodic compilation of such data is helpful in developing trends such as the Forest Reference Emission Level.
Remarks	The collection of forest inventory data, development of allometric equations and mapping of land uses are ongoing processes in Kenya and will provide information for developing an accounting system. The TWG took note of the Full Lands Integration Tool (FLINT) being developed by the the SLEEK programme of the Ministry of Environment, and which is a generic system that integrates remote sensing and ground data through country specific models and systems. The aim is to have a generic framework that Kenya can use for land based emission estimates. Since the FLINT can generate time series emissions, it is possible to model the emissions into the future. The FLINT proposes to use models and data sets generated locally in Kenya and this will help develop Tier 3 reporting. The REDD+ TWG noted the variety of forest types in Kenya, the possible transitions and the drivers of change and how each of these influences emission factors. It was noted that the efficiency and acurateness of the GHG estimates provided from an accounting system will depend on the data quality that is fed into the system. It therefore calls for accurate procedures of data collection, mapping and change detection through a collaborative process. This reiterates the need for an efficient QA/QC system. The FLINT can be described as a complex and higher tier model. The UNFCCC[27] notes that the use of these higher tier methods, complex models or plant specific measurements or estimations may have improved national inventories. However, they demand strong transparency of methodshighly credible results. As such, the UNFCCC approves models that it considers appropriate for use because they combine transparency and credibility of results. The TWG therefore understands the caution for using higher tier models and noted the need for extensive research to accurately capture GHG fluxes. The REDD+ programme also has the option of using other UNFCCC accredited models to generate its estimates. Such models include the IPCCC model and the ALU model.

[26] Decision 14/CP.19 Paragraph 4– Cancun agreements: "Agrees that the results of the implementation of [REDD+] activities, measured against the forest reference emission levels and/or forest reference levels should be expressed in tCO2e/year".
[27] https://unfccc.int/files/national_reports/application/pdf/course_on_review_of_higher_tiers.pdf

Lead	NEMA
Stakeholders	REDD+ TWG, KFS, MENR, KEFRI, DRSRS, Universities
Schedule	A trial is being done by SLEEK and this anactivity scheduled for Q4 each year.
Budget	US$10 000 yearly to compile REDD+ related accounts
Current status and actions required	Research on GHG fluxes and Emission factors should be enhanced to capture the variety of conditions in the country

n. Drivers of Forest Change

Description	In REDD+, 'drivers' are defined as actions and processes that result in deforestation and forest degradation. It is important to understand the key Drivers of Deforestation and Forest Degradation for national REDD+ strategies and/or action plans and the formulation of policies and measures. Drivers can be direct or indirect. Direct drivers are activities that directly impact forest cover and loss of carbon. Indirect drivers refer to interactions that may influence changes in forests. They could be social, economic, political, cultural or technological processes. They do not only refer to actions on forestlands but also actions in other land uses that may influence forestlands.
Remarks	A study on drivers of deforestation commissioned by KFS has been completed[28] to support the understanding of factors that influence changes in forests of Kenya. Further studies by the UNEP WCMC have been done to understand the manifestation of such factors and facilitate their ranking in different land uses of Kenya. Within its forest management mandate, the KFS also has records of some drivers of change in some areas. Such drivers include fires, legal and illegal logging, pest and disease effects. The development and implementation of management plans with CFAs is also a major source of information on drivers of change. The REDD+ TWG noted that drivers of change keep on changing depending on the country's development phase and development priorities. For example in Kenya, the current drivers of change are more towards urbanisation as compared with excisions of 1990s. What is largely driving deforestation today is more about infrastructure – expansion of roads (e.g the LAPSSET project), the construction of the Standard gauge railway, irrigation projects, Urbanizations and growth of towns etc. some indirect drivers could be related to policies like the expansion of agricultural areas and the energy policy of rural electrification. Therefore it is important not only to understand the drivers of change but also the history of transition of these drivers. Therefore the TWG recommended that the report on drivers of change prepared by KFS in 2013 may need to be revised to capture other emerging issues including Oil and coal exploration, irrigation projects, and other infrastructural development.
Lead	KFS
Stakeholders	REDD+ TWG, KEFRI, KEMFRI, NMK, Ministry of Agriculture, CFAs, NGOs and CBOs, Universities.
Schedule	Develop assessments of drivers of change then periodically update from Q2 to end Yr 3.
Budget	US $12 000 yearly to update on drivers of change
Current status and actions required	1. A periodic analysis of drivers should be programmed to capture the changing trends of drivers and their manifestations over time and in different regions of the country. 2. A mapping of drivers should be done to show their spatial manifestation and enhance development of PAMs to address them.

[28] Analysis of drivers and underlying causes of forest cover change in the various forest types of Kenya. Ministry of forests and wildlife 2013.

o. Policies and Measures for REDD+ Implementation

Description	Policies and Measures (PAMS) in REDD+ can be described as actions taken or mandated by the government to guide the implementation of REDD+ activities (emissions reductions and/or removals), as decided by the country. The PAMS do not work in isolation (i.e for REDD+ gains only) but are designed to potentially support other government objectives. Such objectives may include food security, envirnmental protection, integrated rural development and sectoral transformation, enhancement of energy efficiency, rural electrification, dryland afforestation and diversification of production. The policies should address the five REDD+ activities of: 1. Reducing emissions from deforestation; 2. Reducing emissions from forest degradation; 3. Conservation of forest carbon stocks; 4. Sustainable management of forests; and 5. Enhancement of forest carbon stocks.
Remarks	The RPP that defines the proposed REDD strategy in Kenya considered policy development as a core issue to the success of the REDD+ programme. The REDD+ TWG noted that policies regarding the implementation of REDD+ are largely documented within the policies and laws of Kenya. For example, The Kenya constitution 2010, the Environmental Management and Coordination Act, the Draft Forest Bill, the Wildlife Conservation and Management Act, the proposed land use policy and the Community Land Act and the Water Act are all examples of policies that have provisions that directly address REDD+ related activities. This aspect requires on some initial analysis and then interaction and coordination with the relevant leading Ministries.
Monitor	NRCO
Stakeholders	KFS, Climate Change Secretariat, Ministry in charge of Forests, Ministry of Planning, Ministry of Agriculture, Attorney General's office REDD+ TWG
Schedule	Initiated in Q2 Yr1 and developed though to end Q2 Yr 3
Budget	US$40 000 yearly to monitor effects of PAMs on emissions
Current status and actions required	
	An immediate analysis of PAMS and their methods of measurements should be initiated. 1. Identify the PAMS within government laws that directly address drivers of change 2. Identify drivers that have no policies addressing them and may require special PAMs to be documented or enacted 3. Identify ways of measuring the impacts of these PAMS for each driver based on existing data collection procedures or new proposed procedures. 4. Identify suitable proxies for monitoring effects of PAMS specifically for indirect drivers 5. Link the PAMs information to the information system to provide periodic information about their performance

p. Providing Information on Safeguards

Description	The UNFCCC requires all countries implementing the REDD+ mechanism to provide information on how safeguards are being implemented. The safeguards[29] are generally about ensuring that implementation of REDD+ does not compromise national laws, the rights of the local and indigenous communities, participation of relevant stakeholders, conservation of ecosystems and biological diversity and sustainability beyond REDD+ incentives. The information on safeguards needs to be linked to the Socio and Environment Strategic Assessment (SESA) and the discussion on UN REDD socio principles is under way with support from UNEP.
Remarks	In Kenya, many of the safeguards are already in place through existing laws, policies and practices. The requirement from the UNFCCC is not to report on the safeguards themselves but rather to provide information on how Kenya is implementing the safeguards. This can be demonstrated, for instance, through the existing policies for REDD+ implementation which are defined in Kenya's RPP. The safeguards can be implemented largely using the data in the information system, such as the registry of REDD+ projects and participants. An internal M&E system, a system for dealing with grievances and disclosure and communication protocols will be necessary elements of the National REDD+ Programme and these can likewise contribute to providing information on respecting the safeguards. The Kenya Constitution 2010, the Environmental Management and Coordination Act, the Draft Forest Bill, the Wildlife Conservation and Management Act, the proposed land use policy and the Community Land Act and the Water Act are all examples of policies that have provisions that directly address several of the safeguards issues related to REDD+. The TWG noted that there is an ongoing process to document safeguards in Kenya as documented in the existing laws and the related effort would be to ensure the NFMS process remained informed and communicated effectively to the broader REDD+ efforts on Safeguards.
Monitor	NRCO
Stakeholders	KFS, Ministry of Environment, NEMA, CCS
Schedule	Participation in their development starting Q2 Yr1 through to end Yr3.
Budget	Participation in their development starting Q2 Yr1 through to end Yr3.
Current status and actions required	Link the safeguards to the information system to ensure the documented safeguards are properly reported and monitored

[29] Decision 1/CP.16: The Cancun Agreements

q. Benefit Sharing

Description	REDD+has been defined as an effort to create a financial value to the carbon stored in forests by supporting developing countries to receive results-based payments for results-based REDD+ actions[30]. Ensuring that the received benefits are shared equitably among participating actors is key to ensure the success of the REDD+ actions. Therefore an efficient NFMS should link benfits for REDD+ actions to the positive effects of the actions
Remarks	Benefit sharing is an issue enshrined in all environmental laws in Kenya though for purposes of REDD+ it may require further consulation. Already the UNDP is supporting an ongoing activity for options of finance distribution on REDD+ in Kenya. The Kenya constitution notes the role of the local communities in environmental conservation. In recognising the role of forest adjacent communities, the Forest Act 2005 recognises participatory forest management and the formation of community Forest Associations. Each of the 150 forest stations of Kenya has an CFA and many of them have signed management agreements for the adjacent forests with KFS. Such agreements stipulate how the communities will benefit from the resource. Similar institutions that are made up of local communities and formed for purposes of co-managing and co-benefiting from the local natural resource are found in the draft wildlife conservation bill and also the Water Act It is not clear how the metrics of benefit sharing will be arrived at under the REDD+ programme. It may be based on factors like the carbon emission reductions, the effort in reducing the emissions, the livelihoods of the communities or any other developmental priorities of the government. Similarly, the befits may be in cash or in kind. To ensure equitable distribution of the benefits, it should be proposed that the agency responsible for benefit distribution be completely independent from any agency involved in implementing REDD+ activities.
Monitor	KFS
Stakeholders	REDD+ TWG, Ministry of Finance, Ministry of Planning, CFAS, NGOS, Private Companies,
Schedule	Initiate Q1 Yr1 for completion end Yr3.
Budget	US$100 000 to plan and implement a sharing mechanism
Current status and actions required	A benefit sharing mechanism should be documented and piloted based on existing laws and benefits that may accrue due to REDD+

[30] REDD+ Rule book

r. Participatory Community Monitoring

Description	REDD+ implementation may rely on communities and developed units in monitoring forest carbon changes. Such communities described as individuals or groups with a stake, interest or right in the forest[31] may include private companies, civil society organizations, indigenous people, forest dwelling communities, forest adjacent communities and small holder farmers. The use of such groups may potentially reduce some costs and enable more frequent measurements and collection of ancillary data and information since the commmunties live with or adjacent to the forest resource. Their participation is also potenitial incentive or motivation to enhance their positive participation in REDDD+ implementation.
Remarks	Community monitoring of forest resources has been piloted in countries like Tanzania. The TWG was given illustrations of the ongoing work by the Friends of the Mau Watershed (FOMAWA), a private company, monitors among tree farming communities adajacent to the Mau forest complex and in Transmara, the Forest Action Network (FAN) runs a programme in which community scouts peridocally provide information on drivers of forest degradation. Such a system can be used as a cheap source of information for a national tree/forest monitoring programme. The TWG noted the National Alliance of Community forest Associations (NACOFA) and the Indigenous Information Network (IIN) as community networks that coordinate communities with interest in forest resources. These communities do not have enough capacity to effectively report on forest resource changes and lacks the financial and technical capacity to collect forest resource information that could support the NFMS. Similarly communities in the coastal region of Kenya like the Kaya forests and those in Arabuko Sokoke were identified as being effective in forest resource conservation including an understanding of forest biodiversity. Involving communities in collection of forest resource data have been adopted in KFS programs specifically the NRM, the FPP and the ICFRA noting that these communities have better knowledge of the forest adjacent to them, can easily navigate through the forest routes and are easy to remunerate. Some of these community members were found to have been very resourceful. It was agreed that community monitoring of forest resources as a joint venture with the technical REDD+ implementation team should be trialled as an option that would minimise on inventory costs. This brings the community closer to the forest and enhances their understanding of the objectives of conservation, privding an incentive to participate in the objectives of a REDD+ programme.
Lead	KFS
Stakeholders	REDD+ TWG, NACOFA, CFAS, NGOS, Indigenous Information Network, Private Companies
Schedule	Should be piloted then expanded to the rest of the country.
Budget	US$500 000 to pilot and expand to the rest of Kenya, initiating in Q1 Yr 1 for completion in Q1 Yr4.
Current status and actions required	A piloting of community carbon monitoring programme should be initiated in several forests

[31]Introduction to stakeholder engagement. Modue No 11 -The REDD+ academy

s. National Circumstances for REDD+

Description	National circumstances refer to country specific factors, conditions, dispensations, priorities, actions or activities that may influence the trend of GHG emissions. Such circumstances may range from government priorities like settlement of indigenous communities in forests to generation and availability of datasets. Decisions 4/CP.15, 12/CP.17 and 13/CP.19 mention national circumstances as an important consideration in the construction of FREL/FRLs and for determining the REDD+ related projects.
Remarks	Kenya, just like other countries, has its specific circumstances that may influence GHG trends. These include: • The history of the forestry sector that was largely production based, creating specific zones of plantation forests. • That Kenya is a developing country whose main objective is to meet the developmental requirements of its population and this may compromise afforestation activities. • The role of mega-fauna like elephants in forest change. • Hosting refugees from other countries and the related compromise to sustainable utilization of wood resources. • The policy to eliminate invasive species that enhance forest cover but compromise biodiversity. • The data sets for Kenya may not be available and may not be of good quality. • Institutional arrangements that change and the impacts on stability of mandates. • Lack of policy to regulate tree cutting in private lands. • The fact that tree crops growing on farmlands are managed under the Agriculture Act. When reviewing this, the REDD+ TWG noted that: i. The aspects of national circumstances as relating to REDD+ is not very clearly understood and needs proper documentation ii. A mapping of the national circumstances is required to identify their influence spatially and over time iii. A few developmental programmes are not backed up by laws and this makes it difficult to integrate them into the definition of national circumstances The TWG noted that Kenya's 1st National Communication, submited in 2001, listed some National circumstances. However these need to be updated and specifically those related to REDD+.
Lead	KFS
Stakeholders	REDD+ TWG, CCS, Ministry in charge of Forests, Mnistry of Planning, Ministry of Agriculture, AG's office, Universities
Schedule	Initiate activity Q2 Yr1 for completion Q2 Yr 3.
Budget	US$10 000 yearly to update the national circumstances
Current status and actions required	An update of the national circumstances should be continued

t. Modelling and Forecasting

Description	Forecasting refers to the prediction or estimation of the of the situation or trend in the future. In this case it predicts the forest cover and stocks as well as associated GHG fluxes or their trends into the future. Forecasting is mainly based on prediction modelling that utilises existing datastes. On the basis of the national circumstances, historical reference level(s), and current land and forest policies a forecast can be made of the forest cover of change trends some period into the future. This forecast is the business-as-usual (BAU) scenario and it does not account for REDD+ interventions. It is on this basis that conservation scenarios that show benefits of REDD+ activities are developed.
Remarks	The REDD+ TWG noted that the Full Lands Integration Tool (FLINT) developed by the SLEEK programme is a generic system that integrates remote sensing and ground data through country specific models and systems. The aim is to have a generic framework that Kenya can use for land based emission estimates. Since the FLINT can generate time series emissions, it is possible to model the emissions into the future. The FLINT proposes to use models and data sets generated locally in Kenya and this will help develop Tier 3 reporting. The right construction of the forecast of the reference level(s) determines to a large extent the benefits that Kenya might accrue from the REDD+ Programme. This is therefore a critical activity that requires testing and verification. Under the support from the World Resource Institute, Kenya has generated maps of possible forest restoration and afforestation areas. This could be used in projecting forest changes over time and can be used to create targets of forest cover for the future. Forecasts may be updated regularly to integrate new data and reflect new or updated policies.
Lead	KEFRI
Stakeholders	REDD+ TWG, KFS, CCS, NEMA, Ministry of Planning, Ministry of Lands, DRSRS, Universities
Schedule	Initated and completed within Yr2
Budget	US$10 000 to do testing on appropriate forecasting models
Current status and actions required	Testing of models should be initiated immediately to enable decision and documentation on the models to be used in Kenya.

u. Reference Emission Level/Forest Reference Level for REDD+

Description	Based on forecasting models, Forest Reference levels illustrate the historical trend of forest cover and/or stock changes which help determine conservation measures. FREL/FRLs are benchmarks used to assess performance from REDD+ implementation: Performance is assessed by comparing emission estimates after REDD+ implementation with the FREL/FRL(s). A Forest Reference Emission Level (FREL) includes activities that reduce emissions only. Thus the scope of a FREL would be, for example, reducing emissions from deforestation and/or forest degradation. A Forest Reference Level (FRL) on the other hand includes both activities that reduce emissions and activities which increase removals. Thus the scope of a FRL could include the same activities as a FREL plus for example enhancement of forest carbon stocks. Development of FREL/FRL should be based on a set of historical data whenever possible that sets out the changes over time in area of land uses (AD), and of the emissions resulting from those changes (EF) particularly for forest. For reducing emissions from deforestation, the forests reference level can be based on the interpretation of satellite imagery and areas of change. For forest degradation this is typically much more difficult and requires periodic inventory data or other such modelling. In determining degradation, information from the drivers of forest degradation may be appropriate. Under the CDM, reference levels are proposed to cover at least 20 years Historical reference levels should be updated with data that has been collected using a consistent method across time. This includes land cover mapping, satellite imagery and land cover change detection methods. As time progresses, historical reference levels should be updated with the most recent data on forest resources. Analysis of historical data – e.g. satellite imagery – should be agreed; means of testing accuracy of historical outputs especially where there is no matching secondary data, should be based on agreed assumptions. The following key elements need to be considered by countries when developing FREL/FRLs: • Forest definition; • Data: How historical data have been taken into account both forest change and emissions from change; • Scope: REDD+ activities, pools and gases included in the FREL/FRL;
Remarks	The REDD+ Technical Working Group has discussed the development of Kenya's FREL and FRL. The TWG noted that under the SLEEK time series land cover mapping including ground data verification, Kenya can develop historical forestry trends. However the construction of the FREL/FRL is also forward looking and factors that influenced the forest trends may no longer be current or may not apply in future. Therefore the development of the FREL/FRL is very much dependent on the analysis of drivers, national circumstances and the PAMs for REDD+ implementation. The TWG noted the following as relevant steps towards constructing the FREL/FRL: 1. Decide on the reference period and develop a historical trend of forests based on satellite imagery and ground data, 2. Using the base year and develop a forest/GHG projection to the future without PAMs, 3. Gather information on national circumstances and their influence on the forest/GHG trend, 4. Identify the PAMS that are in place or will be implemented to reduce GHG emissions, 5. Model the forest/GHG trend with PAMs to propose the effect of the PAMs on GHG emission reductions.
Lead	KFS

Stakeholders	REDD+ TWG, DRSRS, KEFRI, Ministry of Environment, CCS
Schedule	This is an ongoing activity, commencinc Q1 Yr 1 for completion in Q4 Yr 3.
Budget	US$10 000 yearly to support development of trends.
Current status and actions required	1. Kenya needs to define the base year for its construction of the forest reference level, considering the options to ensure REDD+ benefits for the country and the ability to generate historical information as derived from the land cover change mapping. 2. Due to the manifestation of drivers of change which differs spatially, the country may be divided into regions, forest reference levels generated per region and an average of the country made

v. Project Registry

Description	A REDD+ National Strategy and Action Plan requires a clear documentation of the roles and responsibilities of the actors. A registry of the actions, kind of actions, the actors, their locations scale of implementation, benefits sharing mechanisms etc are items that can be documented in a registry.
Remarks	Kenya has not had a discussion on the REDD+ registry mainly because the REDD programme has not commenced. It was noted that the development of the REDD+ website is ongoing. The KFS has established a Forest Information System which is documenting the status of the different forests of the country. The FIS is tasked with generating and maintaining a database with georeferenced information about all forest resources. Such data includes plantation inventory data, data from natural forests, fire information, disturbance data and data on forest management. The FIS is well equipped in terms of office space, hardware, software and human resources and can host the REDD+ registry. Several programmes including the MMMB, FPP, SLEEK and the FAO UN-REDD have supported the FIS in terms of hardware, software and human resource to enhance its capacity and ability to provide information which is a benefit for the NFMS. Though this could serve as the REDD+ registry, the TWG observed that REDD+ activities may be obscured by the KFS management priorities.
Lead	KFS
Stakeholders	REDD+ TWG, CCS, Ministry of Environment, Ministry in charge of ICT, CFAS, NGOs,
Schedule	Develop starting in Q1 Yr 1 for completion Q2 Yr 3
Budget	US$20 000 per year for 4 years to support the infrastructural development
Current status and actions required	There is need to urgently prepare a REDD+ Registry design. This includes providing information such as: 1) What kind of information is domiciled, where and in which format? 2) Does the FIS provide a platform for the REDD+ registry or it will be overwhelmed with other responsibilities? 3) What are the limitations of use in terms of whom, when, rights and privileges of use? 4) What other systems and source of information does the registry connect to?

w. REDD+ Information System

Description	The National REDD+ Programme may develop a system that collects data from the sources, stores it and disseminates it to the relevant sectors. Such a system may have the MRV capacity. The system should have appropriate levels of accessibility for different users, stakeholders and the general public to ensure the integrity and management of the data sets while being able to inform users. The system should avail REDD+ information to all relevant stakeholders, as per the UNFCCC Decisions[32]. This accessibility can be achieved through a web-based interface.
Remarks	Kenya has targetted to develop a REDD+ information system that is capable of doing Measurments Reporting and Verification. This system can integrate activity data from inventory and remote sensing with the drivers of change, PAMS, national circumstances, safeguards and benefit sharing mechanisms. The TWG reviewed information from such systems like the FLINT in SLEEK which is under development. The FLINT integrates activity data from inventory and remote sensing and links it to attributes of change and emission factors to generate GHG fluxes at a pixel level. The TWG was informed of an envirnmental monitoring system developed for the Mau forest complex[33] but whose implementation has not kicked off. This system has not been piloted and therefore its applicability is unknown. There is also the proposed GFOI/NASA datacube which is expected to use inventory and remotely sensed data to generate emissions and hopes to be linked to policies. The TWG was informed of the REDD+ website that has been developed within the KFS website and has been displaying information about REDD+. Noting the uniqueness of the REDD+ programme and the need to make its information available to the local and international community, the TWG proposed the strengthening of the REDD+ website to make it relevant, updated and informative. Noting that all the reviewed information systems are in stages of development, the TWG proposed further discussions on the design of the REDD+ information system.
Lead:	KFS
Stakeholders	REDD+ TWG, Ministry in charge of ICT, KNBS
Schedule	This is an ongoing activity throughout the project.
Budget	US$100 000 to design a system and US$ 10, 000 yearly to maintain the system
Current status and actions required	Discussions on the design of the REDD+ information system should be initiated immediately with decisions documented so the system can be developed.

[32] Modalities for national forest monitoring systems. Decision 11/CP.19: http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf#page=31
[33] Consultancy services to develop an environmental monitoring system for the Mau Forest Ecosystem 2013. AESA East Africa Ltd

x. International Reporting

Description	The UNFCCC agreements oblige Annex 1 countries to make yearly GHG reporting, National Communications after every four years, and biannual reporting to indicate compliance. In promoting transparency and accountability, Non annex 1 countries like Kenya are also encouraged to provide periodic national communications. The Government of Kenya has to report regularly on its National GHG Inventory and provide national communications to the UNFCCC. The Ministry in charge of Environment and Natural Resources the national UNFCCC focal point, the NEMA and the Climate Change Secretariat, are all resposnible for international reporting. The information from the National REDD+ Programme will be included in the reporting on the Agriculture, Forestry and Other Land Use (AFOLU) sector.
Remarks	Kenya has only submitted the first national communication done in the year 2002[34]. The second national communication is underway. Based on the UNFCCC decisions[35] Kenya has to demonstrate the need for REDD+ related compensation through periodic reporting of its emissions and sinks associated with forest land. Therefore Kenya has to enhance the process of developing national communications and submitting them to the UNFCCC to be able to benefit from REDD+ related funding.
Lead	NEMA
Stakeholders	REDD+ TWG, KFS, MENR, CCS
Schedule	Continuous – yearly GHG inventories, National Communications after every four years, and Biannual Update Reporting to indicate compliance throughout the project
Budget	US$10 000 yearly to support national communications on components related to REDD+ until 2020
Current status and actions required	Support the KFS to avail REDD+ related data to the international reporting process of the Ministry

[34] First National Communication of Kenya to the UNFCCC: http://unfccc.int/resource/docs/natc/kennc1.pdf
[35] Work programme on results-based finance to progress the full implementation of the activities referred to in decision 1/CP.16, paragraph 70: http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf#page=24

9. Kenya NFMS Road Map – Logical Framework

a. The Requirements for NFMS – Interaction with other Project Efforts

As described the efforts being undertaken in Kenya to track GHG emissions in the land sector have been initiated at different points in time, by different donors and in partnership with different institutions. The R-PP was submitted in 2010 and the SLEEK Program commenced implementation in April of 2013. The ICFRA funded by the Government of Finland and supported technically by the Natural Resources Institute of Finland (Luke) has completed its pilot phase including field plots, sampling design and a "National Forest Resources Assessment Field Manual Biophysical Survey Kenya". These efforts have overtaken some of the requirements for the NFMS and refined others with much of the work to develop the NFMS remaining. The linkages that are formed tend to be ad hoc and largely based on individuals. REDD+ has a focus on forest land only, while SLEEK is working across the whole land sector including forest land as well as grassland, cropland and other land uses. There is a need to avoid duplication, avoid repetition and increase efficiency.

The SLEEK program has conducted its final documentation and hosted its final quarterly meeting in the week of 15th February 2016. The final products and documentation of decisions along with confirmation on progress, products and products to be finalised in the future will become public in due course. Indications of the substance of the SLEEK contribution and therefore the focus for effort by KFS and partners on the NFMS should be available in the short term.

b. NFMS Road Map – Baseline and Objectives

Logical Framework Baseline

A series of collaboration meetings were held with the assistance of the FAO UN-REDD Technical Support and identified that in respect of the NFMS SLEEK will create the sustainable approaches for:

- Some of the policy and system design settings that will include forest definition, carbon pool selectin, forest stratification and land use classification;
- Land Cover Classification of forest and non-forest is being delivered with 2010 and 2014 completed and each two years from 1990 contracted to be completed by November 2016 – 17 maps in all. The work includes a manual on Land Cover Classification and a process manual;
- Land Cover Change Detection for deforestation/reforestation through assessment of non-forest, forest and classification into strata.

This work and related products can be relied upon by the NFMS, both initially and for future work and calculation.

Logical Framework Target

The work of SLEEK in remote sensing analysis will not deal directly with all the aspects of REDD+ which will need to be developed for the NFMS in terms of working out the measurement, recording and reporting, namely:

- Reducing emissions from forest degradation
- Conservation of forest carbon stocks
- Sustainable management of forests
- Enhancement of forest carbon stocks

Other aspects not being delivered by SLEEK are:

Reference Level for forests

- Establish the historic time period during which emissions will be estimated
- Consider REDD+ requirements for identifying areas of deforestation and forest degradation
- Identify significant pools using Key Category Analysis
- Calculate the carbon stock change on areas defined as deforestation
- Calculate the carbon stock change on areas defined as degradation
- Assess the uncertainty related to the Reference Level

Conduct in-depth analysis, description and decisions on:

- Drivers of deforestation
- National circumstances
- Historical reference emission level
- Land use and forestry policies for reference levels

The NFMS Logical Framework has the objectives of:

1. NFMS is established and utilised in Kenya.
2. FRL for Kenya is established.

c. Logical Framework

Description	Indicators	Means of Verification	Assumptions & Risks
Overall Goal Forest reporting in Kenya is systematized.	• NFMS data used in national reporting	• UNFCCC REDD+ reporting • National statistics • Annual Reports	• The Government of Kenya seeks to fulfill international commitments on REDD+ and UNFCCC • The Government of Kenya remains committed and motivated to implementing and maintaining the NFMS.
Project Purpose REDD+ readiness activities in KFS are strengthened	• Effective modalities, mechanisms and processes for the NFMS • Communication with stakeholders on NFMS and FRL	• KFS organizational structure • KFS Annual Reports • KFS Budget • Records of KFS participation in relevant fora, meetings and processes	• The KFS commits to the requirements and obligations for the NFMS and related resourcing and internal collaboration • Sufficient resources are made available by KFS to enable the effective establishment of structures and capacities for the delivery of the NFMS. • Relevant actors and stakeholders maintain effective engagement with KFS.
Outputs 1. NFMS is established and utilised in Kenya. 2. FRL for Kenya is established.	• Operation of the NFMS • Modalities, mechanisms and processes to implement the project • Communication with stakeholders and others on the NFMS and FRL • Environment for the ongoing support for the NFMS created • Current future financial and other resource requirements for the NFMS in place	• REDD+ related data, reports and maps • Report to the UNFCCC • Records of meetings and decisions of Steering Committees, Working Groups and Consultation Groups • Annual project work plans and reports on progress • Communications and consultation plans and records of actions, products, events and outreach • Project budget papers and Annual Budget Planning • Independent evaluations commissioned at mid-term and project end • KFS organizational structure, Annual Reports and budget	• The Government of Kenya seeks to fulfill international commitments on REDD+ and UNFCCC • A viable institutional structure is available or can be established within KFS for the planning and delivery of the project • Sufficient resources are made available by KFS to enable the effective establishment of structures and capacities for the delivery of the NFMS and FRL. • Ready access to reliable transparent spatial data is made available by data custodians.

Description	Indicators	Means of Verification	Assumptions & Risks
Activities Inter-related activities for the NFMS and FRL include: • Forest Definition • Land use categorization • Forest Stratification • Mapping Standards • Inventory Standards • Land use category mapping processes • Mapping Land Use Change • National Forest Inventory • Development of Allometric Equations • Internal Verification • Prepare Carbon Map • Carbon Change Calculation • Developing National Accounts • Drivers of Deforestation and Forest Degradation • Policies and Measures for REDD+ Implementation • Safeguards • Benefit Sharing Mechanism • Community Monitoring • National Circumstances • Modelling and Forecasting • Reference Levels for REDD+ • Project Registry • Development of an Information System • International Reporting	• NFMS management arrangements in place • Institutional arrangements, roles and responsibilities defined, specified, allocated and agreed. • Cross-cutting, policy and safeguards issues and aspects addressed • NFMS and FRL meets requirements and performance standards • QA/QC for the NFMS and FRL • Capacity available or built to implement the project • Engaged and contributing institutions	• Formally agreed management arrangements recorded and reported • Project Management and Implementation plans • Technical and other reports on NFMS and FRL specifications and performance requirements • Service Agreements, Contracts and formal arrangements with contributing institutions. • Presentations and Publications on NFMS development • Independent evaluations commissioned at mid-term and project end • Records of meetings and decisions of Steering Committees, Working Groups and Consultation Groups • Annual workplans and reports on progress • Software, manuals, technical documentation and peer review of the NFMS and FRL	• The KFS commits to the requirements and obligations for the NFMS and related resourcing and internal collaboration • Sufficient resources are made available by KFS to enable the effective establishment of structures and capacities for the delivery of the NFMS. • KFS can mobilize and consistently maintain the management and capacity necessary for project implementation • A viable institutional structure is available or can be established within KFS for the planning and delivery of the NFMS and FRL • Mandates and management arrangements can be agreed between KFS and partnering institutions.

10. Timeline of activities and Tentative Budget

Based on consultation with existing projects, examination of past projects, REDD+ Technical Working Group inputs, a timeline and budget was developed for the National Forest Monitoring System development. Very detailed planning has not been undertaken for each aspect but indications of timing and funding requirements have been prepared. The Tasks are also reflected in the NFMS Road Map spreadsheet where each task has a tab that contains the steps proposed, indicative budget and timeline, the summary tab of which is contained in Figure 1.

The total budget is estimated at US$5 718 000 noting that this includes US$3 000 000 for the National Forest Inventory as designed by the ICFRA Pilot Project. The costs for implementation based on these preliminary estimates for the non-FRA is US$2 718 000.

The duration of the work envisaged is four years. Many of the tasks will be completed within three years and a year of implementation is included to enable adjustments to scheduling and duration that may arise or be needed, further refinement and a year of operational use to assess sustainability and enable incorporation of the tasks into routine operations by the agencies with the relevant mandates. Some activities are ongoing in nature or continuous.

Figure 1: Timeline and Budget for the NFMS Development

Kenya NFMS Timeline and Budget Summary																	
Year	Budget	Notes	One				Two				Three				Four			
Quarter			First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TOTAL	$ 5,718,000																	
		Budgetting has been prepared for four (4) years 2016 - 2020																
TASK - Forest Definition	$ -																	
TASK - Land Use Categorisation	$ 10,000	Based on need identified in the current SLEEK mapping																
TASK - Forest Stratification	$ 20,000	To cater for 4 for stakeholder meetings																
TASK - Mapping Standards	$ 20,000	to support implementation of the SoK standards among mapping institutions																
TASK - Inventory Standards	$ 40,000	US$ 10,000 per year for 4 year when the system will be in place																
TASK - Land Use Category Mapping Processes	$ 400,000	US$100,000 per year for 4 year when historical maps will be ready																
TASK - Mapping Land Use Change	$ 400,000	US$ 100,000 per year for 4 years when a sustainable system will be in place	CONTINUOUS UPDATE															
TASK - National Forest Inventory	$ 3,000,000	Based on ICFRA budget	FUNDING TO BE SOURCED															
TASK - Development of Allometric Equations	$ 500,000	Based on ICFRA budget for a rigorous research programme																
TASK - Internal Verification (QA/QC)	$ 100,000	US$ 50,000 for each set of mapping and inventory over 4 years when a system will be in place - 2 sets.	CONTINUOUS ACTIVITY															
TASK - Prepare Carbon Map	$ 100,000	Uses land use maps and inventory datasets to generate a carbon base map																

Kenya NFMS Timeline and Budget Summary

Year	Budget	Notes	One				Two				Three				Four			
Quarter			First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TOTAL																		
		Budgetting has been prepared for four (4) years 2016 - 2020																
TASK - Carbon Change Calculation	$ 100,000	US$100,000 annually to support research among the implementing institutions; capacity building and monitoring of the PSPs																
TASK - Developing National Accounts	$ 40,000	This is an activity done for each national communication to support REDD related figures, budget of US$10,000 per year																
TASK - Drivers of Forest Change	$ 48,000	US$ 12,000 yearly to update on drivers of change for 4 years																
TASK - Policies and Measures for REDD+ Implementation	$ 40,000	The budget is US$10,000 per year to undertake PAMs analysis and minotor effects of PAMs on emissions																
TASK - Safeguards	$ -	Budget has already been allocated and task completed																
TASK - Benefit Sharing Mechanism	$ 40,000	The task is under implementation and the budget is for updating results																
TASK - Community Monitoring	$ 500,000	For review of past initiatives and establishing pilots to confirm the preferred method for paticipatory monitoring																
TASK - National Circumstances for REDD+	$ 40,000	The budget is for updating National Circumstances documented in previous national communications																
TASK - Modelling and Forecasting	$ 10,000	The budget is for a modelling activity and is assigned to an expert team																
TASK - Reference Emission Level/Forest Reference Level for REDD+	$ 40,000	The Budget is a for two stakeholder meetings and is supplemented by modelling																
TASK - Project Registry	$ 80,000	US$20,000 per year to support infrastructure development																
TASK - REDD+ Information System	$ 140,000	$100,000 to design and $10,000 per year to operate	CONTINUOUS ACTIVITY															
TASK - International Reporting	$ 50,000	The budget will support the participation of REDD+ experts in the National Communication reports		CONTINUOUS ACTIVITY														

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Appendix 1: Concepts of National Forest Monitoring Systems and Reference Levels

Official documents from the UNFCCC

- United Nations Framework Convention on Climate Change. Official text of the Convention, with details on reporting in Article 4. Document FCCC/INFORMAL/84.

- Conference of the Parties to the UNFCCC, 11th session, December 2005: "Reducing emissions from deforestation in developing countries: approaches to stimulate action" (the first submission on REDD to the UNFCCC); submission by Papua New Guinea and Costa Rica on behalf of the Coalition for Rainforest Nations. Document FCCC/CP/2005/MISC.1.

- Decisions of the Conference of the Parties to the UNFCCC on REDD+:
  - Decision 1/CP.13: "Bali Action Plan", with reference to all five eligible activities for REDD+. Document FCCC/CP/2007/6/Add.1.
  - Decision 2/CP.13: "Reducing emissions from deforestation in developing countries: approaches to stimulate action". First decision on REDD, calling for demonstration activities. Document FCCC/CP/2007/6/Add.1.
  - Decision 4/CP.15: "Methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries". Specific references to the national forest monitoring system. Document FCCC/CP/2009/11/Add.1.
  - Decision 1/CP.16, section C: "Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries". Introduction of safeguards, reiteration of requirements for the national forest monitoring system. Document FCCC/CP/2010/7/Add.1.
  - Decision 12/CP.17: "Guidance on systems for providing information on how safeguards are addressed and respected and modalities relating to forest reference emission levels and forest reference levels as referred to in decision 1/CP.16". Details on preparation and submission of reference levels and guidance on providing information on safeguards. Document FCCC/CP/2011/9/Add.2.
  - Decision 11/CP.19: Modalities for national forest monitoring systems:
    - Paragraph 2 of this decision changes the guidance given in paragraph 6 of 2/CP.13 and paragraph 1 of 4/CP.15 into a decision and states that the NFMS should be guided by the most recent IPCC guidance and guidelines in estimating anthropogenic forest-related greenhouse gas emissions by sources, and removals by sinks, forest carbon stocks, and forest carbon stock and forest-area changes.
    - Paragraph 3 of this decision formalizes the guidance from 4/CP.15 and 1/CP.16 into decisions, and emphasizes the importance of following the guidance on MRV set out in 1/CP.13 in relation to Nationally Appropriate Mitigation Actions (NAMAs).
    - Paragraph 4 states that a NFMS for REDD+ has no fixed formula and will develop according to national circumstances.
  - Decision 14/CP.19: Modalities for measuring, reporting and verifying:
    - Paragraph 3 explains that the MRV data should be transparent, and consistent over time and with the established forest reference emission levels and/or forest reference levels.
    - Paragraph 4 describes that the results of the implementation of REDD+ activities, should be expressed in tCO2e/year.
    - paragraph 5 indicates that an NFMS for REDD+ does not necessarily require to start with advanced methods and datasets but can keep on improving datasets and methodologies with time.
    - paragraph 6 describes that the REDD+ results should be reported through the Country's Biennial reports and the national communications.
    - paragraph 7 indicates that for countries seeking benefits from REDD+ implementation, they should annex a technical report describing their measurements in their biennial or national communication report.

- paragraph 10 describes the verification of REDD+ results noting that, upon the request of the developing country Party seeking to obtain and receive payments for results-based actions, two LULUCF experts from the UNFCCC roster of experts, will review the country reports.

- There are many unofficial documents as well, such as submissions by observers on specific issues. All of these are available from the UNFCCC web site.

Other relevant documents on specific issues

- Meridian Institute: "Modalities for REDD+ Reference Levels: Technical and Procedural Issues". Available for download at http://www.REDD-OAR.org.
- Meridian Institute: "Guidelines for REDD+ Reference Levels: Principles and Recommendations". Available for download at http://www.REDD-OAR.org.
- UN-REDD guidance on governance in forestry.
- World Bank SESA methodology

Appendix 2: Technical background

All reports on greenhouse gas emissions and removals that countries submit to the UNFCCC have to follow the methodology adopted by the IPCC. Like the UNFCCC itself, IPCC is an international body made up of representatives of Parties to the Panel from virtually all the countries in the world. The IPCC was established under the auspices of the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to assess the extent of climate change, its causes and its effects. Additionally, it publishes guidelines and guidance for the reporting of anthropogenic greenhouse gas emissions and removals. The UNFCCC has formally adopted the "1996 IPCC Guidelines for National Greenhouse Gas Inventories" for the reporting of National Communications. In more recent Decisions, the UNFCCC has encouraged "to use the most recent Intergovernmental Panel on Climate Change guidance and guidelines, as adopted or encouraged by the Conference of the Parties"[36], being the "2006 IPCC Guidelines for National Greenhouse Gas Emissions". The guidelines can be downloaded for free from the internet[37].

All reporting for REDD+ will be done through the Biennial reports and the National Communication of the individual countries participating in the REDD+ mechanism[38] and will be based on IPCC methodology as updated from time to time. Of particular interest are Volume 1 on general issues and Volume 4: Agriculture, Forestry and Other Land Uses (AFOLU).

IPCC Guidelines key concepts

This section describes the key concepts that the IPCC Guidelines use in the estimation of emissions and removals of greenhouse gases from anthropogenic origin. Adherence to these concepts is important in order to apply the same principles in REDD+, guaranteeing consistency with the national forest monitoring system for REDD+ and the National Communications to the UNFCCC.

Tiers

In order to accommodate different levels of information, knowledge and inventory capacity in different countries, the IPCC defines three Tiers for the estimation of emissions and removals of greenhouse gases. Increasing Tiers imply increasing accuracy of the estimates due to an increased use of local data and more evolved estimation methods. Estimates based on higher Tier methods and parameters have a higher (implied) confidence and are thus able to generate higher amounts of results-based benefits.

Tier 1 estimates – using default parameter values given in the IPCC Guidelines – should only be used if there is no other option. For Kenya's REDD+ programme, this may apply in the case of litter which is a largely stable pool, with insignificant emissions and where not much research has been done and may not be justifiable. Application of Tier 1 default parameters is assumed to result in a conservative estimate of the size of the carbon pool – meaning that the size of the pool is estimated in such a way that the actual, but unknown, amount of the carbon pool is likely to be larger.

Framework of Tier structure for AFOLU methods has been set out in the 2006 IPCC Guidelines, Volume 4, Chapter 1, Box 1.1 as:

- Tier 1 methods are designed to be the simplest to use, for which equations and default parameter values (e.g. emission factors) are provided in the IPCC Guidelines. Country-specific activity data are needed, but for Tier 1 there are often globally available sources of activity data estimates (e.g. deforestation rates, global land cover maps, fertilizer use, etc.), although these data are usually spatially coarse;
- Tier 2 can use the same methodological approach as Tier 1, but applies emission factors that are based on country- or region-specific data, for the most important land-use categories. Country-defined emission factors are more appropriate for the climatic regions and land-use systems in the country. Higher temporal and spatial resolution and more disaggregated activity data are typically used in Tier 2 to correspond with country-defined coefficients for specific regions and specialized land-use categories;

[36] UNFCCC Decision 4/CP.15 "Methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries", paragraph 1(c). UNFCCC document FCCC/CP/2009/11/Add.1.
[37] http://www.ipcc-nggip.iges.or.jp/
[38] UNFCCC Decision 11/CP.19: Modalities for national forest monitoring systems

- At Tier 3, higher order methods are used, including models and inventory measurement systems tailored to address national circumstances, repeated over time, and driven by high-resolution activity data and disaggregated at sub-national level. These higher order methods provide estimates of greater certainty than lower tiers. Such systems may include comprehensive field sampling repeated at regular time intervals and/or GIS-based systems of age, soils data, and land-use and management activity data, integrating several types of monitoring. Pieces of land where a land-use change occurs can usually be tracked over time, at least statistically. In most cases, these systems have a climate dependency and thus provide source estimates with interannual variability. Models should undergo quality checks, audits, and validations and be thoroughly documented.

Tier 2 estimates apply nationally-appropriate methods and/or parameters. This is the recommended minimum Tier for REDD+. It implies that there is detailed information on the forest land and the forest types in the country and that at least basic information is available about species composition and merchantable timber volume for the different forest types. Countries should aim for this Tier in the estimation of at least above-ground biomass and preferable also for dead wood and litter carbon pools; if soil organic matter is an important carbon pool under specific conditions – such as in mangroves – use of Tier 2 estimation methods in those circumstances is recommended.

Tier 3 methods are the most complex in terms of monitoring of status and processes, changes in land use in a spatially-explicit manner, knowledge of biophysical processes and required data to make the estimates. The IPCC Guidelines do not present any methods for Tier 3 estimation, only good practice guidance. For REDD+ purposes, a Tier 3 method could be the development and application of an allometric equation for the estimation of one or more carbon pool(s) on the basis of the measurement of a few key properties of a tree or a forest stand.

As such, Tier 3 methods can be aligned with participatory approaches involving a large number of local communities; the method is derived for local conditions and the many measurements provide a detailed spatial resolution of the estimate. Despite the cost and organizational burden of implementing Tier 3 estimation, this is the recommended target as it yields the best estimate with the highest confidence; the additional cost is likely to be more than offset by the higher estimate compared with lower Tier estimates (which are conservative) and the higher benefits that such estimates may generate in the international market.

Estimation methods from different tiers may be freely combined within a reporting period or over time, as long as proper documentation of estimation methods is provided.

Land-use categories

The IPCC identifies six land-use categories for estimation of emissions and removals of greenhouse gases of anthropogenic origin:

1. Forest Land – Land that supports tree cover following the national definition of “forest”, which is typically expressed in terms of a minimum area, minimum height at maturity and minimum crown cover. This also includes land that is temporarily unstocked (e.g. after harvesting or a major disturbance), but which is expected to revert to tree cover under the definition of forest. Depending on the national definition, land covered with certain non-tree species such as bamboo or palms; and some types of tree production systems, such as coffee or rubber plantations may also be considered forest under the national country definition;
2. Cropland – Land for the production of agricultural crops. This includes agroforestry systems under the IPCC description, but land under agroforestry use that is dominated by tree cover may also be counted as Forest Land;
3. Grassland – Pastures and rangeland that is not Cropland. Land with sparse woody vegetation (e.g. canopy cover is too low to be considered Forest Land) is part of this category;
4. Wetlands – Land that is perennially or seasonally inundated and which is not accounted under any of the above categories. It includes natural and artificial water courses and bodies (e.g. rivers, lakes and reservoirs);

5. Settlements – Land which supports human habitation (cities, villages) and transportation and other infrastructure, according to national definitions;
6. Other Land – Land which does not fall into any of the above categories – bare (degraded) land, bare rocks, desert, snow and ice.

The land-use categories may be further subdivided for estimation of emissions and removals and reporting purposes. IPCC does not prescribe or require any subdivisions, but it does suggest that these may be applied in order to facilitate the estimation and reporting.

Examples of such subdivisions related to forest and tree cover are:

Land-use category	Sub-category
Forest Land	• Natural • Plantations • Mangroves
Cropland	• Agroforestry • Perennial crops
Grassland	• Woodland • Shrubland
Settlements	•Buildings •Road

The area reported for these six land-use categories, including any sub-categories, should sum up to the total area of the country. Care should be taken therefore not to double-count any land use, for example a tea plantation, as a tree crop under Forest Land and as an agricultural production system under Cropland. The exact definition of the land-use categories should be done by the assigned national authority that reports on greenhouse gas emissions and removals but this may be guided by the specific lead institutions in the different sectors with significant emissions.

Estimation of emissions and removals of greenhouses gases is only done for areas of managed land, that is land which is subject to human impacts for production, ecological or social functions. That implies that REDD+ can only be applied to those areas of forest land which are classified as managed (otherwise there is no estimation and reporting and thus no basis for generating results-based benefits in unmanaged lands). In general, any forest which is generally accessible to people can be classified as managed since “management” is not restricted to formal types of management under control or license of the state or by private ownership.

Both managed and unmanaged land should be accounted for in National Communications, even if only as a validity check on the areas reported. In Kenya it is more than likely that all Forest Land can be classified as managed.

Stratification

Land-use (sub) categories can be stratified in order to obtain more homogeneous units for which separate estimation methodologies or conversion factors exist. The IPCC suggests a stratification of the Forest Land category along ecological zones and climatic domains (between which one may expect a large variance). Further stratifications can be made on forest type – e.g. broad-leaf, needle leaf, deciduous, evergreen, mangrove, plantation. Stratification should strike a careful balance between the overhead costs of having to estimate emissions and removals of greenhouses gases from every stratum, with its concomitant burden of establishing an estimation method and/or set of conversion parameters for each stratum, and the (assumed) higher accuracy of the estimate that is obtained. In general, stratification should at least be applied to the forest type and preferably also on ecological zone if the country has distinct zones based on topography or climate. Stratification is considered good practice by the IPCC.

Land-use conversion

Over time, land use can change from one category to another. The IPCC identifies separate methodologies for land staying within a certain land-use category between reporting periods and land converted to another land-use category during a reporting period. Whenever possible, these conversions should be made explicit – e.g. Grassland Converted to Forest Land – instead of generic – e.g. Land Converted to Forest Land. For REDD+ purposes, one land-use category and two land-use conversions are of interest:

- Forest Land Remaining Forest Land – This refers to land which is reported as forestland in the two instances of reporting/monitoring. However degradation activities also occur on this type of land use conversion and “sustainable management” of the forest qualifies as a REDD+ eligible activity;
- Other Land uses Converted to Forest Land – In case of natural regeneration upon abandonment of Cropland or Grassland or planned conversion to forest. Whenever possible, the origin land-use category prior to it becoming Forest Land should be made explicit. In case of natural regeneration the REDD+ eligible activity of enhancement of forest carbon stocks” could be applied, while for planned reforestation it could be “sustainable management of forest” or “enhancement of forest carbon stocks”;
- Forest Land Converted to other Land use (any of the other land-use categories) – When forest is lost due to deforestation or some other disturbance. This is not a REDD+ activity of course, but the country has to report on all the managed Forest Land. If REDD+ activities had been developed on the land being converted, then these estimates may be used to estimate the emission from the conversion. Note that land that remains assigned for forestry purposes after harvesting is still considered forest – the “temporarily unstocked” situation.

After a conversion the area is counted under the new land-use category, but in a so-called transition period during which specific estimation methods for the carbon pools are used to properly estimate the carbon dynamics until a new equilibrium is reached. The IPCC default period for such an equilibrium lasts for 20 years.

Estimation of area for each land-use category

The IPCC identifies three Approaches to estimate the area in each land-use category:

1. Total area of the land-use category – In this case only national statistics on the total area for each land-use category is available. No details are given on conversions between land-use categories. This might be sub-divided between administrative units, but no specific locations or processes are known;
2. Total area of the land-use category and conversions between land-use categories – In addition to the information from the previous category, changes between land-use categories are known, for instance from detailed inventories at sub-national level, but their locations are not. This information can be represented in a ‘conversion matrix’, which gives areas for each combination of original land-use category and current land-use category;

3. Spatially-explicit land-use conversion data – In this case the precise locations of changes in land-use category are known, for instance from analysis of satellite imagery or detailed field surveys. As in Approach 2, a conversion matrix can be constructed.

The IPCC does not differentiate strictly in the reporting between Approaches. Countries are encouraged to use Approach 2 or 3 and a suggestion is made that countries can mix Approaches within a reporting period and over time as the need arises and knowledge and information increase.

Approaches for the estimation of areas in each land-use category are not to be confused with Tiers for estimating amounts of carbon pools. It is fair to suggest, however, that higher Approaches and Tiers should be adopted in step. It would be very odd to apply a Tier 3 estimation method for a carbon pool on an Approach 1 area estimate, for instance. Inversely, a Tier 1 estimation method could conceivably be applied on an Approach 3 area estimate – as in the case of soil organic carbon, which is not likely to be measured with sufficient spatial resolution to provide tailored estimates for all land-use categories and conversions between them.

Greenhouses gases

In the 1996 Guidelines the IPCC identifies a number of greenhouse gases, from the well-known carbon-dioxide (CO_2) to complex molecules such as the family of halocarbons (used in refrigerators, air conditioners and power transformers). All of these gases have what is termed Global Warming Potential (GWP) in the atmosphere, which is expressed in CO_2-equivalent units (CO_2e). For the AFOLU sector – and thus REDD+ – carbon dioxide is the principal greenhouse gas of consideration, with a few notable exceptions, which must be estimated and reported and include:

- In mangroves and seasonally flooded forests, a non-negligible amount of methane (CH_4) and nitrous oxide (N_2O) may be formed in and released from the soil[39];
- If soils in plantations are being fertilized, nitrogen oxides (NO_x) will be released, which are a precursor to the greenhouse gas nitrous oxide;
- Forest fires release nitrous-oxides and sulfur-dioxide (SO_2).

Carbon pools

The IPCC recognizes five carbon pools for the AFOLU sector. Countries do have the option to deviate from these definitions, but this is not recommended as all methods provided in the Guidelines use these carbon pools consistently. It is possible, however, to adapt the pool details to the current practice of forest survey and inventory, such as in the definition of class sizes.

The 2006 IPCC Guidelines saw the addition of a new carbon pool: Harvested Wood Products (HWP). HWPs are those components of trees that are converted into timber, board, paper/pulp, etc. which store carbon after removal from the forest. It is fundamentally different from the other carbon pools in several respects:

- The carbon is not stored on-site;
- HWPs have a life-cycle that is different from that of the forest. For every product a “half-life” period can be defined, which is used to determine the amount of product still remaining after a certain period of time; the rest is assumed to have oxidized and thus emitted into the atmosphere as CO_2. The half-life has a default value of 2 years for paper and 30 years for timber products;
- HWPs are not reported together with the other carbon pools for a certain area. Instead they are reported at the national level, in order to account for them together with imports and exports of wood-based materials;

[39] The IPCC Guidelines provide estimation methodologies for these greenhouse gases under the land-use category of Wetlands. In many countries, however, mangroves and particularly seasonally flooded forests are accounted as forests and reported as Forest Land in the National Communications. The Guidelines allows for such deviations from the categories listed, but these need to be clearly documented and applied consistently in subsequent National Communications. In practice this means that the methodology for Wetlands can be applied to estimate emissions for Forest Land.

- For application in REDD+, where local stakeholders have an interest in a locally consistent accounting structure such that results-based benefits may be determined, HWPs are not relevant, particularly not when those stakeholders accrue the benefits from raw material being converted into HWP – e.g. harvesting of trees for pulp or timber by smallholders;
- If, however, harvesting of trees is managed and controlled by large companies or state-owned organizations, it is imperative that the local stakeholders share in the benefits of the harvest, because the conversion of trees into HWPs will impact the carbon balance of the forest and thus the amount of results-based benefits that can be claimed to support monitoring for REDD+.

Table 1: Definitions for carbon pools used in AFOLU for each land-use category

Pool		Description
Biomass	Above-ground biomass (AGB)	All biomass of living vegetation, both woody and herbaceous, above the soil, including stems, stumps, branches, bark, seeds, and foliage. Note: In cases where forest understory is a relatively small component of the above-ground biomass carbon pool, it is acceptable for the methodologies and associated data used in some tiers to exclude it, provided the tiers are used in a consistent manner throughout the inventory time series.
	Below-ground biomass (BGB)	All biomass of live roots. Fine roots of less than (suggested) 2 mm diameter are often excluded because these often cannot be distinguished empirically from soil organic matter or litter.
Dead organic matter (DOM)	Dead wood	Includes all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps, larger than or equal to 10 cm in diameter (or the diameter specified by the country).
	Litter	Litter Includes all non-living biomass with a size greater than the limit for soil organic matter (suggested 2 mm) and less than the minimum diameter chosen for dead wood (e.g. 10 cm), lying dead, in various states of decomposition above or within the mineral or organic soil. This includes the litter layer as usually defined in soil typologies. Live fine roots above the mineral or organic soil (of less than the minimum diameter limit chosen for below-ground biomass) are included in litter where they cannot be distinguished from it empirically.
Soils	Soil organic matter (SOM)	Includes organic carbon in mineral soils to a specified depth chosen by the country and applied consistently through the time series. Live and dead fine roots and DOM within the soil, which are less than the minimum diameter limit (suggested 2 mm) for roots and DOM, are included with soil organic matter where they cannot be distinguished from it empirically. The default for soil depth is 30 cm.

Adapted from: IPCC 2006 Guidelines, Volume 4, Chapter 1, Table 1.1.

Key categories

In order to reduce the effort in compiling National Communications and focusing resources on those areas where the majority of emissions and removals take place, the IPCC identifies key categories. A key category is "one that is prioritised within the national inventory system because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level, the trend, or the uncertainty in emissions and removals". As such, key category analysis is a task for the national authority that compiles the National Communications, to be applied on each sector individually. Key category analysis aims to identify those categories within the sectoral scope – such as AFOLU – that have a significant influence on the inventory.

For Forest Land this implies that the following questions need to be answered:

- Which management activities are significant?
- Which CO_2 emissions or removals from various carbon pools are significant?
- Which non-CO_2 gases are significant?

Typical key categories in forestry are:

- AGB for all forests that have undergone or are undergoing human impacts. For managed forests that have not suffered such impacts – such as National Parks or wildlife reserves – AGB does not necessarily have to be estimated because the carbon dynamics from human impacts will be minimal, unless there are special management actions such as fire management,
- If there is a significant amount of deforestation: SOC and dead wood in Forest Land converted to some other category (BGB is instantly converted to dead wood upon deforestation),
- If there is a significant amount of forest regeneration: SOC, AGB and BGB on Land Converted to Forest Land,
- SOC in mangroves and peatlands.

Other key categories may be identified based on national circumstances. The key categories should jointly comprise a substantial part of emissions and removals – 95% as established by the IPCC. They should be identified using quantitative data if such data are available in the country (e.g. forest inventory data); in the absence of such data a qualitative assessment of key categories may be made. Key categories should be estimated with the highest tier method possible. Other categories may be estimated with a Tier 1 or Tier 2 method.

In most developing countries, estimation of at least some carbon pools on Forest Land will be classified as key category, especially when the country participates in the REDD+ mechanism. This will, in all likelihood, include AGB, which can be included in a PCM protocol. Litter and dead wood may also be collected through PCM – as the sampling and measurement are straightforward – even if they are not classified as a key category. Even if they are classified as a key category, SOC and BGB are not amenable for inclusion in PCM due to the complexities of sampling and measurement – these carbon pools are best left to professional forest survey staff or researchers.

Two basic approaches to calculation: stock-difference and gain-loss[40]

There are two methods described by (IPCC, 2006) to estimate changes in carbon stock[41]:

- Stock-Difference method; estimation of difference in carbon stocks of a land unit by comparing carbon stocks for the same location at time 1 and 2. It generally requires comparing measurements from national forest inventory cycles,
- Gain-Loss method. This method is applicable at all IPCC Tiers and subtracts biomass carbon loss from biomass carbon gain.

[40] This topic was the subject of a briefing note to the TWG that sets out the issue more clearly. This was discussed in the TWG meeting in November 2015.

[41] Taken from: UN-REDD 2015. Technical considerations for Forest Reference Emission Level and/or Forest Reference Level construction for REDD+ under the UNFCCC.

Section 2.1 of the GFOI Methods and Guidance Document (GFOI, 2014) discusses gain-loss and stock-difference (or stock change) methods as applied to REDD+ activities and has a decision tree on the choice between them.

The most common approach applied so far by developing countries (discussed in FAO, 2014) to estimate historical emissions from deforestation for use in FREL/FRLs is to develop activity data through analysis of remote sensing (e.g. Landsat or higher resolution) images. Emission factors are estimated by calculating the difference of average carbon stock in forest biomass with the carbon stock in the replacing land use biomass (e.g. crop land). In this approach the average carbon stocks of both land uses are estimated based on NFI data (only from one cycle and not comparing two as with the stock difference method), literature and/or IPCC default values.

Stock Difference Method

In the MGD the GFOI identifies that the IPCC notes that the stock change method provides good results where there are relatively large increases or decreases in estimated biomass, or where countries have very accurate forest inventories. Since not all countries possess an NFI, this restricts application of the stock change method, and so the advice in the MGD focuses more on the gain-loss method[42].

The gain-loss method estimates annual emissions or removals of CO_2 as the sum of gains and losses in carbon pools occurring on areas of land subject to human activities. Changes in the carbon pools are often estimated as the product of an area of land and an emission or removal factor that describes the rate of gain or loss in each carbon pool per unit of land area. The gain-loss method does not require an NFI, although information from an NFI can be used to derive emission and removal factors, as well as provide insights into the causes of gains or losses of carbon pools.

Gain Loss Method

To calculate the emissions and removals using the gain-loss method, countries need activity data, i.e. information about the extent of REDD+ activities. Most activity data are areas sufficiently disaggregated so that they can be used to estimate emissions or removals when combined with emission and removal factors and other parameters which are usually expressed per unit area. Remote-sensing is likely to provide the major source of such area data.

For the conversions from forest to other land use which are summed to calculate total deforestation, the gain-loss method multiplies areas of land-use change, which may be estimated using remote sensing, by the difference in carbon stocks per unit area between forest and the new land use. For Forest Land remaining Forest Land, the gain-loss method estimates the annual change in above-ground biomass carbon as the difference between the annual increment in carbon stocks due to growth and the annual decrease in stocks due to losses from processes such as commercial harvest, fuel wood removal, and other disturbances such as fire and pest infestation. The balance of gains and losses (i.e. net change) can also be estimated from sample plots representative of strata subject to the processes involved.

REDD+ activities and sampling[43]

If a country decides to participate in the REDD+ mechanism of the UNFCCC, all the managed Forest Land in that country needs to be included in REDD+ accounting. In this sampling, a number of issues should be clarified including those listed below:

i The design, of the inventory to include the strata,
ii The number of plots to be measured,
iii The sizes of the plot and their orientation in reference to one another,
iv The attributes to be measured at different levels within the plot,
v The repeatability of measurement in cases of permanent sample plots.

42 GFOI (2013) Integrating remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests: Methods and Guidance from the Global Forest Observations Initiative: Pub: Group on Earth Observations, Geneva, Switzerland, 2014.
43 The material in this section is partially drawn from the manuals and reports of the Improving Capacity for Forest Resource Assessment Pilot Project (ICFRA).

Number of samples, accuracy and confidence interval

The goal of sampling is to achieve an estimate of emissions and removals with a stated accuracy and confidence interval, using the least number of measurements. In all cases the average biomass in the forest stratum and its standard deviation need to be established. This is best done by professional foresters, using generally accepted techniques for sampling. In practice this implies a minimum of 30 randomly located samples per forest stratum.

Protocols regarding confidence interval and maximum error are likely to be established nationally. The number of samples required to reach that confidence interval given a certain maximum error for each forest (type) should be determined by a professional organization, e.g. the Forest Survey Department, using accepted statistical practice. It can be reduced by careful stratification of forest ecosystem / type, because that will reduce the standard deviation of the samples in each stratum, and this is strongly recommended.

Sampling design

Sampling design was undertaken based on the expected information to be extracted from the measurements. In the case of carbon assessment for REDD+, the number of samples per forest stratum should be based on the sampling assessment. Where the assessment is made for and with communities implementing REDD+ activities, sampling should be designed such that all communities have regular measurements in the forest land that they manage for the national REDD+ program. This typically leads to a sampling density that is much higher than might be necessary statistically. There are a variety of reasons to support such a higher sampling density:

- Communities need to be able to self-assess their performance in reducing emissions and enhancing removals. This helps them in negotiating benefits that the community should receive from implementing REDD+ activities and the reduced emissions and enhanced removals achieved;
- Communities can only assess their performance if measurements are made in the forest that they manage, since it is unlikely that the state agencies will be able to assess the dynamics in the forest for each participating community from a national forest monitoring system using remote sensing and standard forest inventory programs alone. Areas where no REDD+ activities are implemented, or where implementing is lackluster or inadequate will negatively impact the achievements of efficient implementers, thus reducing their interest for lack of benefits;
- If measurements are made regularly, they will be made with fewer mistakes than if protocols are used only sporadically, both for forestry staff and community members;
- A higher sampling density will allow for error checking.

In practice, a single community may be managing from a few hundred to a few thousand hectares of forest land. This area will likely have several distinct regions in it, based on forest type, condition (e.g. pristine, degraded; on a steep slope, riparian buffer) or management regime (e.g. plantation, regeneration, sustainable harvesting).

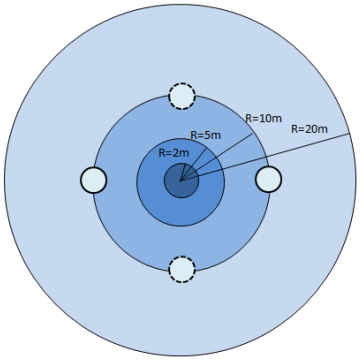
Each of these regions will require measurement of tree and forest properties to estimate the carbon balance. Given that the reporting to the UNFCCC takes place bi-annually, the measurement needs to be repeated with at least a bi-annual frequency.

Plot design

Plot design is a function of the parameter that needs to be measured. The plot should be large enough to capture enough data points (trees, litter traps, etc.) to enable the calculation of mean value and variance, but not so large that the measurement becomes burdensome. The ICFRA has carried out this assessment and the primary sampling unit is a concentric sample plot (Figure 4). The plots are grouped into clusters for practical reasons in order to take into account the reduced inventory costs. The measurement unit, i.e. a cluster, should as a rule of thumb, be measurable within one working day for a field crew. If some of the plots in a cluster are outside of a forest, it

may be possible to measure more than one cluster in a day. Also 25% of clusters are established as permanent. On permanent clusters GPS measurements are preferably done using high-precision GPS receiver, other measurements and markings in the permanent clusters are done in such a way that re-measurement is possible. Other clusters are temporary.

There are some additional measurements on permanent plots compared with temporary plots. First, direction and distance from the plot centre to every tally tree are recorded. Secondly, the plot centre point should be marked with a 40 cm long metallic pin and about three fixed points should be marked and data collected,



Note: All distances indicate horizontal distances

Figure 2: ICFRA Sample plot design[44]

Data Quality Assessment and Internal Verification

All the information that is reported to the UNFCCC in the National Communications needs to be assessed for its quality and an estimate of accuracy and associated uncertainty is highly encouraged. Accuracy is defined by the IPCC as "agreement between the true value and the average of repeated measured observations or estimates of a variable. An accurate measurement or prediction lacks bias or, equivalently, systematic error" and uncertainty as "lack of knowledge of the true value of a variable that can be described as a probability density function (PDF) characterising the range and likelihood of possible values. Uncertainty depends on the analyst's state of knowledge, which in turn depends on the quality and quantity of applicable data as well as knowledge of underlying processes and inference methods".

The sampling design enables the computation of an estimate with a known error for the number of samples, given the average and standard deviation of the parameter under consideration (biomass, litter, dead wood, etc.) and an established confidence interval.

Assessment of data quality can take place in the temporal domain – cross-reference repeated measurements over time – and in the spatial domain – compare estimates with those from other REDD+ areas in the same forest stratum. Observed inaccuracies may have more causes than just measurement errors, such as:

- Improper stratification of the forest
- Differences in efficiency of intervention to reduce emissions and enhance removals
- (Use of) Instrument error (e.g. use of a regular tape measure gives circumference of the tree which might be recorded as DBH)

Data quality analysis should therefore not be a last step before data is inserted into national accounts of greenhouse gases; instead it should be used to provide feed-back to practitioners of REDD+ on potentials improvements in procedures and implementation.

[44] See chapter 4.2 of ICFRA manual

Appendix 3: National strategies and Action Plans for REDD+ implementation

Countries wishing to participate in the REDD+ programme need to develop strategies and action plans for the implementation of REDD+ activities. These describe how emissions will be reduced, how forest carbon stocks will be enhanced, conserved and sustainably managed. Such strategies are derived from an analysis of the national circumstances, policies and stakeholders engagements. Though the UNFCCC does not prescribe a perfect way to develop national strategies, in developing national strategies, countries are requested to address, among others the following issues[45]:

- Drivers of deforestation and forest degradation
- Land tenure issues
- Forest governance issues
- Gender considerations
- Ensuring full and effective participation of all relevant stakeholders

Policies and Measures for REDD+ implementation

Policies and Measures (PAMS) refer to actions and strategies that the government identifies to guide the implementation of REDD+ activities. Normally such policies do not serve the REDD+ benefits only but also other developmental objectives. Such measures are normally embedded in a country's environmental and forest conservation laws but for the purposes of REDD+ their effects should be monitored in the context of the five REDD+ activities listed below:

- Reducing emissions from deforestation
- Reducing emissions from forest degradation
- Conservation of forest carbon stocks
- Sustainable management of forests and
- Enhancement of forest carbon stocks

A system for periodic monitoring the effects of these PAMS should be established to show how effective the policies are in the REDD+ implementation and advise on the need to identify more effective policies.

In association with the PAMs, the countries are also encouraged to provide information on safeguards and benefit sharing mechanisms.

Information on Safeguards

Safeguards are described as measures designed to mitigate risks. The process of REDD+ implementation is expected to be beneficial to livelihoods and ecosystems. Every country willing to participate in the REDD+ programme is expected to document safeguards associated with the implementation. The following safeguards have been identified as important in REDD+ implementation[46] :

1. That action complements or is consistent with the objectives of national forest programmes and relevant international conventions and agreements;
2. Transparent and effective national forest governance structures, taking into account national legislation and sovereignty;
3. Respect for the knowledge and rights of indigenous peoples and members of local communities, by taking into account relevant international obligations, national circumstances and laws, and noting that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples;
4. The full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities;
5. That actions are consistent with the conservation of natural forests and biological diversity,

[45] Decision 1/CP.16 paragraph 72.
[46] UNFCCC Decision 1/CP.16, Appendix I, paragraph 2.

ensuring that the [REDD+] actions are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits;
6. Actions to address the risks of reversals;
7. Actions to reduce displacement of emissions.

The countries should develop a system for providing information on how the safeguards are being addressed and respected throughout the implementation of REDD+ activities, and periodic information on how the safeguards are being addressed and respected throughout the implementation of REDD+ activities.

Benefit sharing mechanisms

The success of a REDD+ implementation programme may be associated with the benefits or incentives assigned to the implementers. Therefore policies and measures associated with REDD+ implementation should identify incentives that encourage specific actions from stakeholders. Such policies may be direct such as cash transfers or governance incentives such as improved land tenure clarification. The UNFCCC notes that such incentives should support the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits.[47]

Many environmental laws have designed benefit mechanisms for the communities and indigenous people. The reporting of such benefit sharing mechanisms ensures a proper monitoring of the REDD+ implementation programme.

[47] 1/CP.16; Appendix 1; para 2(e).

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