REPUBLIC OF KENYA

Ministry of Environment and Natural Resources

Kenya Forest Service

The Capacity Development Project for Sustainable Forest Management
Inception Meeting for REDD+ Readiness Component

Programme Date: 26th July 2016

Venue: KFS Headquarters Karura

Purpose: To explain and discuss the contents of work plan of the REDD+ Readiness Component in The Capacity Development Project for Sustainable Forest Management as JICA new forestry project.

Participants: Members of the Technical Working Group for REDD+, JICA Kenya Office, JICA Project Members, Other stakeholders.

Time	Contents	Person in charge
08:50 – 09:00	Registration	Secretariat
09:00 – 09:10	Intoroductory Remarks	KFS
09:10 – 09:20	Introductory Remarks - About JICA new Forestry Project -	Mr. Kenichi TAKANO Chief Advisor of the Project
09:20 – 09:50	Background of the REDD+ Readiness Component including the Roadmap and Progress of Mapping Work.	Alfred Gichu National REDD+ Coordinator, Faith Mutwiri, FIS Section
09:50 – 10:00	Q & A	Alfred Gichu
10:00 – 10:20	Tea Break	All
10:20 – 11:00	Overall Contents of the Work Plan on REDD+ Readiness Component -Basic Concept and Implementation Methods-	Kazuhisa KATO Component Leader
11:00 – 11:15	Specific Contents of Activies on Remote Sensing	Kei SATO Forest Remoto Sensing
11:15 – 11:30	Specific Contents of Activies on Forest Information Platform as Database	Kohei YAMAMOTO Database
11:30 – 12:20	Plenary	Alfred Gichu
12:20 – 12:30	Closing Remarks	Director, KFS
12.30 –	Lunch and departure	All

Participants list of the Capacity Development Project for Sustainable Forest Management Inception Meeting for REDD+ Readiness Com
26th July 2016, at Kenya Forestry Service Headquaters Karura

	Name	Organization	
1	KAZUHISA KATO	JOFCA-REDD+COMPONENT	
2	FAITH MUTWIRI	KFS	
3	GEORGE TARUS	KFS	
4	YUSUKE TAKEDA	JICA - KEFRI PROJECT	
5	MASAKI NARUMI		
6	KENICHI TAKANO	JICA	
7	SIRAYO PETER		
8	JOSEPH KAMAU	KFS-ICT	
9	OSMAS OMARIO		
10	JOHN NGUGI	KEFRI	
11	CHARLES N. MUNDIA	DEDAN KIMATHI	
12	FLORENCE TUUKUO	KFS	
13	ALPHONCE C GUZHA	US FOREST SERVICE	
14	PETER NDUATI	KFS	
15	MERCELINE OJWALA	DRSRS	
16	SERAH KAHURI	KFS	
17	MINO RANDRIANARISON	FAO-UNREDD	
18	PETER NTHIGA	ERMIS AFRICA	
19	JOHN N NGUGI	JICA KENYA OFFICE	
20	MIHARU FURUKAWA	JICA KENYA OFFICE	
21	TAKINAGA SACHIKO	JOFCA(JICAP/J)	
22	EUNICE MAINA	KFS	
23	MWANGI KINYANJUI	KARATINA UNIVERSITY	
24	MICHAEL MURATHA	KFS	
25	MARGARET OUMA	DRSRS	
26	ALVIN SANDE CHEPTOEK	GREENBELT MOVEMENT	
27	NYASAKA O. DIVINAH	KFS	
28	WINNIE MUSILA	MENR-SLEEK	
29	TOM KEMBOI	AWT	
30	ALI MWAANZA	MENR-SLEEK	
31	PERIS KIMANI	SLEEK	
32	GORDON SIGU	MENR	
33	DEAN RIZZETTI	CCI	
34	EMILIO MUGO	KFS	
35	JOAN KARIUKI	PROJECT SECRETARY	
36	KOHEI YAMAMOTO	PASCO CORP (DATABASE)	
37	KEI SATO	PASCO (REMOTE SENSING)	
38	YUKI HONJO		
39	ALFRED GICHU	KFS	

Establishment of the Forest Reference Level and the National Forest Monitoring System

Alfred N. Gichu
NRCO

Objectives of REDD+

Kenya is participating in REDD+ Readiness to support :

- Realization of Constitutional ,vision 2030 and Green Economy strategy objectives;
- Design of policies and measures to protect and improve forest resources;
- realization of the NCCRS goals.
- Contribution to global climate change goals.
- Access to International carbon finance to support forestry development;

Priority Areas of Focus

1. Reducing pressure to clear forests for agriculture, settlements and other land uses;
2. Promoting sustainable utilization of forests by promoting efficiency, energy conservation;
3. Improving governance in the forest sector by strengthening national capacity for FLEG , advocacy and awareness ;
4. Enhancement of carbon stocks through forestry extension, incentives for commercial forestry, addressing the fire problems

REDD+ Readiness Activities

- Intended to ensure the country is ready for REDD+ implementation.
- **Readiness activities include**
  - A **national strategy for implementation** and the institutional and legal implementation framework,
  - A **Reference Emission Level and/or Forest Reference Level** for greenhouse gases (GHG) emissions from deforestation and/or forest degradation; and
  - A **National Forest Monitoring system** to assess the effect of the REDD strategy on GHG emissions, livelihoods and other benefits;
  - A safeguard Information System

FLR and NFMS

- FLR and NFMS form two of the four elements of the **Warsaw framework of REDD+ activities**;
  - a benchmarks for assessing performance in implementing REDD+ activities , expressed in tonnes of CO2 equivalent per year;
- The NFMS is used for tracking performance of activities (management of information, support MRV of actions and achievements;
  - Provides estimates of emissions from D&D, and removals from SFM and enhancement activities in a geographical area.
- Once an FRL is established, it is submitted to UNFCCC for assessment on
- Kenya intends to submit its reference level by early 2018.
- A **Roadmap for establishing the FRL and NFMS** has been completed with support from UN-REDD and FAO.
- A lot of mapping work has already been undertaken through FPP & SLEEK;
- Strong capacity within forest sector institutions to support activities – **FPP , SLEEK and FAO support;**
- Technologies and methodologies need to be **consistent with SLEEK and GHG-I**

Kenya's Drivers for FRL and NFMS

- establish the extent, status and health of forest resources;
- provide a basis for performance based management;
- Basis for resource allocation
- Basis for Reporting and verification (vision 2030 , Env't &forest policy, FAO, UNFCCC, UNCCD, CBD)
- Provide a sound basis for policy dialogue and positive interventions in support of forest sector planning.

4 decisions related to FRLs

Decision 4/CP. 15	"…**transparently** taking into account **historic data**, and adjust for **national circumstances**…"
Decision 1/CP. 16	FREL/FRLs one of the 4 REDD+ elements
Decision 12/CP.17	Modalities for FREL/FRL-'**Construction** guidelines'
Annex	Submission guidelines for FREL/FRL **information**
Decision 13/CP.19 & Annex	Guidelines **technical assessment** Procedure technical assessment (timing etc)

Decisions Made

- Scale: National (Recognize the existence of project activities)
- Scope (activities): Deforestation, Degradation, Afforestation, Restoration
- Scope (pools): AGB, BGB, Soil
- Scope (gases): CO_2, CH_4
- Construction approach: Historical average + adjustment based on policy documents?
- Historical period: (available data 1990-2014) 2000-2014
- Forest definition: 0.5 ha / 15% / 2 m excl. perennial crops

Forest Land Stratification

- Forest land use will be stratified into the following categories:
  - ✓ Plantation forests
  - ✓ Coastal and mangrove forest
  - ✓ Montane, Western rainforest and bamboo forest
  - ✓ Dryland forests
  - Further to the above stratification forest types will be stratified on the basis of canopy closure of: 15-40%, 40-65% and above 65%.

Pending Issues for FRL Construction

- Key category analysis pools per selected activity
- Analysis of AD deforestation (accuracy assessment change maps)
- Analysis of AD degradation (charcoal records ?, grazing register ,fire data)
- Analysis of AD enhancement-afforestation,
- Analysis of AD enhancement-restoration ?
- Analysis of EF deforestation and afforestation
- Analysis of EF degradation and restoration (?)
- Create emission estimates (AD x EF)
- Stakeholder validation proposed FREL/FRL?
- Drafting of FRL submission

THANK YOU FOR YOUR ATTENTION

Explanation of the Work Plan
on
The REDD+ Readiness Component
in
the Capacity Development Project for the Sustainable Forest Management in the Republic of Kenya

By Kazuhisa KATO – Team Leader-
2016.7.26

Contents of the Work Plan

Introduction
1 Outline of the Project and the Work
1.1 Background of the Project
1.2 Objective of the Work
2 Work Implementation Policy
2.1 Basic Concepts of Work Implementation
2.1.1 Basic Concepts from Technical Aspects
2.1.2 Basic Concepts from Management Aspects
2.2 Implementation methods of the Work
2.2.1 Activities in the first year（June 2016 - June 2017）
2.2.2 Activities in the second year（July 2017 ~ June 2018）
2.2.3 Activities in the third year（July 2018 – Jun 2019）
2.2.4 Activities in the forth year（July 2019 – June 2020）
2.2.5 Activities in the fifth year（July 2020- June 2021）
2.2.6 General Activities（from June.2016 to June.2021）
2.3 The Work Flowchart
2.4 Work Plans
2.5 Assignment and Work Period for Team Members of the Project
2.6 Others
2.6.1 Materials and equipment required for the Work in Kenya
3 Implementation Structure of the Project and the Work

Roles and objectives of the REDD+ Readiness Component (the Work) in the Project

Strengthening national capacity at the national and county level for sustainable forest management

1. Enhancing implementing and monitoring capacities of forest policies/strategies at the national level
2. Pilot forest management activities
3. Implementing REDD+ readiness activities
   - Developing a system for periodical forest monitoring
     - Developing NFMS (system development using outputs produced in the past)
     - Capacity development of C/P organizations through development of NFMS
4. Breeding drought tolerant trees
5. Strengthening regional cooperation

Basic Concept from Technical Aspects

(1) Defining the NFMS as methodology and the NFMS as a database (forest information platform)
(2) Development of the NFMS that meets international requirement
(3) Development of a forest information platform taking into consideration its use, clarifying objectives
(4) Assessment of land-cover maps of 2014 and preparation of forest change maps that contribute to REDD+ implementation
(5) Development of a highly applicable FRL that can reach the level of other countries or meet requirements of donors
(6) Implementation of sustainable forest cover change monitoring
(7) Effective MRV training courses that can lead to right use and operation of the forest information platform
(8) Effective PR activities led by C/Ps
(9) Efficient use of outputs of relevant administrative organizations of Kenya

(1) Defining the NFMS as methodology and the NFMS as a database (forest information platform)

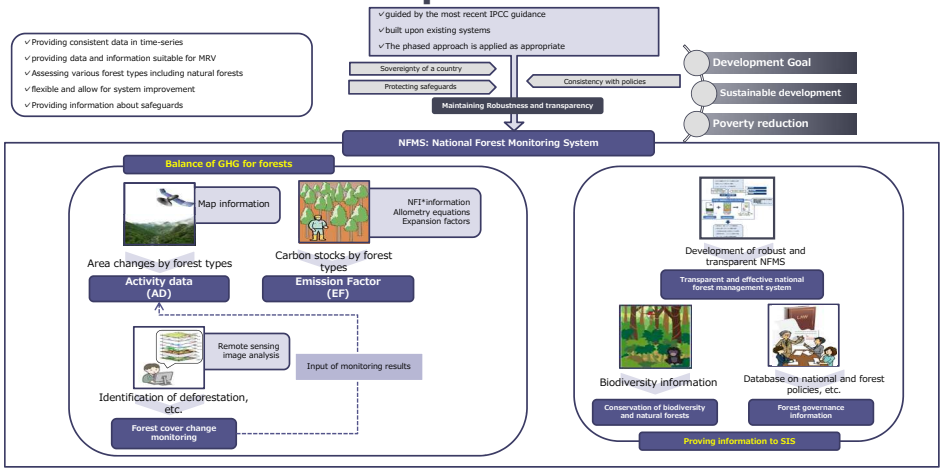
- **NFMS**

  Methodology of how forests are monitored

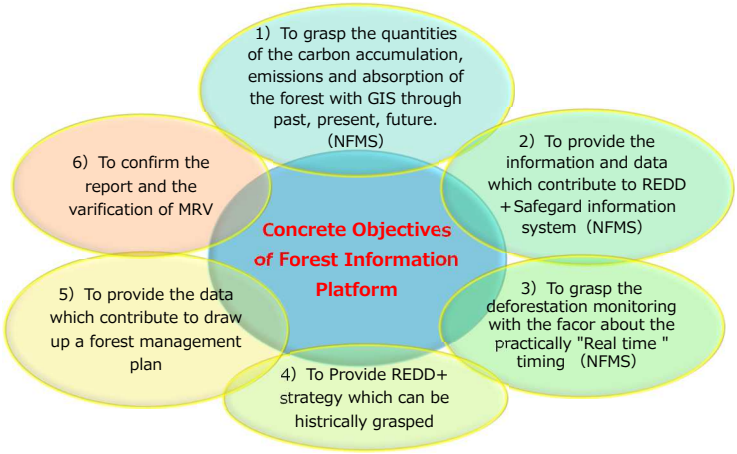
- **Forest Information Platform**

  A database to provide information that does not only include the information identified according to the NFMS but the information necessary for implementing REDD+ and sustainable forest management

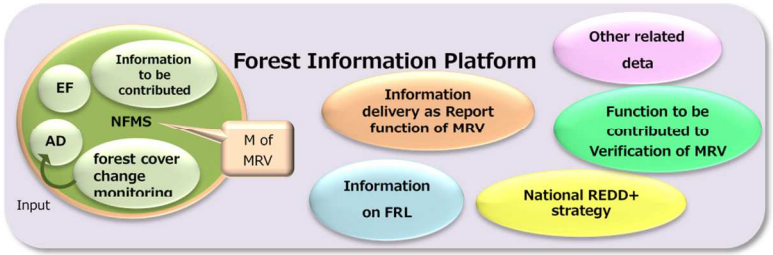
(2) Development of the NFMS that meets international requirement



(3) Development of a forest information platform taking into consideration its use, clarifying objectives #1



(3) Development of a forest information platform taking into consideration its use, clarifying objectives #2



Points to be kept in mind for establishment of FIP

- To extend the existing System of Kenya (KFIS：Kenya Forest Information System) as much as possible
- It will be possible to add and update the data of FRL, MRV method and the national inventory data which other donners will develop.
- System environment with which local officers are able to keep maintaining
- To take the methodology to improve the functionality and the manual document quality by making an actual use of local officers through installing prototype system in the early stage of the Work.

(4) Assessment of land-cover maps of 2014 and preparation of forest cover change maps that contribute to REDD+ implementation

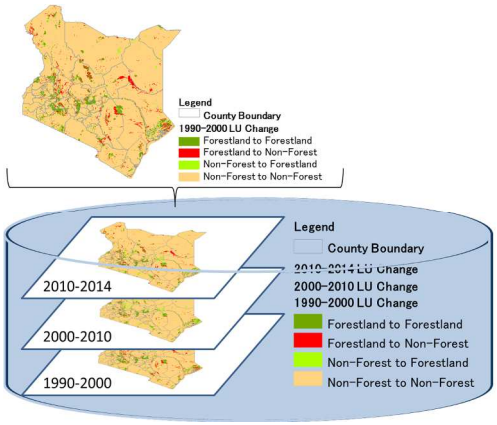
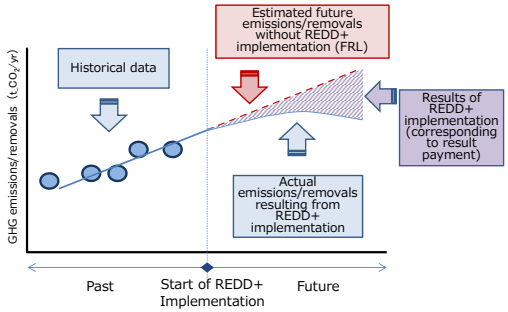


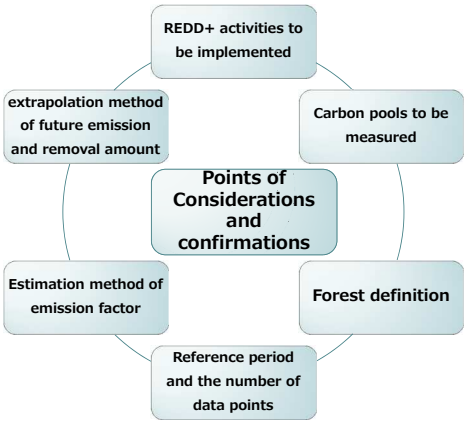
Image of Forest Cover Change Map

2 options of maps to be used to prepare forest cover change maps

1) the biyearly basis Land Cover Map between 1990 and 2014 which was and will be created by SLEEK.
2) Land Cover Maps 1990, 2000 and 2010 which were created by the "Forest Preservation Program" and the Land Cover Map 2014 by SLEEK.

(5) Development of a highly applicable FRL that can reach the level of other countries or meet requirements of donors



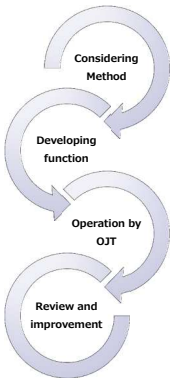


(6) Implementation of sustainable forest cover change monitoring

The expected specific objectives

- the results of monitoring will be utilized as reference data and information for the creation of land cover map.
- The results can be contributed to the biennial report to be submitted to UNFCCC
- The results can be utilized for the forest management

Establishment of monitoring system by OJT incorporating PDCA cycle



Considering method: (Action)	Studying the satellite imagery to be used (optical imagery or radar imagery) Considering method of satellite imagery analysis etc. based on the review and improvement in the previous year
Developing function: (Plan)	Decision of material and equipment to use and the function, and design of flow of analysis
Operation by OJT: (Do)	Preparation of manuals (technical manual and operation manual including assignment of C/P, the rotation and assignment of manager)
Review and improvement: (Check)	Review and improvement of operation results Reflecting the review to the method to be taken in the next year

(7) Effective MRV training courses that can lead to right use and operation of the forest information platform

Points to be kept in mind for implementation of MRV training

- **Identification of the present status of C/P personnel on his or her ability, skills and knowledge and assessment of his or her weakness and gaps**
- **Considering with the C/P personnel effective program designing that matches request and needs of Kenya**
- **Developing a suitable training system (trainers, training venue, training period)**
- **Considering support incorporating an element of ToT that enables technical transfer to other personnel by the trainees**
- **Testing and distributing questionnaires for objectively assessing suitability of the training courses and reflecting their results on the training courses of the next year and thereafter**

(8) Effective PR activities led by C/Ps

PR tools planned at present

Methods	What is posted and targets
Holding workshops in Kenya (inviting mass medium)	Posting stakeholders of Kenya about the activities of the Work
Introducing the activities through the website of KFS	Posting stakeholders of Kenya and its outside about the activities of the Work
Submitting technical documents summarizing the project outputs to the UNFCCC	Posting international communities about progress of REDD+ in Kenya by the outputs of the Work
Posting information through the "Japan Public-Private Platform for REDD+" set up in Japan	Posting related parties in Japan about the activities of the Work, its knowledge, good practices, etc.

(9) Efficient use of outputs of relevant administrative organizations of Kenya

- Smooth conduct of activities will be enhanced and the most applicable NFMS to Kenya will be developed by taking most advantage of the existing systems and information.
- What should be used is not only outputs or systems already developed but also good practices and lessons learned obtained in process of the development.

Basic Concept from Management Aspects

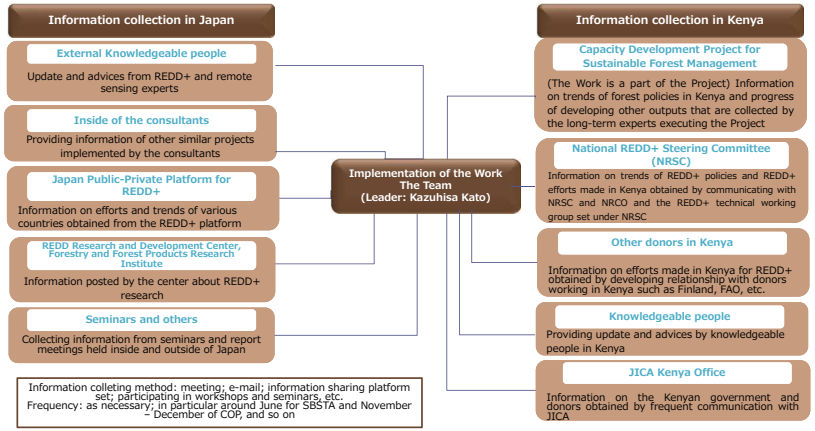
(1) Coordination with relevant projects implemented by other donors
(2) Sure understanding of relevant information inside and outside of the country
(3) Development of ownership of the C/P by incorporating an element of OJT
(4) Keeping the implementation of the Work flexible
(5) Coordination with the Japanese long-term experts involved with the Project

(1) Coordination with relevant projects implemented by other donors

Name of Projects	Donor bodies	Activities
Not known	UN-REDD (FAO)	• Development of a draft Kenya NFMS Road Map for development of the NFMS and FRL • Assessment of accuracy of the land use maps developed under the Japanese Program Grant Aid for Environment and Climate Change
Miti Mingi Maisha Bora (MMMB) Project	Finland	• Supporting development of "National Forest Program" • Preparation for the National Forest Resources Assessment (NFRA) Project for developing national forest inventory that becomes a component of the NFMS
System for Land-based Emissions Estimation in Kenya (SLEEK)	Clinton Foundation	Land use maps of 2014 (Tier 2 level)
Forest Carbon Partnership Facility (FCPF)	World Bank	The Readiness Preparation Proposal (R-PP) for REDD+ was approved in 2010. • It is considered that the land issues with indigenous people conflict with the REDD+ safeguards, and then funds (USD 3,600,000) for implementing the R-PP have yet to be installed as of November 2015.

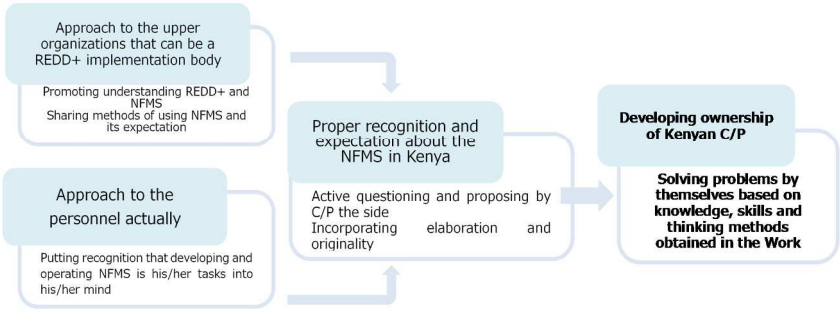
(2) Sure understanding of relevant information inside and outside of the country

System of identifying relevant information inside and outside of the country



(3) Development of ownership of the C/P by incorporating an element of OJT

Process of developing ownership



(4) Keeping the implementation of the Work flexible

Three elements for taking appropriate measures

Identifying circumstances	**Collecting information on policies and security as well as technique through a network system shown in the Basic concept from management aspects (2) "Sure understanding of relevant information inside and outside of the country"**
Forecast	Forecasting possible changes from the collected information. Considering measures for possible changes that can be taken as a part of the regular works. If the changes cannot be treated as a part of the regular works, alternatives that can correspond to the changes and their advantages and disadvantages are analyzed.
Measures	Deciding information sharing, communication, reporting and a decision making structure in advance in cases where changes are forecasted and corresponding to the changes is needed.

(5) Coordination with the Japanese long-term experts involved with the Project

- when the Team leaves Kenya temporarily or anytime it is necessary in order to enhance information sharing to Japanese long-term experts.
- it will be arranged so that progress of the Project can be coordinated with that of the Work by involving the Japanese long-term experts in checking progress of the activities implemented under the Work in a year and to develop a plan for the next year.

Implementation Methods of the Work

[1] Activities on the NFMS and the Forest Information Platform

[2] Activity on various type of map creation

[3] Activities on FRL

[4] Activity on forest cover change monitoring in the whole of Kenya

[5] Activity on the MRV training

[6] Activities on pilot project for REDD+

[1] Activities on the NFMS and the Forest Information Platform

[1-1] Development of the NFMS (1st year)
[1-2] Design and Development of the Forest Information platform (1st year)
[1-3] Review and improvement of NFMS (2nd year to 5th year)
[1-4] Installation of the Forest Information Platform (2nd year)
[1-5] Making a test installation of the Forest Information Platform through OJT (2nd year)
[1-6] Review and improvement of the achievement of the prototype operation on the Forest Information Platform (3rd year)
[1-7] Operation of the new Forest Information Platform with the review and improvement (3rd year to 5th year)

[1-1] Development of the NFMS

Contents (What)	Purpose (Why: Why the information is needed)	Needed Information (Which: by which information the contents are developed)	Specific information (How: How the information is obtained)	Place to get information (Where：where the information is prepared)	Frequency and time (When：When and how often the data is updated)	Persons in charge (Who：Who are the persons in charge)
Activity data	Grasping the Balance of GHG from forests	Area changes by forest types	Develop forest cover change map using land cover map in each year, then extract the area changes	KFS, ○○Department	every○years	KFS○○Department Mr.○○
Emission Factor)	Grasping the Balance of GHG from forests	Carbon stocks per hectare (ha) by forest types	Use the default value of Tier1 or calculate emission factor applying the biomass expansion factors or allometric equations obtained by biomass survey to volume per ha obtained by the forest inventory	KFS, ○○Department	At any times or every○years	KFS○○Department Mr.○○
Balance of GHG from forests	For the National forest monitoring	activity data and Estimation factor	GHG is calculated by multiplying activity data prepared and emission factor developed	KFS, ○○Department	At any times or every○years	KFS○○Department Mr.○○
Forest cover change monitoring	Grasping information about deforestation and forest degradation	Forest cover change monitoring developed by the Work	Analysis of remote sensing data （it will be developed in the Work）	KFS（C/P of the Work）?	Once/year (frequency in the Work) ?	KFS○○Department Mr.○○
Safeguard	Providing safeguard information system (SIS) with information on forest governance	Diagram of forest governance system in Kenya, Forest-related laws and programmes	Summarize the organization chart of KFS, forest-related policies, programmes, laws and treaties.	KFS, ○○Department KFS, △△Department	At any times or ○ times/year	KFS○○Department Mr.○○
Safeguard	Providing SIS with information for consideration of biodiversity	Wild animals and plants protection area map National Park map Other biodiversity information	Collaboration with the Kenya Wildlife Service (KWS), Incorporate biodiversity information item into forest inventory item	KWS, In charge of NFI department	At any times or every○years Modification after the implementation of forest inventory	KFS○○Department Mr.○○

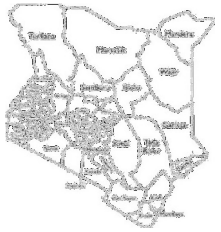
[2] Activity on various type of map creation

[2-1] Process assessment for correctness of Land Cover Map 2014 (1st year)
[2-2] Result assessment for correctness of Land Cover Map 2014 (1st year)
[2-3] Report of assessment result (1st year)
[2-4] Preparation for Land Cover Map creation guidance (1st year)
[2-5] Improvement of guidance material of Land Cover Map creation(2nd year to 5th year)
[2-6] Guidance for creation of Land Cover Map at pilot area (2nd year to 4th year)
[2-7] Reediting the classified category of Land Cover Map 2014 (1st year)
[2-8] Creation of Forest Cover Change Map (1st year)
[2-9] Guidance for creation of Land Use Map 2020 (5th year)

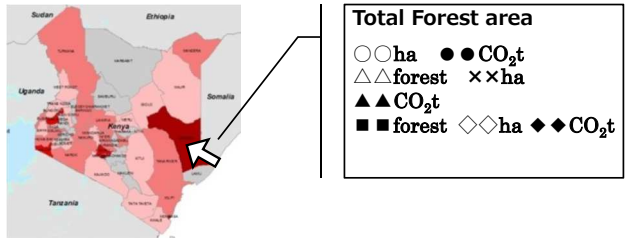
[3] Activities on FRL

[3-1] Collection of information for emission factor (1st to 2nd year)
[3-2] Preparation of carbon map in 2014 (1st year)
[3-3] Analysis of land cover change based on the land cover map (2nd year)
[3-4] Setting FRL (2nd year)
[3-5] Evaluation of FRL (3rd year)
[3-6] Improvement of FRL based on the evaluation (3rd year)

[3-2] Preparation of carbon map in 2014



Estimating carbon amount in each county



Displaying carbon amount by color-coding
The large amount is dark red, the smaller is pink, gray

[4] Activity on forest cover change monitoring in the whole of Kenya

[4-1] Consideration to sustainable method for forest cover change monitoring (1st year)
[4-2] Development for function of forest cover change monitoring (1st year)
[4-3] Operation by OJT (1st year)
[4-4] Review and improvement to pilot operation result (1st year)
[4-5] Operation by OJT (2nd year to 5th year)
[4-6] Review and improvement to operation result in previous year (2nd year to 4th year)

[5] Activity on the MRV training

[5-1] Preparing the plan of MRV training (1st to 5th year)
[5-2] Implementation of MRV training (2nd to 5th year)
[5-3] Review and improvement of the MRV training (2nd to 5th year)
[5-4] Reflecting the MRV training to NFMS (2nd to 5th year)

[5-1] Preparing the plan of MRV training

	Expected Contents of MRV training
①	The outline of REDD+
②	The outline of NFMS
③	The outline of MRV
④	About M (Measurement) of MRV, Forest remote sensing
⑤	About M (Measurement) of MRV, Forest inventory survey and biomass survey
⑥	About R (Reporting) and V of MRV

Considerations	Assumption under the present conditions
Time	July or August every year (total 4 times)
Duration	About 2-3 days
The target participants for the training	10-15 person (KFS staff, Government officials of targeted county, etc.)
Place	Nairobi city

[6] Activities on pilot project for REDD+

[6-1] Consideration of feasibility for implementation of REDD+ pilot project (3rd to 4th year)

[6-2] Preparation of draft project document or feasibility study report(5th year)

Materials and equipment required for the Work

NO.	Name of Equipment	Q'ty	Specification
1	GIS cloud server software	1	ArcGIS online Subscription for 5 years
2	Remote sensing software for desktop	2	ERDAS IMAGINE 2016 version
3	Remote sensing software for desktop	2	Other software will be discussed
4	GIS software for desktop	4	ArcGIS for desktop advanced ArcInfo 10.3 with all the extensions
5	Workstation	6	RAM: <36GB HP Z640 workstations g1X62ea 32 GB RAM and 29 inch screens 8 computers plus screens
6	Handy GPS	4	Mobile mapper 120. 8 pieces
7	Professional GPS instrument	1	Mobile mapper 300. 2 pieces
8	Large-format printer	1	HP design jet t7200 production printer A0
9	Large-format scanner	1	HP Design jet sd pro scanner A0
10	Business printer	1	HP color LaserJet enterprise mfp m 577dn (b5146a)
11	survey 123 for mobile mapping	5	subscription for 5 years
12	Mobile mapping devices	5	Samsung galaxy tablets

NO.	Name of Equipment	Q'ty	Specification
13	Laptops	2	HP 17.3 touch screen, Intel core i7, 16GB memory, ITB Hard Drive windows 10
14	Laminating machine	1	HP A0 machine
15	Geo-information data base software	1	Oracle 11G Advanced Edition
16	Geo-information data base software option for spatial data management	1	ArcGIS for Server Enterprise Standard, Portal for ArcGIS Level1 with Image Extension
17	GIS Server software	2	
18	Geo-information data base server	2	DELL PowerEdge R930
19	Data storage server	1	VCNP7S-4000020-4U36B
20	Data storage Server Software	1	
21	Rack for server	1	CP-SVN2410MBK
22	Windows server 2008 r2 software licence	4	Windows server 2008 r2 software licence
23	UPS	6	Schneider Electric Smart-UPS XL 3000VA Rack Mount 200V

Implementation Structure of the Work

KFS

Team Leader KAZUHISA Kato

Activities on entire the works	KAZUHISA Kato
Activities on the NFMS and the Forest information platform	KAZUHISA Kato / KOHEI Yamamoto
Activities on various type of map creation	KEI Sato/ SAHORI Fujimura
Activities on FRL	KAZUHISA Kato / XXXXX
Activities on forest cover change monitoring	KEI Sato/ SAHORI Fujimura
Activities on MRV training	KAZUHISA Kato / KEI Sato / SAHORI Fujimura
Activities on pilot project of REDD+	KAZUHISA KATO

Thank you very much!

Contact address: k.kato@jofca.or.jp

Explanation of the Work Plan for Mapping and Forest Cover Change Monitoring Activity

on

The REDD+ Readiness Component

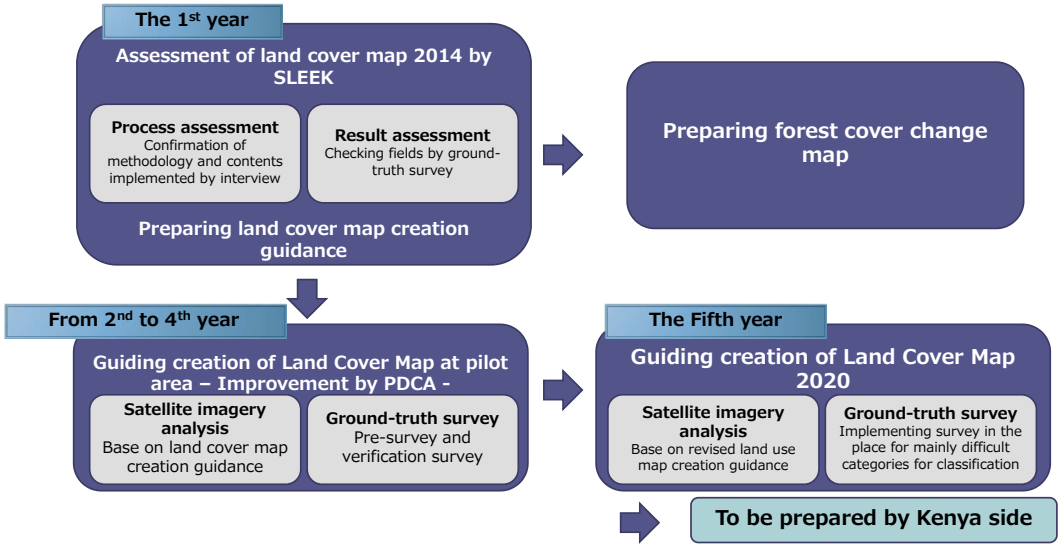
in

the Capacity Development Project for the Sustainable Forest Management in the Republic of Kenya

By Kei SATO – Remote Sensing Expert -

2016.7.26

Assessment of land-cover maps of 2014 and preparation of forest cover change maps



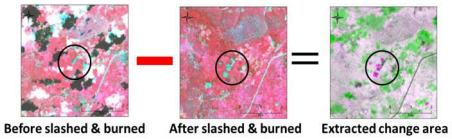
Forest cover change monitoring – Development of function at First Year-

Consideration Points

- Technical point
  * Accuracy, quality, analysis speed, and sustainable method
- Operational point
  * Easy handling, trainable to staff and sustainable operation
- Financial point
  * Satellite image procurement for sustainable operation

Two approaches

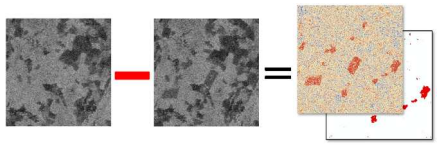
- To use optical satellite imagery
  * LANDSAT, SPOT, Pleiades, WorldView, etc.
- To use SAR satellite imagery
  * ALOS2, TerraSAR-X, RADARSAT
- **Combination approach available**



Example of Optical data utilization

To consider merit and demerit of satellite imagery

- Cloud free or not
- Color information available or not
- Image data accessibility or not
- Analytical availability or not
- Ground Image Resolution



Example of SAR data utilization

To consider merit and demerit of analysis methodology

- Image processing
  - Classification basis
  - Comparison basis between pixel value
- Image interpretation
- Other analysis methodology

To consider utilization of existing equipment

- Data inter operability
  * Not only existing data will be utilized by new equipment, but also new data will be utilized by existing equipment.
- Operability for existing and new
  * It will be included basic function for processing.

Approach, Satellite Imagery, Capability with Availability of staffs and equipment plan will be surveyed and discussed with C/P

Forest cover change monitoring – Pilot operation with OJT and improvement at First Year -

Pilot operation with OJT

- Preparation of operation manual
  - How to use the developed function based on utilized screen capture
  - Consideration of operability
    * Assignment of operation staff, rotation and assignment of administrative staff
- Preparation of training program for OJT
  - It will be considered basis knowledge
- OJT operation

Forest cover change monitoring – Pilot operation with OJT and improvement at First Year -

Improvement

- Improvement points will be extracted through the OJT operation
- Extracted improvement points will be applied to monitoring function and operation manual

Forest cover change monitoring – OJT Operation and improvement -

Improvement based on PDCA

- Improvement period: Second to Fourth Year
  * Plan Do Check Action

Thank you very much!

Contact address: koetia2696@pasco.co.jp

Explanation of the Work Plan
on
The REDD+ Readiness Component
in
Forest Information Platform
Database System implementation

The Capacity Development Project
for the Sustainable Forest
Management
in the Republic of Kenya

By Kohei YAMAMOTO– database

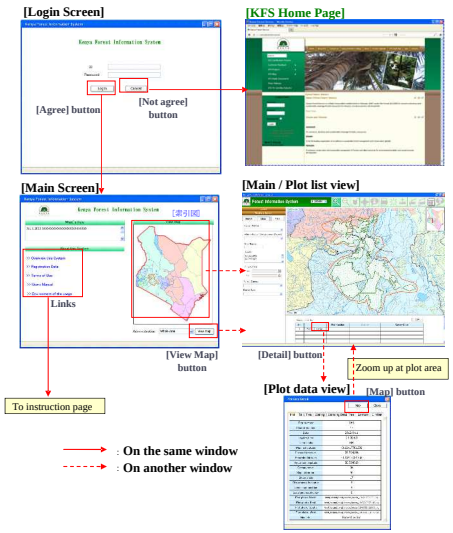
2016.7.26

Forest Information Platform

- The system expansion of the data interoperability
  - to be examined over the existing database or the prospected necessary information to be added.
- The software renewal and replacement
  - to insure the extensibility which will be required after the period completion of the Work.
- The web application service
  - to be able to add and update the data of the national REDD+ strategy data and of the newly developing data such as FRL, MRV method and the national inventory data which other donner will develop.

KFIS:Kenya Forest Information System

Example of Display Flow

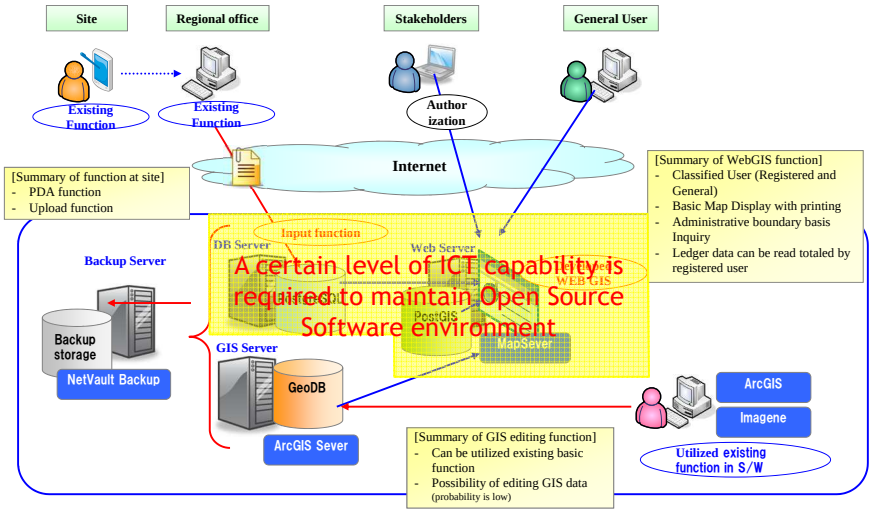


Web mapping system on open source software base

The existing System is opened to the internet about the information such as the data of Forest Inventory and the capacity biomass which the project Program Grant Aid for Environment and Climate Change “the forest Presentation Programme” developed.

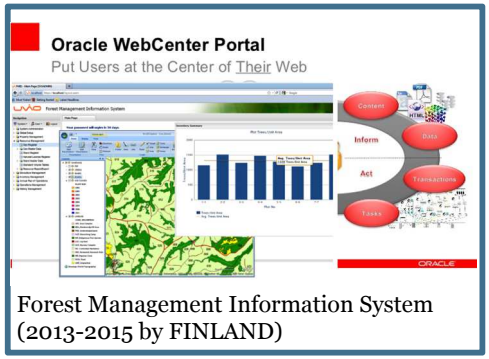
“A basic web portal, on which the vegetation maps can be viewed.” *MMMB Programme Document (Revised): September 2013 quote*

Summary of System Structure in KFIS Ground Design



FMIS:Forest Management Information System

UVIO

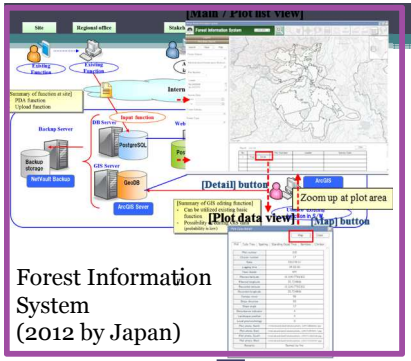


Forest Management Information System (2013-2015 by FINLAND)

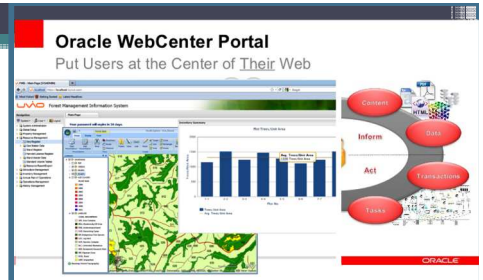
Forest Management Information Package Web System for Plantation data

The server-based license for UVIO FIS software has been purchased, installed and configured. A first training has been provided to system administrators and core users, and plantation records are being entered. The FMIS are down to station level.

It is still required to link the shape data with the record, “manually” with QGIS.



Forest Information System (2012 by Japan)



Forest Management Information System (2013-2015 by FINLAND)

Migration

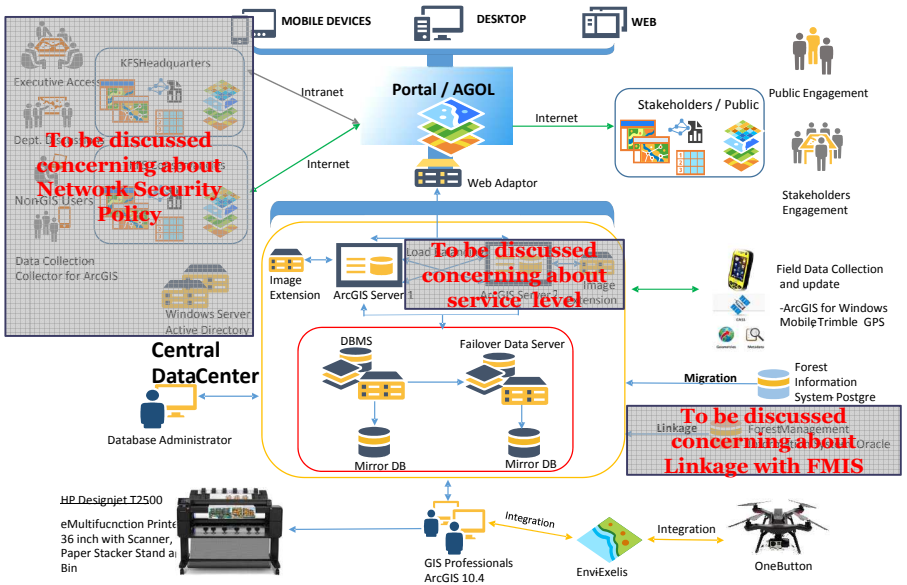
Linkage

Forest Information Platform(2016-2021by Japan)

Forest Information Platform System Structure (draft)

- SaaS (Software as a Services)or On-premises
  - to make balance between the availability of user and the security of the data and system
- ArcGIS Online + Portal for ArcGIS
  - ArcGIS Online for 10user licenses (for county and field use)
  - ArcGIS for Server Enterprise Standard, Portal for ArcGIS Level1(KFS HQ,IC)
- Web AppBuilder for ArcGIS
  - to be able to continue to develop web application the Wizard based Application development environment are build in.
  - to take advantage of the smart devices data correction such as photo, movie GNSS which directly acquired on site the Story Map is available on ArcGIS Online and Portal.

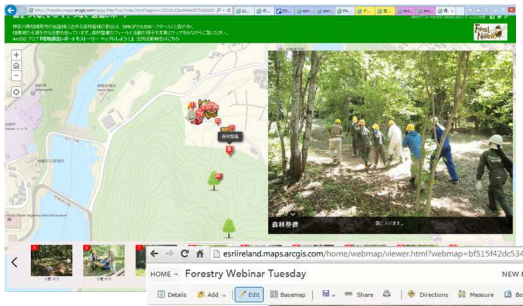
Forest Information Platform(draft image)



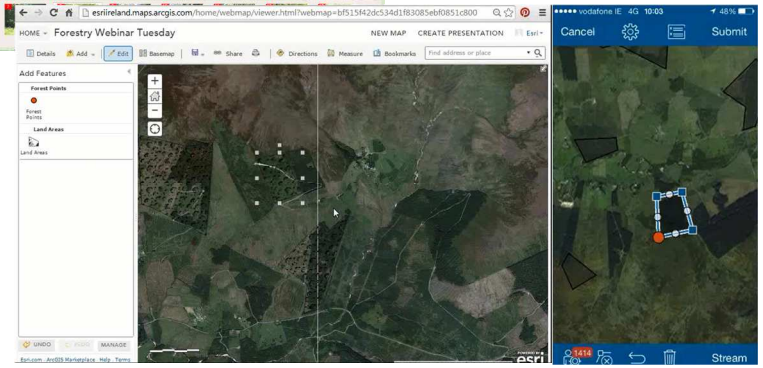
Challenges

- Security
  - User Authentication is required for Web Service
  - Windows Server Management (Active Directory) should be established by ICT before implementation
- Service Level
  - Server redundancy costs is to much for the system
  - How the information service is required
- FMIS Linkage
  - Discussion and coordination with Finland and Australia required

Example of Story Map



Example Web Service



Thank you for your attention.

Contact address: kootho1810@pasco.co.jp

RRPUBLIC OF KENYA

Ministry of Environment and Natural Resources

Kenya Forest Service

Stakeholder consultation workshop

Programme Date: 28th and 29th March 2017

Venue: Masada Hotel Naivasha

Purpose: To explain the activity of REDD+ Readiness Component in The Capacity Development Project for Sustainable Forest Management, discuss the methodology of Activity Data and Emission Factor to set the FRL, discuss the methodology and component of NFMS and share the information of each international partner' s activity related with REDD+ in Kenya.

Participants: Members of the Technical Working Group for REDD+, JICA Kenya Office, JICA Project Members, Other stakeholders.

Day 1	Agenda	Presentation	Contents
8:30-9:00	Registration	-	-
9:00-9:10	Introductory Remarks		-
9:10-9:30	REDD+ Readiness status	Mr. Gichu	
9:30-10:00	Roadmap of NFMS	Dr. Kinyanjui	
10:00-10:20	Overview of Component 3	Mr.Kato	Introduction of Component 3 activity
10:20-10:35	Official Opening	Mr. Omollo	
10:35-10:55	Tea Break		
10:55-11:15	Methodologies for NFMS	Mr.Kato	List up methodologies that will be needed for NFMS and current existing methodologies (NFI, Mapping etc.)
11:15-11:35	Q&A, Discussion		
11:35-11:55	Component of Forest Information platform	Mr.Kato	Proposing sitemap of the platform
11:55-12:15	Q&A, Discussion		
12:15-13:00	【Discussion】 System of Forest Information platform	Facilitator: Mr.Sato	・Utilization of existing systems ・Accessibility of file-based data stored in DB(SQLite, PostgreSQL) ・ Security of data management etc.
13:00-14:00	Lunch Break		
14:00-14:20	Documentation of NFMS	Mr.Kato	Developing NFMS concept, technical methodology and calendar considering with the result based payment schedule
14:20-14:40	Q&A, Discussion		

Day 2	Agenda	Presentation	Contents
9:00-9:20	Additional pilot forest inventory and Carbon stock of AGB and BGB	Mr.Yamashita	Need for additional forest inventory Calculation of additional forest inventory data based on survey results
9:20-9:40	Q&A, Discussion		
9:40-10:00	Consideration of setting soil carbon methodology	Mr.Yamashita	Re-examination and confirmation of soil carbon as target carbon pool.
10:00-10:20	Q&A, Discussion		
10:20-10:40	Tea break		
10:40-11:00	Report on process and results assessment for correctness of Land Cover/Land Use Map 2014	Mr.Sato	Reporting about the assessment of methodology and results of the SLEEK map 2014 by ground truth survey
11:00-11:20	Assessment for SLEEK's time series Land Cover/Land Use Map	Ms Faith	The assessment result of SLEEK map's outputs
11:20-11:50	Q&A, Discussion		
11:50-12:10	Training Plan on MRV	Mr.Kato	Training purpose and target Contents etc.
12:10-12:30	Q&A, Discussion		
12:30-13:00	【Discussion】 REDD+ Activity of Kenya	Facilitator: Mr.Kato	What kind of activities can be acceptable as REDD+ in Kenya
13:00-14:00	Lunch Break		
14:00-14:20	【Discussion】 Development of Kenya REDD+ progress matrix sheet	Facilitator: Mr.Kato	Proposal on developing Kenya REDD+ progress matrix sheet that show required REDD+ activities and each progress
14:20-14:40	Way forward	Mr. Gichu	
14:40-15:00	Closing Remarks		

Annex: LIST OF ATTENDANCE OF REDD+ TECHNICAL WORKING GROUP AND STAKEHOLDERS WORKSHOP IN NAIVASHA

No.	Name	Organization
1	Alfred Gichu	KFS
2	Peter Nduati	KFS
3	Kei Sato	JOFCA
4	Mwangi Kinyanjui	Karatina University
5	Kenichi Takano	CADEP (C.A)
6	Kazihisa Kato	JOFCA
7	Tom Kiptenai	ASF
8	Merceline Ojwala	DRSRS
9	Kazuhiro Yamashita	JOFCA
10	Faith Mutwiri	KFS
11	Serah Kahuri	KFS
13	Eunice Maina	KFS
14	Jane Wamboi	KWS
15	James Kimondo	KEFRI
16	David Adegu	MENR
17	Maurice Otieno	NEMA
18	John Ngugi	KEFRI
19	Tatua Muturi	GISS
20	Naomi Matsue	CADEP-SFM
21	Yuki Honjo	CADEP-SFM
22	John Ngugi	JICA Kenya
23	Miharu Furukawa	JICA Kenya
24	Joan Kariuki	CADEP-SFM
25	Jamleck Ndambiri	KFS
26	Balozi Bekuta	University of Eldoret
27	Margaret Midika	DRSRS
28	Charles Mwangi	DEKUT
29	Divinah Nyasaka	KFS
30	Diana Kishiki	KFS
31	Fredrick Ojwang	KFS
32	Fortunate Benda	RCMRD
33	Florence Tuukuo	KFS
34	Damaris Mwikali	FSK

Minutes of Stakeholder consultation workshop

Date: 28-29 March 2017
Place: Masada Hotel Naivasha
Attendees: Refer Attachment 1
Agenda:

Meeting called to order at 9.05 am by Peter Nduati (Project Manager) who requested Prof. Balozi to start off with a word of prayer. This was followed by a roundtable self-introduction session by all participants from the various stakeholder organizations.

Mr. Nduati noted that some participants did not mention their titles like Professors and Doctors highlighting it was important to mention them for the acknowledgement of the intellect in the meeting.

Mr. Nduati gave an overview of the CADEP_SFM project, he supposed that for ease of remembering the project title, the acronym CADEP_SFM was developed. The project has five components namely; policy support, pilot implementation, REDD+ Readiness support, tree breeding and regional cooperation and each component has a body that is responsible for it ranging from KFS, KEFRI, MENR, County governments and other organizations.

1. REDD+ READINESS ACTIVITIES

Mr. Gichu gave a discussion on the activities that have been implemented over the years in accordance with UNFCCC guidelines. His presentation covered the following areas;

- Context of REDD+ in regards to Paris Agreement, Kenya committed to REDD + activities in 26th Nov 2016,
- Objectives of REDD+ strategy.
- Policy instruments which guide REDD+ implementation.
- Priority Areas of focus.
- Readiness Activities.

The achievements of REDD+ activities.

Reactions

Prof. Balozi suggested that the role of research seems to be look warm whereas it can be of great input in updating knowledge available. In his response, Mr. Gichu said forest cover map activities are geared towards accurate identification of transactional paths and research has been key informant on this.

Dr. Kimondo inquired on safeguards that have been put in place to ensure there are no reversible activities where it emerged that proper planning in problem identification will be carried out ensuring there are no reversible activities.

2. OVERVIEW OF REDD+ READINESS (NFMS &FRL)

Mr. Kato gave a presentation on framework of the work plan for Component 3, stating that it aims to support implementation of REDD+ Readiness activities. He explained in details the roles and objectives of the Component including the functions that would be carried out in every role. The focus areas are: National Forest Monitoring System (NFMS) which he stated can be defined as a methodology in the component, and the Forest Information Platform (FIP) has function as a database in the NFMS in the component, land cover / land use map, Forest Reference Level, Forest cover

change monitoring, Measurement, Reporting & Verification (MRV) training and pilot project on REDD+, Preparation of draft project documents on pilot project for REDD+ which is meant to make contributions to component 2 in case the pilot project will be implemented.

Reactions

Mr. Gichu asked if the work plan took into consideration greenhouse gas inventory for countries. Where Mr. Kato responded that it should be does; on further enquiries if forest reference emission level report can be submitted by Jan 2018, he recommended for stakeholders to decide on the way forward.

3. ROADMAP FOR NFMS

Dr. Kinyanjui itemized the tasks in the roadmap in a chronological order as below;

i)	Forest definition	xii)	Developing national accounts
ii)	Land Use category	xiii)	Drivers of deforestation
iii)	Forest Stratification	xiv)	Policies and measures for REDD+ implementation
iv)	Mapping standards	xv)	Safeguards
v)	Inventory standards	xvi)	Benefit sharing mechanism
vi)	Mapping Land use change	xvii)	Community monitoring
vii)	National forest inventory	xviii)	National circumstances
viii)	Development of allometric equations	xix)	Modelling and forecasting
ix)	Internal verification i.e. Quality Assurance / Quality Check	xx)	Reference levels
x)	Preparation of carbon maps	xxi)	Project registry
xi)	Carbon change calculation	xxii)	International reporting

Reactions

Mr. Gichu clarified that the road map was developed by Dr. Kinyanjui in consultation with International experts and that international reporting will be done through National communication platform thus REDD+ team should work in close association with GHGI as National circumstances will be used to enable accurate information of forestry to be disseminated.

Monitoring was agreed upon to be participatory approach monitoring by involving all relevant stakeholders to report as per REDD+ requirements. The mechanism on benefit sharing will be guided by policies and national documents on benefit sharing.

The participants agreed on the activities captured by the outline of the roadmap while making suggestions of further modelling and forecasting, bringing indigenous knowledge on board and to indicate what should be included in the NFMS.

4. **METHODOLOGIES FOR NFMS**

Mr. Kato brought to light UNFCCC requirements by making reference to decision 11 from Cop 19 on modalities for national forest monitoring systems. Cop 19 decides that basis for estimating anthropogenic forest-related greenhouse gas emissions by sources, and removals by sinks, forest carbon stocks, and forest carbon stock and forest-area changes; it also decides that robust national forest monitoring systems should provide data and information that are transparent, consistent over time, and are suitable for measuring, reporting and verifying anthropogenic forest-related emissions

by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest-area changes.

He gave definitions of NFMS in the component as a methodology stating that there is need to develop methodology for REDD+ and function of NFMS as a database will be developed through establishing Forest Information Platform, he also gave an overview of the UNFCCC requirements then explained the Improving Capacity on Forest Resources Assessment (ICFRA) & System for Land based Emissions Estimation in Kenya (SLEEK) methodologies on classification and sampling design.

Reactions

Mr. Nduati said that ICFRA started stratification which then was taken as foundation for SLEEK information on vegetation types classification according to their characteristics.

Mr. Ndambiri added that ICFRA stratification was used during Forest Preservation Program (FPP) and that SLEEK was developed to produce expected output, He suggested that the challenges at hand should provide more information on what to come up with.

The decisions on stratification should consider costs of monitoring hence avoiding very small clustering; in conclusion, the SLEEK stratification method was embraced.

5. PROPOSED CONTENTS OF THE NFMS DOCUMENT

Mr. Kato made a presentation of a proposal of what the NFMS document should comprise, after which he urged the team to decide on the design and calendar of the document, also there should be an approval in the office system.

Reactions

The proposed contents of the NFMS document were basically accepted, but in addition with proposed contents, there were some comments as below

Mr. Adegu stated that the proposed content was good as it captured all relevant areas also seeking clarification on whether the NFMS would be operational i.e. if there was a way to access it and if it will be continuously updated.

Prof. Charles asked if there was a timeline for NFMS and whether the JOFCA team intends to have the draft by Oct 2017.

Mr. Fortunate noted that drivers of deforestation had been left out in the proposed document. He mentioned that driver of deforestation, national strategy works, policies and REDD+ should be included in NFMS. He also stated that the proposal needed further investigation so as to link NFMS and National Green House Gas Inventory.

In his response, Mr. Kato explained that NFMS will be designed to focus NFMS on monitoring how emissions and removals of forest are changed through forest cover change. He also pointed that the driver of deforestation and its strategic option/Policy and Measures (PaMs) should be considered in the National REDD+ Strategy.

QA/QC is not captured in the proposed document; the team should have comprehensive discussions and decide on whether the content should be included in the document or not.

6. COMPONENTS OF FOREST INFORMATION PLATFORM (FIP)

NFMS can be defined as a methodology- how forests are monitored and FPI can be defined as a database function which includes information on the NFMS and information necessary for REDD+ implementation and sustainable forest management (FIP). Mr. Kato gave a detailed discussion on the conceptual diagram of FIP highlighting its ideas, contents and objectives.

FIP has six objectives; FRL, MRV, safeguards, forest emissions and removals, National REDD+ Strategy and related information, forest administrative information and other relevant data. He also explained the functions to be performed for each objective of the platform. The functions of the platform will be made available by the component while the other work e.g. reporting will be done by other parties in Kenya e.g. Kenya Forest Service.

Historical data will be used to acquire information on how much the country emits and System on safeguards should be linked to the FIP.

Reaction

The proposed platform captures critical issues; nevertheless, further developments are encouraged to add onto the database.

7. SYSTEM OF FOREST INFORMATION PLATFORM

Mr. Sato provided a record on forest information systems that have been used in the country for information management, the systems are;

a) Kenya Forest Information System by Forest Preservation Program
b) SLEEEK system
c) Open Foris by ICFRA
d) Forest Management Information System(UVIO) by MMMB

Of the four; Forest Management Information System by Miti Mingi Maisha Bora is still operational database system.

Reactions

After comprehensive discussions, it was agreed that concept designing is most crucial since the platform will have capabilities and will run in SQL server unlike the existing one which runs on Oracle. It was also discussed that it should be clear on responsibilities of the sectors which will have access to the system for proper handling and security assurance. Updating should be done at high levels to ensure even maps capture relevant information.

Prof. Balozi opined that different users have varied preferences in regards to servers, data, etc. he enquired if the consultant could give recommendations on effectiveness of the platform. He was told that all items need to be defined within the platform and if linking is required, it will be catered for.

A question was raised on what the current system is hosting so that way forward on what the system to be developed will handle can be made, the contents will be discussed conclusively to ensure relevant data on forestry is captured.

8. RECAP OF DAY 1

Prof. Balozi gave an inclusive summary of the presentations that had been covered on the first day.

Reactions

Mr. Gichu sort clarification on whether Forest Reference Levels take into account REDD+ activities, and if so was it the baseline for construction of reference levels. Mr. Kato said that; there should be critical investigation on what to include in each level of the National FRL

9. ADDITIONAL PILOT FOREST INVENTORY AND CARBON STOCK OF AGB AND BGB

Mr. Yamashita explained the reasons for carrying out the exercise which are; to set temporary emission factor without reliability of NFI level for FRL and get the standard deviation for each forest type for future National Forest Inventory and this was done between 15th February and 14th March 2017. In addition to what ICFRA had done, the total number of surveyed plots is 137, this is not enough data as the country data to do reporting for tier2 data when compared with what other countries have done.

After this activity; volume values, above ground biomass and below ground biomass were calculated.

Volume values and AGB were calculated using allometric equations while BGB was calculated using root/shoot ratio (according to IPCC 2006 guidelines).

Volume calculation was done using the equation; (Henry et al 2011)
Vol. = π× (DBH/200)^2×H× 0.5

Calculation of ABG was done using equations shown below.
An equation for common trees, *Acacia spp.* and plantation species (*Pinus patula, Eucalyptus and Cupressus*) : (Chave et al. 2009, 2014)

$AGB=0.0673*(0.598*D^2H)^{0.976}$ (kg)

An equation for *Rhizophra spp.*: (Fromard et al. 1998, Komiyama et al. 2008)

$AGB = 0.128\times DBH^{2.60}$

An equation for Agro-forest: (Henry et al. 2009)

$AGB_{Agro\text{-}forest}=e^{(0.93*\log((d\wedge 2*h))-2.97)}$

Taking the CF default value for (IPCC 2006);
AGB as 0.47 (tonne (tonne.d.m)$^{-1}$
Carbon stock = AGB × CF
Calculation of BGB
Taking CF as 0.5 (tonne C (tonne.d.m)$^{-1}$
Carbon stock = BGB × CF

Reactions

Prof. Balozi sort clarification on the equations applied after which he was able to understand them hence make an explanation bringing all participants to an endorsement of the allometric equations herein.

Mr. Yamashita noted that countries that had already made submissions had national forest inventory data on greater than 1000 plots after which Mr. Gichu opined that the available historical data is enough as of now for submissions and reporting.

It was agreed that based on the result of this additional forest inventory data and the ICFRA data, each forest type's carbon stock per ha will be calculated as country data.

10. CONSIDERATION OF SETTING SOIL CARBON METHODOLOGY

Mr. Yamashita said that the Component is aimed at setting Emission Factor for three of the five carbon pools i.e. Above Ground Biomass (AGB), Below Ground Biomass (BGB) and soil carbon. After giving an overview of other countries indicating that Indonesia has submitted FRL on Peat land while Chile and Guyana dropped soil carbon pool.

He explained the methodology to be used in setting SOC indicating that Tier 1 is available from the IPCC guidelines and requires other kinds of information e.g. climate region, soil type, level for stock change factor etc. This was followed by a detailed discussion of the equations to be used for Tier 1 and the components it takes into account.

He highlighted the problem point saying that it was difficult to find the information for setting the Stock change factor hence seeking suggestions on whether the factor can be set or not.

Reactions

Integrated methodology is necessary and research will be of importance to ensure the relevant information is taken into account.

11. REPORT ON PROCESS AND RESULTS ASSESSMENT FOR CORRECTNESS OF LAND COVER/LAND USE MAPS

Mr. Sato gave a presentation on remote sensing where he stated; it is a science and technology by which the characteristics of objects of interest can be identified, measured or analysed without direct contact with them. Remote sensing though reliable, has a limitation in that image effects depend on different sampling size.

He gave a detailed account of the classification methodology and image processing techniques in SLEEK's approach. After giving an illustration comparing the SLEEK's approach and what was done By the JICA team, it was clear that the SLEEK's approach is recommendable since this approach got classification result as 75.1 % totally. This is means the land cover/land use maps can be used since the comprehensive accuracy result is more than 70% as threshold value. However he stated that accuracy ratio of "Moderate Forest" and "Open Forest" was less than 70% in case of divided to 3 type of forest.

12. PRESENTATION OF LAND COVER/LAND USE MAPS

Ms. Faith stated that from a previous Technical Working Group meeting it had been recommended that Land Cover/Land Use maps for 2010 be revisited to ensure they captured information correctly, this had been done and the result was what the participants were brought to light about. The maps had been initially developed for SLEEK by various stakeholders and they were later embraced for REDD+ program.

The methodology was guided by technical and process manuals with wider stakeholder consultation for improvement of the maps through critical assessment this was done through analysis including statistical, graphical analysis for 2010 maps.

Reactions

Mrs. Kahuri suggested that since the maps had been adopted for use on REDD+, they should be given edition number, name, and serial number. Mr. Tatua responded that validation is of importance for now after which Survey of Kenya will give the required specifications.

Dr. Kinyanjui raised a concern on the interval of developing the maps suggesting for consistency; the interval of developing the maps will be two (2) years or four (4) yeas. It will be decided.

13. TRAINING PLAN ON MRV

Mr. Kato stated that the training has been scheduled for July 2017, for two days with a target of 20-30 participants. The training will be on REDD+ and its Progress, International discussion and transaction, MRV, NFMS and FIP, development of Land cover/Land use maps, activities in development of Activity Data and Development of Emission Factor in Kenya.

Mr. Kato hence sought for suggestions on whether to go ahead with the implementation or not and whether the Kenyan side would disseminate methodology of participatory forest monitoring to other area and if participants can implement Participatory Carbon Monitoring from management viewpoint issues including budgets and logistics.

Reactions

Ms. Wambui opined that the target was limited and that the number of days allocated for the training would not be enough for the team to meet the set objectives. Commenting on the timeline, Mr. Kato said that

there was room for extension during the training if they felt the need to, also indicating that he would consult with other experts on the same.

He also informed the members that the initial training could target national sector with the county being addressed in later years and the participants has no objections.

14. REDD+ TECHNICAL WORKING GROUP MEETING

The meeting was assembled to discuss issues that required critical decision making which included;

National Forest Monitoring System (NFMS) and Forest Information Platform (FIP) to decide on the way forward, accessibility and address security concerns.

a) Stratification to be adopted either SLEEK or ICFRA to make National Forest Inventory design for the development of EF
b) Data assurance for emission factor; can country data be used for emissions estimation
c) What to do about soil carbon; the TWG in 2016 had agreed to move forward with SOC as one of the pools, a decision needs to be made whether SOC can be included or not.
d) Identification of whether the land cover/land use maps and statistics presented previously were appropriate for FREL reporting.

Discussions

a) **National Forest Monitoring System (NFMS) and Forest Information Platform (FIP) to decide on the way forward, accessibility and addressing security concern**s.

The functionalities of Forest Information Platform should ensure it is capable of providing information, as well as being a data management system to be linked with the NFMS. REDD+ system must be clear and be a standard to report to the other sectors e.g. FAO & CBD.

Forest inventory and mapping should be open to the public as secondary data, this should be monitored through restrictions such as user ID, passwords etc.

A dynamic system for FIP is best of choice since information changes continually thus updating and upgrading should be possible for NFMS. It was agreed to discuss and decide the specification for system of FIP

The decision was made that the JICA team would interrogate NFMS documents on the structures that have been and will be developed for NFMS and provide a draft to the TWG. The contents will be discussed and decided referring the other neighbouring countries (such as Tanzania) document of NFMS especially regarding issues on how to monitor the drivers and PaMs to address the drivers.

b) Stratification to be adopted either SLEEK or ICFRA to make National Forest Inventory design for the development of EF

In 2016 the TWG made a decision to use the SLEEK stratification for REDD+ and GHGI reporting, this was still the decision for NFI as well.

In addition, for the NFI, the adequate number of sampling plots have to be calculated again. It is also agreed that the plot shape and inventory contents follow ICFRA method. However, the cluster shape and plot shape will be review to match SLEEK stratification.

c) Data assurance for the emission factor; can country data be used for emissions estimation

The question is whether inventory data available is enough as setting emission factors to move forward with estimation of Forest Reference Levels, considering that it was collected to fill gaps that had been identified on ICFRA data.

Mr. Kato in his response stated the objectives for which the additional forest inventory was conducted highlighting; it was to set temporary emission factor as country data for each forest type and get standard deviation for each forest type for future National Forest Inventory designing.

Mr. Yamashita presented participants with an insight of the emission factor's options available for the setting national FRL for the country, which are default value as Tire 1 and country data based on results of the pilot forest inventory surveys.

For the development of FRL, it is decided that Kenya will develop two FRL which use country data and default value of Tier 1. After developing they will compare the results and select one considering which is more conservative or advantageous for Kenya.

d) What to do about soil carbon;

The TWG in 2016 had agreed to move forward with SOC as one of the pools. However, it needs to be made a decision whether SOC can be included or not. Thus, the value of carbon stock change in soils is needed to calculate for submission of FRL. The default values are shown in the 2006 IPCC guideline, and the values can be used on the condition with several references.

Kenyan side pointed that SOC is included in the Second National Communication (SNC) that was submitted in 2015, and the side also told that it could use the default value of SOC which is used in the SNC. Japanese consultant responded that they would confirm the document and after confirming, finally it should be decided whether SOC is included or not in the FRL that would be submitted in January 2018.

e) Identification of whether the land cover/land use maps and statistics presented previously were appropriate for FRL reporting.

Based on the statistical percentages generated from the land cover/land use maps, 2014 statistics are accurate and was settled upon as the base year then work should be done backwords on some years' intervals to get forest cover changes.

It is decided that the methodology for develop AD follow SLEEK methodology considering the assessment of 2014 land cover/land use map. However, the decision of the reference year of AD was carried over because reference year of the AD should be decided after analysing which year's land cover/land use map information was developed using Landsat satellite imagery which has few errors. Therefore, the reference year and interval of developing map remain as issues from now on. The analysis will be made as soon as possible by the remote sensing section.

AOB

The completed work can be presented at the Ministry of Environment and Natural Resources which supports REDD+ for decision making.

JICA experts requested for key individuals through consultation in the project work to be appointed to work with them especially in component 3 since Mr. Nduati is on a busy schedule with other activities within the project. Mr. Gichu and M. Nduati will deliberate on this and appoint key persons to be integrated into the project.

A team would be constructed (composed) to work on harmonization of SLEEK and ICFRA manuals.

REDD+ Process in Kenya

Alfred N. Gichu,
REDD+ Coordinator

Contents

- Context
- Objectives of Kenya's REDD+ Strategy
- Priority Areas
- Readiness activities
- Kenya's progress towards Readiness

Policy Context

- Kenya is a **signatory to UNFCCC** and commits to conserving carbon storehouses; ratified the **Paris Agreement;**
- **Paris Agreement** recognizes REDD+ process for CC response;
- Climate Change Act, NCCRS, Green economy strategy, LCDS and Forest policy and law for orienting national CC efforts;
- NDC development underway with forest as a key sector for its actualization ;
- Forestry sector is a **source of emission** of GHGs -unsustainable utilization, land use changes, fires, Charcoal burning, logging etc;
- Forests are **carbon storehouses** , **carbon sinks** and therefore a CC solution.
- Policy framework concluded at UNFCCC

REDD+ Goals

Kenya is participating in REDD+ Readiness to support :

- Realization of Constitutional ,vision 2030 and Green Economy strategy objectives;
- Design of policies and measures to protect and improve forest resources;
- realization of the NCCRS goals.
- Contribution to global climate change goals.
- Access to International carbon finance to support forestry development;

Scope of REDD+ Activities

- Reducing Deforestation ;
- Reducing forest Degradation;
- Sustainable management of forests;
- Enhancement of forest carbon stocks

Important that FLR, NFMS and SIS recognize these activities during construction.

Priority Areas of Focus

1. Reducing pressure to clear forests for agriculture, settlements, infrastructure and other land uses;
2. Promoting sustainable utilization of forests by promoting efficiency, energy conservation;
3. Improving governance in the forest sector by strengthening land and forest tenure, capacity for FLEG , advocacy and awareness ;
4. Enhancement of carbon stocks through forestry extension, fire control and FLR

REDD+ Readiness Activities

- **Readiness activities include**
  - A **national strategy for implementation** and the institutional and legal implementation framework,
  - A **Reference Emission Level and/or Forest Reference Level** for greenhouse gases (GHG) emissions;
  - A **Measuring, Reporting and Verification (MRV)** and **Monitoring** system to assess the effect of the REDD strategy on GHG emissions, livelihoods and other benefits.
  - **Safeguard Information system** for ensuring REDD+ safeguards are respected and addressed

These activities collectively referred to as **Warsaw Framework of activities**

REDD+ Readiness Process

1. **National Strategy and implementation framework** will require:
   - Clear understanding of drivers of forest cover change
   - Transparent, equitable and accountable benefit sharing/benefit distribution mechanisms,
   - Inclusive participation of stakeholders;
   - safeguards and grievance mechanisms to protect the interests of stakeholders;
   - Clarification of national land, forest and carbon tenure rights.
   - Clear institutional roles and responsibility

Readiness Process

2. **REL/FRL and NFMS** should be established to serve multiple functions including:
   - Assessing performance of REDD+ activities
   - National GHG inventory and reporting
   - Support forest sector planning and decision making
   - Access to result-based finance for REDD+
   - Compliance with Constitutional and legal requirements
   - Reporting to FAO &other International bodies

Readiness Achievements

Towards **strategy and implementation framework** :

The following analytical studies have been completed;

- Detailed drivers of deforestation and forest degradation
- Demand and supply of forest products in the country
- Charcoal value chain analysis & barriers to investment
- Legal Preparedness studies ongoing
- Carbon rights, Benefit sharing and corruption risks ;
- Assessment of financing options and benefit distribution mechanism
- Stakeholder and FPIC guidelines

Readiness efforts

- **Towards the Safeguards**
  - Carbon rights, Benefit sharing and corruption risks studies completed
  - SESA road map prepared including a FGRM
  - Taskforce on strengthening governance established
  - Stakeholders engagement and FPIC guidelines
- **Towards MRV and FREL**
  - Roadmap completed
  - Forest cover mapping
  - Strengthened Institutions for implementation of activities
  - FRL and NFMS establishment commenced

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																
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	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																
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														

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Forest Definition																	
Steps	$ -																
There is need to integrate some land cover definitions (like shrubland, bushland, woodland etc) that have been used in other mapping activities to fit into the adopted forest definition. Such former land use categories have been identified in mapping legends of SoK, AFRICOVER and																	
Kenya should communicate the adopted definition to the UNFCCC through the national focal point																	
There is need to market the adopted forest definition to all sectors of Kenya to support future mapping activities e.g. by researchers to allow adoption of their results into the NFMS. This will also harmonise reporting on the trends of Kenya e.g. among the media and in the County governments																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Land Use Categorisation																	
Steps	$ 10,000																
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. Croplands and grasslands have also been subcategorised into perennial shrub crops (e.g tea and coffee), agroforestry and annual herbaceous crops (e.g. monocultures of maize and wheat). For grasslands open grasslands and wooded grasslands have been defined.																	
The inclusion of the tree component in croplands could account for a significant carbon sinking activity due to the wood component especially if such trees are planted for long terms. Research should therefore be initiated to see whether this justifies the inclusion of tree crops in the REDD+																	
Continuous update programme required																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Forest Stratification																	
Steps	$ 20,000																
Testing of differences among the general and specific strata should be initiated using the currently available inventory datasets to justify the further categorization of forests.																	
Identification of sources of variation in forest stocks among the proposed 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?																	
The use of generalised strata for broad forest types which is cost effecting and sustainable than the specific categorization																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Mapping Standards																	
Steps	$ 20,000																
The Survey of Kenya has proposed a change in Kenya' s data projection system to enhance compatibility with regional maps. This may call for an adjustment of all the NFMS datasets. Secondly, the National Spatial Data Infrastructure (NSDI) is an effort to coordinate sharing and use of all spatial data in Kenya. This can be a platform through which mapping products from REDD+ can be shared to other interested users.																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Inventory Standards																	
Steps	$ 40,000	$10000 per year for 5 years															
Kenya, through a consultative process spearheaded by KFS has developed manuals for collection of inventory data for the five carbon pools; soils, below ground, litter, deadwood and above ground, for different forest types. There are also manuals for collection data to devlop 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 categoreis of forests and the number																	
The developed manuals should be marketed to all researches to allow integration of their inventory data into the NFMS																	
A process to continuously update of the manuals will ensure they do not get outdated.																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Land Use Category Mapping Processes																	
Steps	$ 400,000																
Since Kenya has adopted to provide spatially explicit wall–wall information 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. 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 freely availed 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. The following needs were identified																	
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. The current mapping of the SLEEK programme and the mapping of the FPP programme have been supported by the RCMRD which is an African Union body and not an institution of the government of Kenya.																	
Carry out extensive research and verification exercise that certifies the produced maps based on ground data																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Mapping Land Use Change																	
Steps	$ 400,000																
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.																	
Continuous update based on technoloy and IPCC guidelines and training programme required																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - National Forest Inventory																	
Steps	$ 3,000,000																
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 namely soil, below ground, litter, dead wood, and above ground. 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.																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Development of Allometric Equations																	
Steps	$ 500,000																
There are many allometric equations that have been developed or used in Kenya. Many of 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. Due to the many species found in the natural forests of Kenya and the variety of stratification levels that have been proposed in the forest stratification section an effort to develop representative allometric equations may be very taxing and expensive.																	
Generalised equations should be explored for application into the specified forest strata.																	
Explore opportunities for widescale research on allometric equations																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Internal Verification (QA/QC)																	
Steps	$ 100,000																
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. 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 JKUAT could also provide the quality control support to the mapping processes due to their expertise and training in geomatic engineering sciences.																	
Information analysis and internal verification are continuous activities.																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Prepare Carbon Map																	
Steps	$ 100,000																
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.																	
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.																	
A discussion on the development of a carbon map should be initiated immediately																	
Prepare Carbon Map Workplan																	
Develop Carbon Map																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Carbon Change Calculation																	
Steps	$ 100,000																
A trial of the gain loss method is being done by SLEEK but requires development of a quality control procedure. As Kenya awaits to implement an NFI, the TWG decided to take the approach of the SLEEK programme to use a gain loss method that may be cheap and sustainable but liable to high levels of uncertainity. Results from this method can be ascertained using data sets from past inventories like those of KIFCON compared with recently inventoried data as a quality control procedure.																	
The gain loss method being implemented under the SLEEK programme should be quality controlled using data from real inventories. Since KIFCON datasets are available, an inventory of the same plots would generate a stock change dataset for Quality Control.																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Developing National Accounts																	
Steps	$ 40,000																
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. Under the SLEEK programme of the Ministry of Environment, a system called FLINT (Full Lands Integration Tool) is being developed which aims at integrating the sets of collected data with emission factors to generate summaries of emissions for forestlands.																	
The FLINT systemprogramme is the only system developed for land use emissions from Kenya. However it is being tested by SLEEK using global datasets. National datasets should be integrated to test the accuracy of the system.																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Drivers of Forest Change																	
Steps	$ 48,000																
A study on drivers of deforestation commissioned by KFS has been completed in 2013 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. There is a need to take account of this and identify a plan to update, add to and refine the identification of drivers of deforestation in Kenya, noting the need to increase the focus on the REDD+ elements of: 1. Reducing emissions from forest degradation; 2. Conservation of forest carbon stocks; 3. Sustainable management of forests; 4. Enhancement of forest carbon stocks. The NFMS partners to re-analyse the drivers of deforestation by:																	
Review the 2013 report on drivers and update it as																	
Undertake additional analysis of new and emerging drivers of forest related emissions, noting at least infrastructure, irrigation and urbanisation but ensuring complete coverage of																	
Undertake a process to confirm the major drivers of forest emissions, past and potential																	
Ensure that the data, information and approach of the NFMS measures and monitors the major drivers of forest emissions.																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Policies and Measures for REDD+ Implementation																	
Steps	$ 40,000																
The REDD readiness proposal 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.																	
To effectively allow measurements of the impacts of PAMS on Kenya's REDD+ programme, there is need to:																	
Categorize drivers of deforestation and forest degradation in terms of impacts (Key categories) and spatial distribution	To be completed as a distinct task																
Identify the PAMS within government laws that directly address the Drivers of change																	
Identify drivers that have no policies addressing them and may require special PAMs to be documented or enacted																	
Identify ways of measuring the impacts of these PAMS for each driver based on existing data collection procedures or new proposed procedures.																	
Identify suitable proxies for monitoring effects of PAMS specifically for indirect drivers																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Safeguards																	
Steps	$ -																
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 Wwater Act are all examples of policies that have provisions that directly address several of the safeguards issues related to REDD+. To effectively document and report on safeguards the NaRCO should initiate a process to compile the list of REDD+ related safeguards and identify how they are covered by the existing laws and policies of Kenya.																	
Being undertaken in other programs and projects																	
Review the existing legislation, regulation, policy and planning in Kenya that relates to the safeguards																	
Identify and document those institutions mandated to implement the safeguards																	
Develop approaches, procedures and reporting mechanisms for safeguards where data and information are insufficient, limited or not presently collected																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Benefit Sharing Mechanism																	
Steps	$ 40,000																
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 a 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																	
Liaise with UNDP and other efforts on Benefit Sharing to collate information on existing efforts to date																	
Work with relevant actors to identify a plan for developing the Benefit Sharing Mechanism																	
In partnership develop the Benefit Sharing Mechanism																	
Conduct a test of the Benefit Sharing Mechanism																	
Revise and finalise the Benefit Sharing Mechanism																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Community Monitoring																	
Steps	$ 500,000																
REDD+ implementation may rely on communities and devolved units in monitoring forest carbon changes. Such communities described as individuals or groups with a stake, interest or right in the forest may include private companies, civil society organisations, 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. A piloting of community carbon monitoring programme should be initiated in several forests, buidling on existing efforts and past work in this theme.																	
Prepare a review of Community based monitoring approaches that have been applied, trialled or considered for Kenya.																	
Identify the preferred approach and methods to use for participatory monitoring, through consultation and secure endorsement of the preferred method.																	
Prepare a plan to pilot the preferred method for participatory monitoring in Kenya that accounts for the forest stratification																	
Implement the pilots on participatory monitoring																	
Review the project results and prepare a final report including findings, recommendations and a proposal to extend the preferred approach across Kenya as appropriate.																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - National Circumstances for REDD+																	
Steps	$ 40,000																
Kenya, just like other countries, has its specific circumstannces that may influence GHG trends. The REDD+ TWG noted that: The aspects of national circumstances as relating to REDD+ is not very clearly understood and needs proper documentation A mapping of the national circumstances is required to identify their position influence spatially and over time A few developmental programmes are not backed up by laws and this makes it difficult to integrate them into the definition of national circumstances																	
This is a basic issue that needs structured attention by NFMS partners through:																	
Definitions of the aspects of national circumstances																	
Gathering of historical data informed by national circumstances, including: Economic development, Population, Vision 2030, Infrastructure																	
Stratification spatially in relation to the national circumstances																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Modelling and Forecasting																	
Steps	$ 10,000																
The Full Lands Integration Tool (FLINT) developed by the SLEEK prgramme 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.																	
Testing of appropriate forecasting models																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Reference Emission Level/Forest Reference Level for REDD+																	
Steps	$ 40,000																
The REDD+ Technical Working Group has discussed the development of Kenyas 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 influnced the forest trends may no longer be current (as indicated in the section on DDFD) or may not apply in future. Therefore the development of the FREL/FRL is very much dependent on the analysis of DDFD and the PAMs for REDD+ implementation.																	
Preparing a discussion paper describing: What the Reference Level is; The role of the Reference Level – This includes considerations of if RL is just for UNFCCC, or does it need to meet WB or other requirements (similar but can be different); The options for preparing a Reference Level; The data requirements																	
Prepare a decision brief that: Identifies the options for preparing a reference level and the requirements, advantages and disadvantages of each approach; Proposes a preferred approach to developing the Reference Level																	
Undertake the preparation of the Reference Level using the selected approach																	
Decide on the reference period and develop a historical trend of forests based on satellite imagery and ground data																	
Determine significant carbon pools applying a key category analysis																	
Source or generate the data sets required	Completed under separate Tasks																
Calculate areas of deforestation and forest degradation	Completed under separate Task																
Calculate the carbon stock change on areas of deforestation	Completed under separate Task																
Calculate the carbon stock change on areas of forest degradation	Completed under separate Task																
Using the base year develop a forest/GHG projection to the future without PAMs	Using Modelling and Forecasting Task Output																
Gather information on national circumstances and their influence on the forest/GHG trend	Completed under separate Task																
Identify the PAMS that are in place or will be implemented to reduce GHG emissions	Completed under separate Task																
Model the forest/GHG trend with PAMs to propose the effect of the PAMs on GHG emission reductions.	Using Modelling and Forecasting Task Output																
Assess the uncertainty related to the Reference Level																	
Notes:																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - Project Registry																	
Steps	$ 80,000																
Kenya has not had a discussion on the REDD+ registry mainly because the REDD programme has not kicked off. It was noted that the development of the REDD+ website is ongoing. The KFS has a Forest Information system in place which seeks to avail all information about forestry related activities in Kenya's public forests to the stakeholders. However, the FIS is currently largely composed of information on plantation forests. Though this could serve as the REDD+ registry, the TWG observed that REDD+ activities may be obscured by the KFS management priorities.																	
An initial review is required to answer the following																	
There are countries with REDD+ strategies – what kind of information is domiciled here? In which format?																	
Does Kenya need a registry? Or can this responsibility be given to the FIS?																	
What are the limitations of use in terms of whom, when, rights and privileges of use?																	
What other systems and source of information does the registry connect to?																	
What other systems does the registry contribute to?																	
Prepare an implementation plan for the REDD+ Registry																	
Create the REDD+ Registry																	

Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - REDD+ Information System																	
Steps	$ 140,000																
All the information pertaining to the National REDD+ Programme needs to be securely stored in one or more information systems. This is a system that collects data from the sources, stores it and disseminates it to the relevant sectors. For the national forest monitoring system the requirements of the information system are extremely high. The KFS has established a FIS under the Planning and Forest information systems section. The section is well equipped in terms of office space, hardware, software and human resources. 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 for the NFMS. The FIS is tasked with generating and maintaining a forest geo database with georeferenced information about all forest resources. Such information is displayed to the public through the KFS website. Already, the Forest Information system has been identified by the FLINT in the SLEEK programme as a major source of data.																	
This is an ongoing activity to update the website and/or integrate with the registry.																	

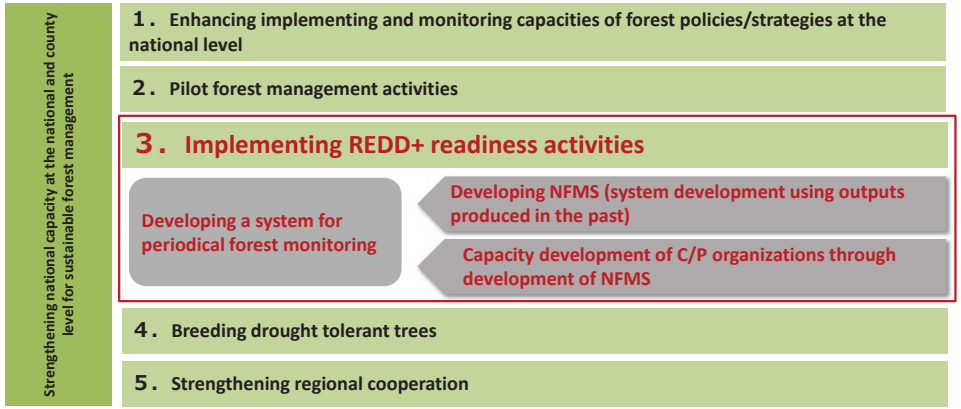
Year	Budget	One				Two				Three				Four			
Quarter		First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
TASK - International Reporting																	
Steps	$ 50,000																
Kenya has submitted the first national communication done in the year 2002. The second national communication is underway. Based on the UNFCCC decisions Kenya has to demonstrate the need to 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.																	
Continuous – yearly GHG inventories, National Communications after every four years, and Biannual Update Reporting to indicate compliance. Support the NaRCO to avail REDD+ related data to the international reporting																	

Overview of Compornent3

The REDD+ Readiness Component
in
the Capacity Development Project for the
Sustainable Forest Management
in the Republic of Kenya

By Kazuhisa KATO - Compornent3 Team Leader
2017.3.28

Roles and objectives of the REDD+ Readiness Component in the Project



Project Period : 2016 June – 2021 June (5 years)

Implementation Methods of the Work

[1] Activities on the NFMS and the Forest Information Platform

[2] Activity on various type of map creation

[3] Activities on FRL

[4] Activity on forest cover change monitoring in the whole of Kenya

[5] Activity on the MRV training

[6] Activities on pilot project for REDD+ (Contribution to Component 2)

[1] Activities on the NFMS and the Forest Information Platform(FIP)

Defining the NFMS as methodology and the NFMS as a database (forest information platform)

- **NFMS**
  Methodology of how forests are monitored
- **Forest Information Platform (FIP)**
  A database to provide information that does not only include the information identified according to the NFMS but the information necessary for implementing REDD+ and sustainable forest management

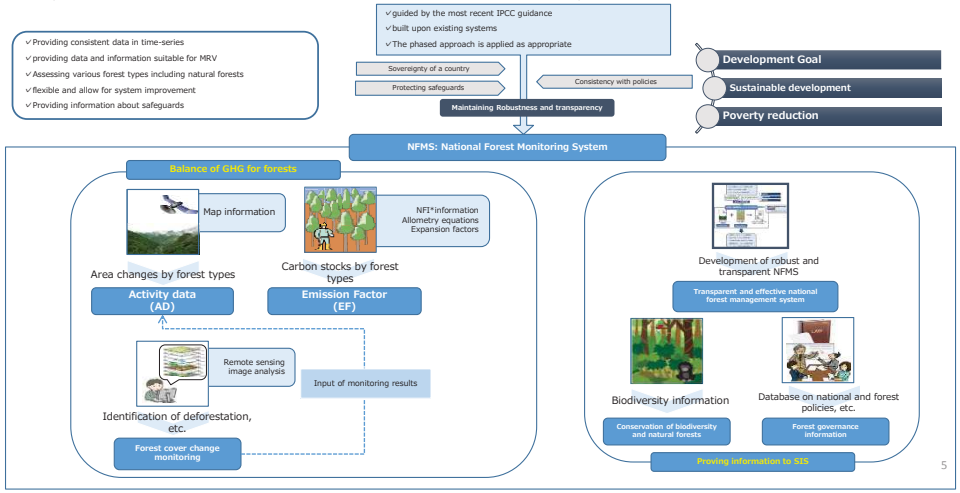
[1] Activities on the NFMS and the Forest Information Platform(FIP)

Work Plan for five(5)years

		1st year	2nd year	3rd year	4th year	5th year
1	Development of the NFMS	■				
2	Design and Development of the FIP	■				
3	Review and improvement of NFMS		■	■	■	■
4	Installation of the FIP		■			
5	Making a test installation of the FIP through OJT		■			
6	Review and improvement of the achievement of the prototype operation on the FIP			■		
7	Operation of the new FIP with the review and improvement			■	■	■

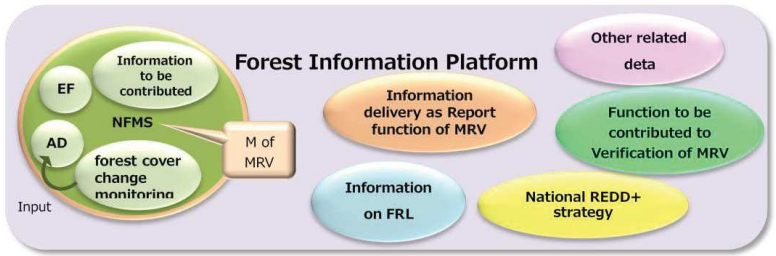
[1] Activities on the NFMS and the Forest Information Platform(FIP)

Development of the NFMS that meets international requirement



[1] Activities on the NFMS and the Forest Information Platform(FIP)

Development of a FIP taking into consideration its use, clarifying objectives



Points to be kept in mind for establishment of FIP

- To extend the existing System of Kenya (KFIS：Kenya Forest Information System) as much as possible
- It will be possible to add and update the data of FRL, MRV method and the national inventory data which other donners will develop.
- System environment with which local officers are able to keep maintaining
- To take the methodology to improve the functionality and the manual document quality by making an actual use of local officers through installing prototype system in the early stage of the Work.

[2] Activity on various type of map creation

Work Plan for five(5)years

		1st year	2nd year	3rd year	4th year	5th year
1	Process assessment for correctness of Land Cover Map 2014	■				
2	Result assessment for correctness of Land Cover Map	■				
3	Report of assessment result	■				
4	Preparation for Land Cover Map creation guidance	■				
5	Improvement of guidance material of Land Cover Map creation		■	■	■	■
6	Guidance for creation of Land Cover Map at pilot area		■	■	■	
7	Reediting the classified category of Land Cover Map 2014	■				
8	Creation of Forest Cover Change Map	■				
9	Guidance for creation of Land Use Map 2020					■

[2] Activity on various type of map creation

Assessment of land-cover / land use maps of 2014 and preparation of forest cover change maps that contribute to REDD+ implementation

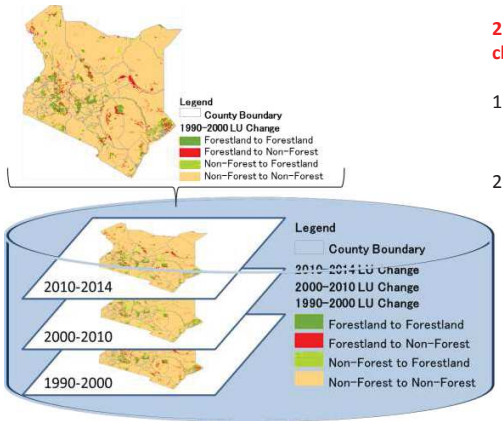


Image of Forest Cover Change Map

2 options of maps to be used to prepare forest cover change maps

1) the time series Land Cover / Land Use Maps between 1990 and 2014 which was and will be created by SLEEK.
2) Land Cover Maps 1990, 2000 and 2010 which were created by the "Forest Preservation Program" and the Land Cover Map 2014 by SLEEK.

Above issue will be discussed based on the results of assessment for SLEEK Land Cover / Land Use Map 2014 and time series maps

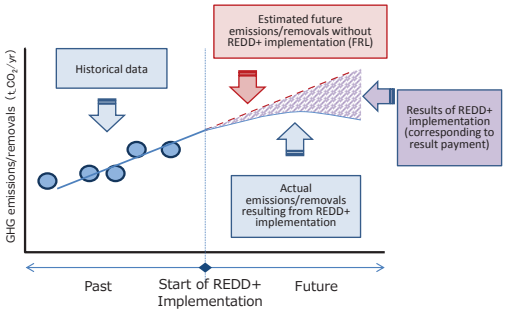
[3] Activities on FRL

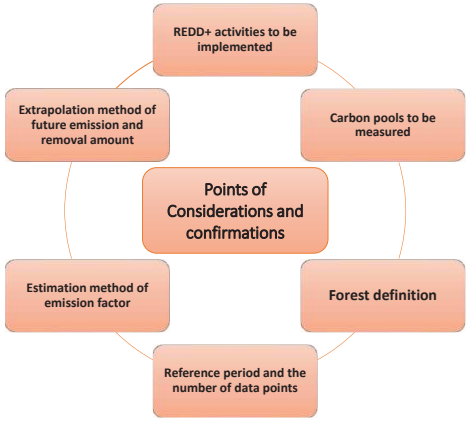
Work Plan for five(5)years

		1st year	2nd year	3rd year	4th year	5th year
1	Collection of information for emission factor	■	■			
2	Preparation of carbon map in 2014	■				
3	Analysis of land cover change based on the land cover map		■			
4	Setting FRL		■			
5	Evaluation of FRL			■		
6	Improvement of FRL based on the evaluation			■		

[3] Activities on FRL

Development of a highly applicable FRL that can reach the level of other countries or meet requirements of donors

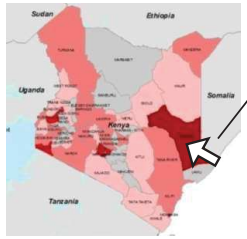




[3] Activities on FRL

Preparation of carbon map in 2014

Estimating carbon amount in each county



Displaying carbon amount by color-coding
The large amount is dark red, the smaller is pink, gray

Total Forest area

○○ha ●●CO_2t
△△forest ××ha
▲▲CO_2t
■■forest ◇◇ha ◆◆CO_2t

[4] Activity on forest cover change monitoring in the whole of Kenya

Work Plan for five(5)years

		1st year	2nd year	3rd year	4th year	5th year
1	Consideration to sustainable method for forest cover change monitoring	■				
2	Development for function of forest cover change monitoring	■				
3	Operation by OJT	■				
4	Review and improvement to pilot operation result	■				
5	Operation by OJT		■	■	■	■
6	Review and improvement to operation result in previous year		■	■	■	

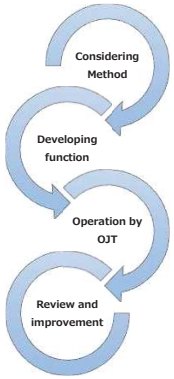
[4] Activity on forest cover change monitoring in the whole of Kenya

Implementation of sustainable forest cover change monitoring

The expected specific objectives

- the results of monitoring will be utilized as reference data and information for the creation of land cover map.
- The results can be contributed to the biennial report to be submitted to UNFCCC
- The results can be utilized for the forest management

Establishment of monitoring system by OJT incorporating PDCA cycle



Considering method: (Action)	Studying the satellite imagery to be used (optical imagery or radar imagery) Considering method of satellite imagery analysis etc. based on the review and improvement in the previous year
Developing function: (Plan)	Decision of material and equipment to use and the function, and design of flow of analysis
Operation by OJT: (Do)	Preparation of manuals (technical manual and operation manual including assignment of C/P, the rotation and assignment of manager)
Review and improvement: (Check)	Review and improvement of operation results Reflecting the review to the method to be taken in the next year

[5] Activity on the MRV training

Work Plan for five(5)years

		1st year	2nd year	3rd year	4th year	5th year
1	Preparing the plan of MRV training	■	■	■	■	■
2	Implementation of MRV training		■	■	■	■
3	Review and improvement of the MRV training		■	■	■	■
4	Reflecting the MRV training to NFMS		■	■	■	■

[5] Activity on the MRV training

Preparing the plan of MRV training

	Expected Contents of MRV training
(1)	The outline of REDD+
(2)	The outline of NFMS
(3)	The outline of MRV
(4)	About M (Measurement) of MRV, Forest remote sensing
(5)	About M (Measurement) of MRV, Forest inventory survey and biomass survey
(6)	About R (Reporting) and V of MRV

Considerations	Assumption under the present conditions	1st training(1st year)
Time	July or August every year (total 4 times)	July
Duration	About 2-3 days	2 days
The target participants for the training	10-15 person (KFS staff, Government officials of targeted county, etc.)	20-30 person (National and county level)
style	Open / Closed	Open
Place	Nairobi city	Nairobi city

[6] Activities on pilot project for REDD+ (Contribution to Component 2)

Work Plan for five(5)years

		1st year	2nd year	3rd year	4th year	5th year
1	Consideration of feasibility for implementation of REDD+ pilot project					
2	Preparation of draft project document or feasibility study report					

Thank you very much!

Contact address: k.kato@jofca.or.jp

Methodologies for National Forest Monitoring System (NFMS)

The REDD+ Readiness Component
in
the Capacity Development Project for the Sustainable Forest Management
in the Republic of Kenya

By Kazuhisa KATO - Compornent3 Team Leader
2017.3.28

UNFCCC Requirements

Mechanism of REDD+

Readiness
(To receive results-based finance, developing country party should have the following in place)

- ☐ A national strategy or action Plan
- ☐ An assessed forest reference emission level and/or Forest reference level
- ☑ A national forest monitoring system (NFMS)
- ☐ A system for providing information on how the safeguards are being addressed and respected

Implementation
(Developing country party undertake the following activities to receive results based finance)

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

1/CP.16 The Cancun Agreements Paragraph 70,71

Modalities for national forest monitoring systems

Decision 11/CP.19

2. Decides that the development of Parties' national forest monitoring systems for the monitoring and reporting of the activities,1 as referred to in decision 1/CP.16, paragraph 70, with, if appropriate, subnational monitoring and reporting as an interim measure, should take into account the guidance provided in decision 4/CP.15 and be guided by the most recent Intergovernmental Panel on Climate Change guidance and guidelines, as adopted or encouraged by the Conference of the Parties, as appropriate, as a basis for estimating anthropogenic forest-related greenhouse gas emissions by sources, and removals by sinks, forest carbon stocks, and forest carbon stock and forest-area changes;

3. A lso decides that robust national forest monitoring systems should provide data and information that are transparent, consistent over time, and are suitable for measuring, reporting and verifying anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest-area changes resulting from the implementation of the activities referred to in decision 1/CP.16, paragraph 70, taking into account paragraph 71(b) and (c) consistent with guidance on measuring,reporting and verifying nationally appropriate mitigation actions by developing country Parties agreed by the Conference of the Parties, taking into account methodological guidance in accordance with decision4/CP.15;

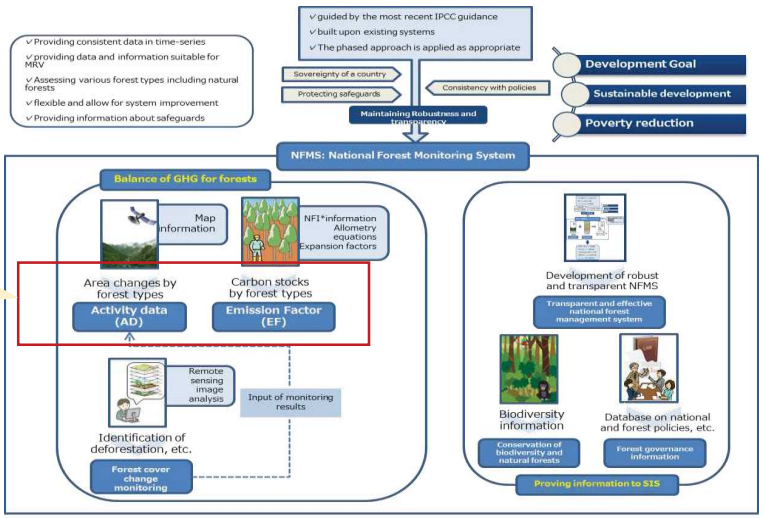
Definition of the NFMS in Kenya

Defining the NFMS as methodology and the NFMS as a database (forest information platform)

- **NFMS**
  Methodology of how forests are monitored
- **Forest Information Platform**
  A database to provide information that does not only include the information identified according to the NFMS but the information necessary for implementing REDD+ and sustainable forest management

Modalities for national forest monitoring systems

Need to Identify each methodologies as Kenya REDD+



＊NFI：National Forest Inventory

Development of the NFMS

Contents（What）	Purpose（Why: Why the information is needed）	Needed Information (Which: by which information the contents are developed)	Specific information (How: How the information is obtained)	Methodologies（How：How to grasp the information）	Place to get information（Where：where the information is prepared）	Frequency and time（When：When and how often the data is updated）	Persons in charge（Who：Who are the persons in charge）
Activity data	Grasping the Balance of GHG from forests	Area changes by forest types	Land Use Land Cover MAP	Method that is used by SLEEK	SLEEK	Every years?	SLEEK
Emission Factor	Grasping the Balance of GHG from forests	Carbon stocks per hectare (ha) by forest types	EF is Calculated by multiplying the Result of National Forest Inventory and allometric equation that will be selected for Kenya REDD+.	Carbon esitimation【Forest】NFI Methodology：ICFRA Allometric equation：Proposed by ICFRA and modified by JICA【Non Forest】Apply Tier 1 data of IPCC guideline	KFS, ○○Department	NFI：At any times or every○years	KFS○○Department Mr.○○
Balance of GHG from forests	For the National forest monitoring	activity data and Estimation factor	GHG is calculated by multiplying AD and EF	Multiplying AD and EF	KFS, ○○Department	At any times or every○years	KFS○○Department Mr.○○
Forest cover change monitoring	Grasping information about deforestation and forest degradation	Forest cover change monitoring developed by the Work	・Analysis of remote sensing data (it will be developed in the Work) ・Use of JJ-FAST		KFS（C/P of the Work)？	Once/year (frequency in the Work)？	KFS○○Department Mr.○○
Safeguard	Providing safeguard information system (SIS) with information on forest governance	Diagram of forest governance system in Kenya, Forest-related laws and programmes	Summarize the organization chart of KFS, forest-related policies, programmes, laws and treaties.	Link to Safeguard information system	KFS, ○○Department KFS, △△Department	At any times or ○ times/year	KFS○○Department Mr.○○
Safeguard	Providing SIS with information for consideration of biodiversity	Wild animals and plants protection area map National Park map Other biodiversity information	Collaboration with the Kenya Wildlife Service (KWS), Incorporate biodiversity information item into forest inventory item	Link to Safeguard information system	KWS, In charge of NFI department	At any times or every○years Modification after the implementation of forest inventory	KFS○○Department Mr.○○

Methodology to develop AD

Decided/Undecided matter

- **Forest Definition:**

Minimum surface area	0.5ha
Minimum Height	2m
Minimum Cover	15%

- **MAP :**

Map	SLEEK MAP ??
Image	Land Sat image or any available and more aculeate image
Methodology	Wall to Wall Supervised Classification Developing 2014 map as base map
Time	Every year??

Methodology to develop EF

- **Sampling Design of NFI**

Stratification: which stratification will be used, ICFRA proposal or SLEEK

ICFRA Proposal: 4 stratum mentioned in the following figure and 4 forest type (Bamboo, Mangrove, Natural Forest and Plantation)

SLEEK: 4 forest classes (Montane Forest, Western Rain Forest and Bamboo Forest, Mangrove Forest and Coastal Forest, Dryland Forest, and Plantation) and 3 class of Canopy coverage, total 12 forest types

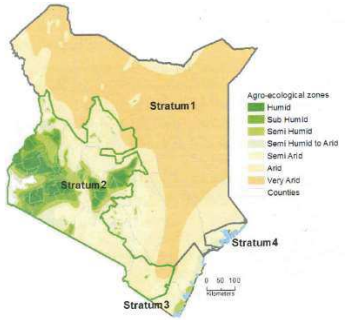


Figure . Suggested geographic strata for the NFRA

*ICFRA 2016. Proposal for National Forest Resources Assessment (NFRA) in Kenya.

Stratum No.	Type of Statum
Stratum 1	Grasslands
Stratum 2	Forested Areas
Stratum 3	Coastal Areas
Stratum 4	Mangroves

Methodology to develop EF

- Sampling Design of NFI

ICFRA proposal: Systematic sampling method

- Distance of 2km-by-2km: (4km^2 grids) over the whole country
- Calculating number of clusters in the following table. However, if SLEEK stratification is used that means the strata designed in the ICFRA proposal is not used, the number of clusters has to be re-calculated based on the SLEEK stratification.

Table . Number of clusters in different geographical strata

	First-phase		Second- phase	
	All land	All Forest	On land	Forested
Stratum 1, Grasslands	95,661	1,028	1,014	423
Stratum 2, Forested area	45,293	3,992	3,933	2,070
Stratum 3, Coastal area	6,876	230	230	121
Stratum 4, Mangroves	283	50	50	41
Total	148,113	5,300	5,227	2,655

*ICFRA 2016. Proposal for National Forest Resources Assessment (NFRA) in Kenya.

Methodology to develop EF

- Sampling Design of NFI

ICFRA proposal: Cluster sampling method

- Cluster design is as follows. However, if SLEEK stratification is used that means, how the cluster design will be adjusted, e.g. left side figure is for forest except for mangrove, right side figure is for mangrove.

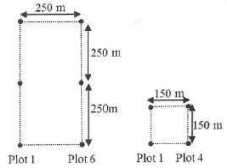


Figure . Cluster designs in Strata 1-3 (left) and in Stratum 4 (right).

Methodology to develop EF

- Plots shape

ICFRA proposal: Cercle shape is used as mentioned in the following figure. However, if SLEEK stratification is used, how each shape will be applied to the SLEEK stratification, e.g. left side is for non-forest, right side is for forest.

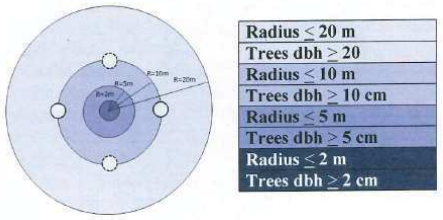


Figure . Sample plot design for Stratum 1 and 3

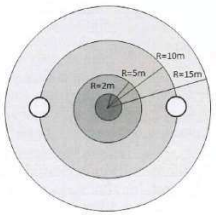


Figure . Sample plot design for Stratum 2 and 4

*ICFRA 2016. Proposal for National Forest Resources Assessment (NFRA) in Kenya.

Methodology to develop EF

- Measurement method in the plots:

- ICFRA proposal: As mentioned in the table

Table .Measurement on the circular sample plots.

	DBH/ diameter (cm)	Height/ length (m)	Plot radius (m)	Plot area (m^2)
Tree	≥ 2	≥ 1.3	2	12.6
Tree	≥ 5	≥ 1.3	5	78.5
Tree	≥ 10	≥ 1.3	10	314.2
Tree (Strata 2 and 4)	≥ 20	≥ 1.3	15	706.9
Tree (Strata 1 and 3)	≥ 20	≥ 1.3	20	1256.6
Climber	≥ 2	≥ 1.3	2	12.6
Climber	≥ 5	≥ 1.3	15	706.9
Bamboo		≥ 1.3	10 or 2 × 2.0	314.2 or 25.13
Lying dead wood	≥ 10	≥ 1.0	15	706.9
Shrub		≥ 1.3	15 or 2 × 2.0	706.9 or 25.13
Stump			15	706.9
Regeneration	< 2	≥ 0.10	2 × 1.5	14.13

*ICFRA 2016. Proposal for National Forest Resources Assessment (NFRA) in Kenya.

Proposed contents for NFMS document

Chapter 1	Background and Purpose	
Chapter 2	UNFCCC Requirements	
Chapter 3	Current Forest Monitoring in Kenya	3.1 General situation
		3.2 Institutional structure
		3.3 General status of forest condition
		3.4 Land use/cover mapping
		3.5 Forest inventory survey
		3.6 Information collected from local offices and communities
		3.7 Data management
Chapter 4	Principles of NFMS Development in Kenya	
Chapter 5	Conceptual design of the NFMS in Kenya	5.1 Composition of the NFMS
		5.2 Phased Approach
		5.3 Relation with other activities
Chapter 6	Development of NFMS Components	6.1 Activity Data
		6.2 Emission Factor
		6.3 Forest Cover Change Monitoring
		6.4 Providing information to SIS
		6.5 Data Management System in the Forest Information Platform
		6.6 Institutional arrangements for NFMS
		6.7 Calendar of NFMS
Chapter 7	Cost Considerations	

Chapter 6 : Development of NFMS Components

Write Calendar of NFMS

Example

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Map Creation (AD)	X	X	X		X		X		X		X		X		X		X
National Forest Inventory (EF)							X					X					X
Forest Reference level				X				X					X				
Result-Based payment Submission									TA-BUR 2020		TA-BUR 2022		TA-BUR 2024		TA-BUR 2026		TA-BUR 2028

Component of Forest Information Platform (FIP)

The REDD+ Readiness Component
in
the Capacity Development Project for the Sustainable Forest Management
in the Republic of Kenya

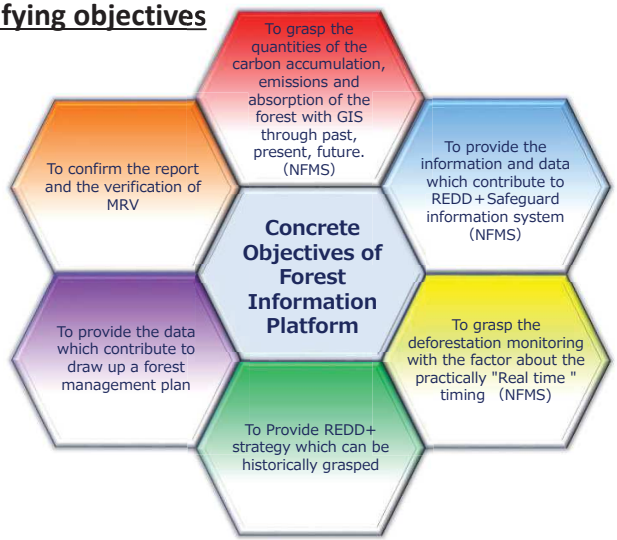
By Kazuhisa KATO - Compornent3 Team Leader
2017.3.28

Definition of the NFMS in Kenya

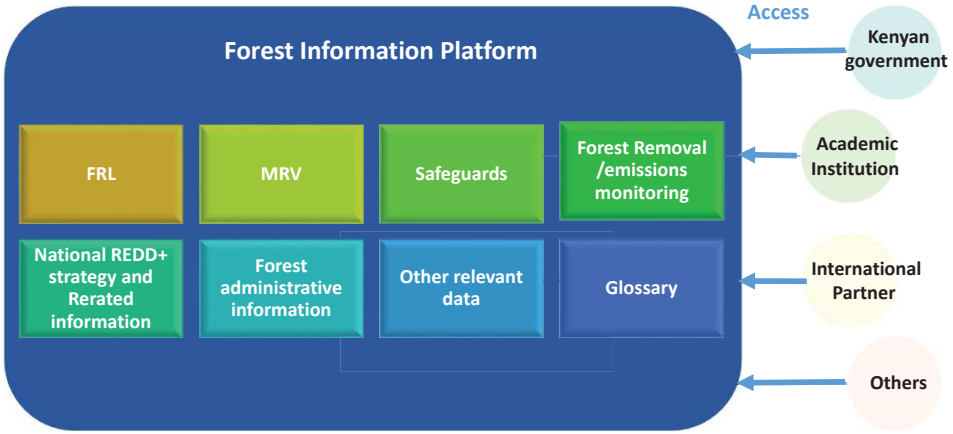
Defining the NFMS as methodology and the NFMS as a database (forest information platform)

- **NFMS**
  Methodology of how forests are monitored
- **Forest Information Platform**
  A database to provide information that does not only include the information identified according to the NFMS but the information necessary for implementing REDD+ and sustainable forest management

Development of a Forest Information Platform taking into consideration its use, clarifying objectives

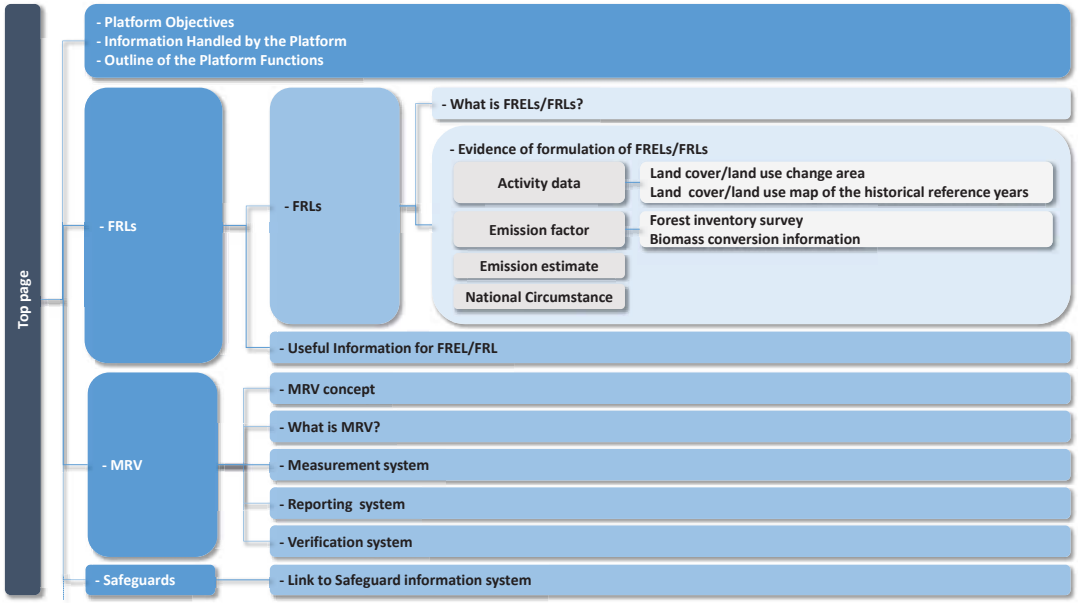


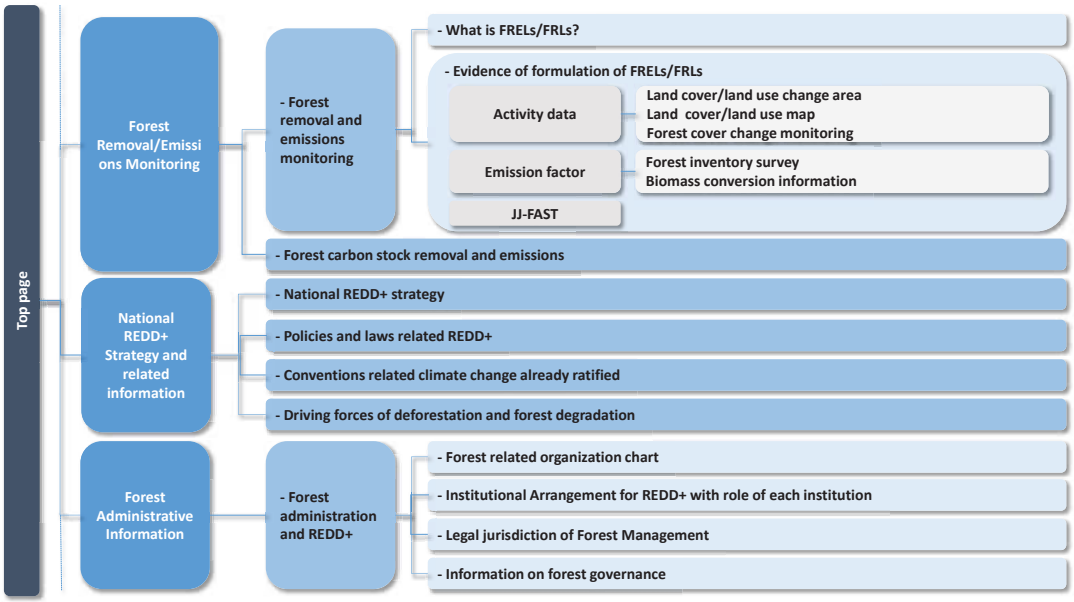
Conceptual diagram of Forest Information Platform

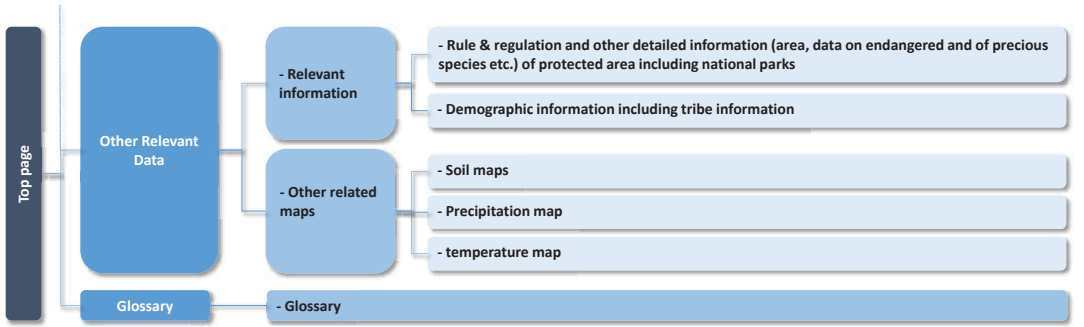


Functions of Forest Information Platform

Target Information	Outline of the function
FRL	• FRL is presented to quantify the reduction in emissions achieved by REDD + activities. • All elements relating to activity data, emission factors, and estimates used to set up FRL are clearly indicated.
MRV	• Concerning REDD +, concepts and plans that show how to measure, report and verify in Kenya are shown.
Safeguard	• Information on how safeguards were dealt with and respected through REDD + activities is provided through safeguard information systems.
Removal/emissions monitoring	• The amount of carbon accumulation in the forest, and the transition of absorption and emission are shown.
National REDD+ strategy and related information	• Information on national REDD + strategy is provided. • Driving forces of deforestation and forest degradation are shown quantitatively. • A quantitative assessment of policies, strategies and measures is presented.
Forest Administrative Information	• Forest governance Information such as institutional arrangement, policy, plan and etc. in Kenya is shown.
Other relevant data	• Information on forest growth and concession will be provided. • Other relevant data will be provided
Others	• Glossary, Link, etc.







Discussion for Forest Information Platform

on

The REDD+ Readiness Component

in

the Capacity Development Project for the Sustainable Forest Management in the Republic of Kenya

By Kei SATO – Forest Remote Sensing / GIS –

2017.3.28

Existing System

- **Kenya Forest Information System by FPP**
- **SLEEK system**
- **Open Foris Collect by ICFRA**
- **Forest Management Information System by MMMB**

Kenya Forest Information System and SLEEK system

Kenya Forest Information System

- Currently not use whole system
- H/W existing, utilizing

SKEEK system such as reporting system

- Currently not use part of system such as reporting, etc.
- Installed system is prototype system

Open Foris Collect

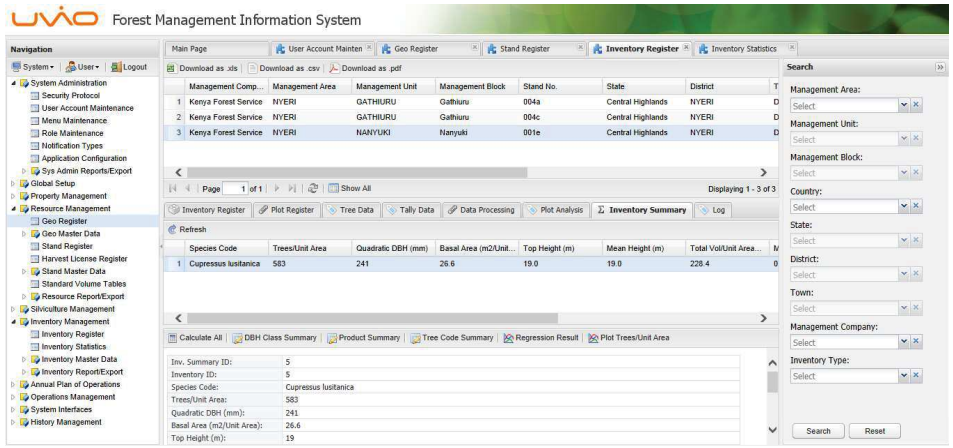
Open source

- Free software
- Utilized DB is SQLite
- Utilized calculation software is R package

Considering points

- SQLite is library, it is not for server
- Management of Forest Inventory Data
- Script based calculation
- Data security

Forest Management Information System



UVAIO Forest Management System

Considering points

- Data transfer from Open Foris Collect to this system
- Could not display Geospatial information with attribution

Forest Information Platform

Forest Information Platform

ArcGIS server basis with SQL server

- Geospatial based database
- Centralized database
- Can be available GIS functions

How to link?, How to utilize as combination?
or should be develop?

Thank you very much!

Contact address: koetia2696@pasco.co.jp

Ministry of Environment and Natural Resources
Kenya Forest Service
Stakeholder consultation workshop
28TH & 29TH March 2017
Masada Hotel
NAIVASHA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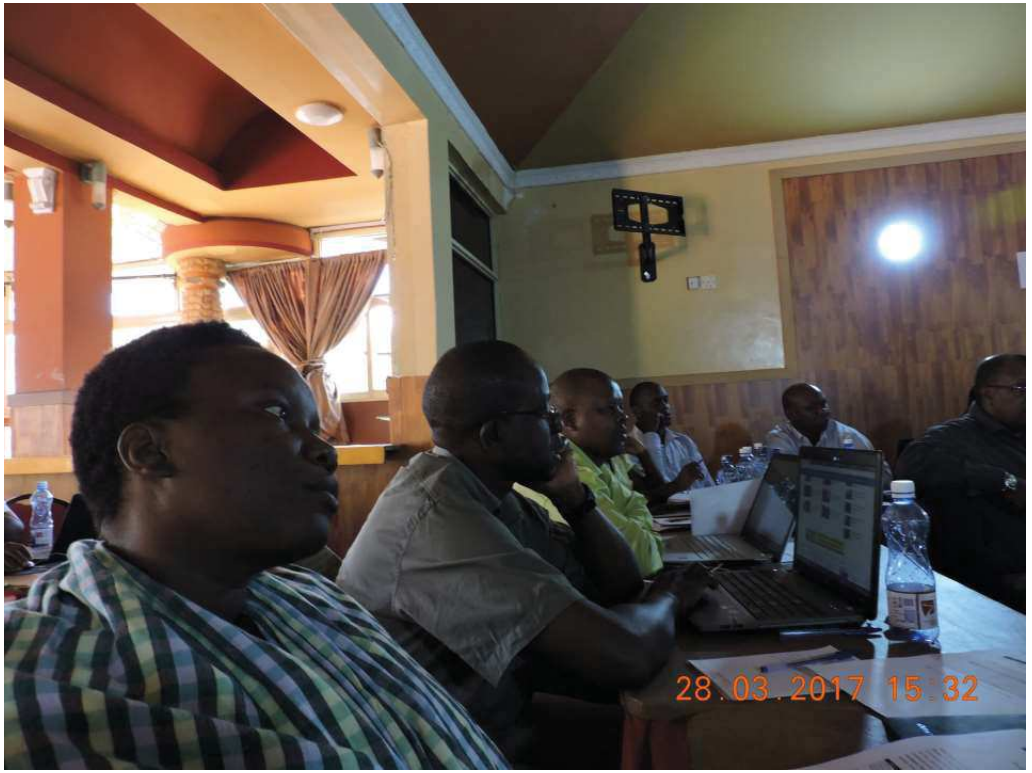
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RECAP OF DAY 1 PRESENTATIONS

Ministry of Environment and Natural Resources
Kenya Forest Service
Stakeholder consultation workshop

LIST OF PRESENTATIONS

No.	PRESENTATION	PRESENTER	FACILITATOR
1.	Introductory remarks	Mr. Nduati	Mr. Gichu
2.	REDD+ readiness activities	Mr. Gichu	
3.	Overview of component 3 REDD+ readiness (FRL & NFMS)	Mr. Kato	
4.	Roadmap for NFMS	Dr. Kinyanjui	
5.	Methodologies for NFMS	Mr. Kato	Dr. Kimondo
6.	Forest Information platform	Mr. Kato	
7.	System of Forest Information platform	Mr. Sato	
8.	Q & A and Discussion		

Introductory remarks - Mr. Nduati

- Mr. Nduati informed participants that:
  - this was a Capacity Development Project for Sustainable Forest Management.
  - the project is for 5 years (june 2016 – June 2021).
  - there are 5 components
  - Component 3 i.e. National Forest Monitoring System (NFMS)& Forest Information Platform(FIP) would be the main focus of the workshop.

REDD+ readiness activities - Mr. Gichu

- Mr. Gichu gave a brief review of the REDD+ process in Kenya and policy context – Kenya is a signatory to the UNFCCC and had ratified the Paris agreement.
- Highlighted the REDD+ goals
- The scope of REDD+ and activities
- Priority areas of focus
- REDD+ readiness activities
  - National strategy and implementation framework needs
  - REDD+ Emission Level (REL) /Forest Reference Level (FRL) & NFMS
  - Efforts including safeguards, (Measuring, Reporting & Verification) MRV & Forest Reference emission Level (FREL)

Roles and objectives of REDD+ readiness – Mr. Kato (Team leader component 3)

- Mr. Kato said that the implementation method had 6 implementation activities which he summarised.
- He gave a detailed discourse for each activity with proposed work plan.
  - National Forest Monitoring System(NFMS) – gives method of monitoring that should meet international standards
  - Forest Information Platform(FIP) – dealt with databases

    - has 9 sub activities
- He suggested that Measurement, Reporting &Verification (MRV)training be in July 2017

Roadmap for NFMS– Dr. Kinyanjui

- Dr. Kinyanjui gave a concise discourse of the foreseen activities in the roadmap.
- He innumerated important activities to include:
  - Mapping standards
  - Inventory standards (ICFRA manuals)
  - Mapping landuse change & change detection
  - Developing Allometric equations
  - Internal verification i.e. Quality Assurance (QA) / Quality Control (QC)
  - Develop carbon map
  - National accounts Full Lands Integration Tool (FLINT)
  - Drivers of change
  - Policies and measures for REDD+ implementation (Mr. Gichu's presentation)

Roadmap for NMFS – cont'd

- Safeguards
- Participatory monitoring
- Benfit sharing mechanisms
- National circumstances for REDD+
- Modeling and forecasting
- Reference Emission Level (REL) / Forest Emission Level (FEL)
- Project registry & Forest Information Platform (FIP)
- International reporting needs

Methodologies for NMFS – Mr. Kato

- Mr. Kato started by introducing some of the requirements by UNFCCC.
- He gave a very detailed critique and contrasted SLEEK and ICFRA methodologies
  - Classification
  - Sampling design
- Mr. Kato put forward a possible calendar for implementation of REDD+
  - Members agreed to build on the draft
- A passionate discussion ensued and while members endorsed the SLEEK approach, it was not lost on them regarding some of the challenges

Forest Information Platform – Mr. Kato

- Mr. Kato showed schematic and conceptual diagrams of FIP clarifying the objectives.
- He highlighted the functions of Forest Information Platform (FIP)
- He also shared proposed contents of National Forest Monitoring System (NFMS) document which members embraced and said could be internalized
- He itemised the functions of FIP and recommended development of proper safeguards
- He alluded that FIP will not have data
  - Country to populate it from relevant sources (historical data, monitoring data….)

System of Forest Information platform – Mr. Sato

- Mr. Sato highlighted the chronology of the Forest Information system in Kenya
  - Kenya Forest information System (FFP)
  - SLEEK
  - Open Foris Collect (ICFRA)
  - Forest Management Information System (MMMB)
- On further interrogation it was clarified that the only information system present was the Miti Mingi Maisha Bora(MMMB) supported Forest Management Information System (FMIS).
- He presented some information systems and their challenges

System of Forest Information platform – Mr. Sato

- It was agreed that Mr. Kato and Mr. Sato:
  - suggest NFMS and the FIP best suited to our needs
  - suggest ways of linking any current useful data / information system we have to the system
- Further, participants agreed that the NFMS and FIP could be made public so that various stakeholders could contribute data / information.
- This is important as reporting to UNFCCC is done at the National level and National data will be difficult / too expensive to get if left to one organization alone

Capacity Development Project for Sustainable Forest Management in the Republic of Kenya
(REDD+ Readiness Component)

Additional pilot forest inventory
and
AGB, BGB carbon stocks

Forest Inventory
Kazuhiro YAMASHITA
Japan Overseas Forestry Consultants Association
29th March, 2017

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- Analysis for EF
- Goal of additional pilot forest inventory

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- Gap research for additional pilot forest inventory
- Implementation of additional pilot forest inventory

Result (Additional pilot forest inventory)
- Available surveyed plots number

Method (Calculation)
- Calculation of Volume
- Calculation of AGB
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- Analysis for Biomass stock (ton/ha) and Carbon stock (ton/ha)

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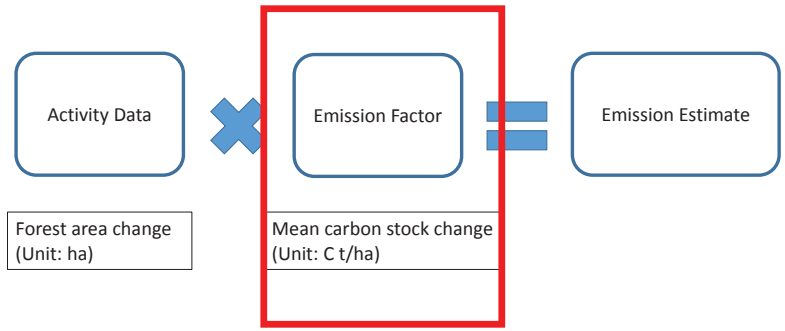
Introduction Analysis for EF



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Introduction Goal of additional pilot forest inventory:

1) This project aimed to set temporary EF without reliability for FRL from KFS original Data (EF with reliability can be obtained from NFI only)
2) This project aimed to establish pre-inventory data for base data for NFI plot sampling by step-wise approach.

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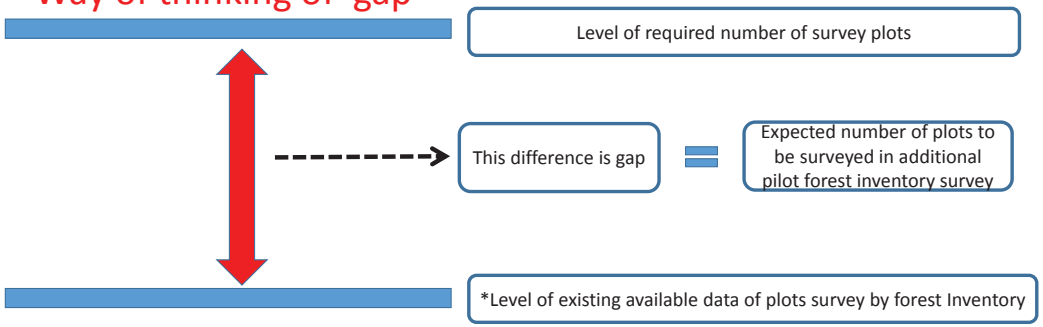
Method Additional pilot forest inventory

- Gap research for additional pilot forest inventory

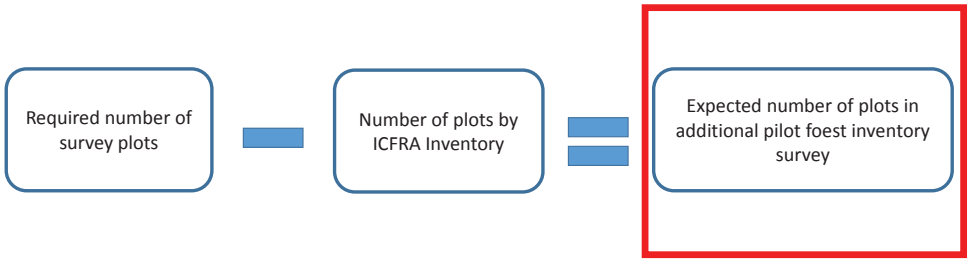
Way of thinking of gap



*Only data matching with forest classification of Activity data (12 forest types) can be used as existing available data. Considering this rule, only ICFRA data can be used as existing available data.

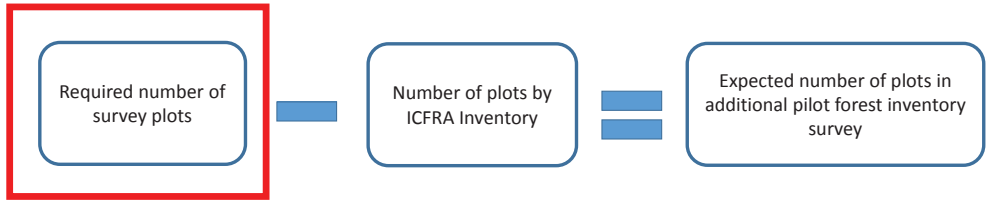
Method Additional pilot forest inventory

- Gap research for additional pilot forest inventory



Method Additional pilot forest inventory

- Gap research for additional pilot forest inventory



- For pre-inventory, required data for each stratification is 5 to 10 plots (Kataoka 1959).
- If number of plots is less than number of NFI, the data is not reliable.
- On this project, the survey for NFI can not be implemented.
- However, the acquired data will be reliable to find enough plots number for future NFI at the Tier 2.

Method Additional pilot forest inventory

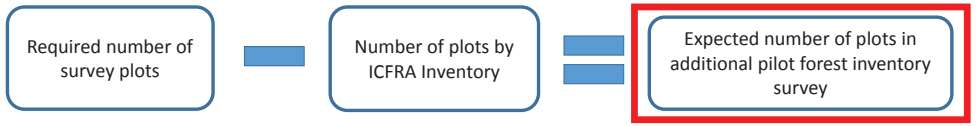
- Gap research for additional pilot forest inventory

Table 1. Number of plots in each 12 forest type class from the ICFRA pilot Forest inventory Data

Class	Dense	Moderate	Open	Total
Montane Forest & Western Rain Forest	4	4	0	8
Coastal Forest & Mangrove Forest	10	2	3	15
Dryland Forest	2	2	7	11
Plantation	23	6	0	29
Total				63

Method Additional pilot forest inventory

- Gap research for additional pilot forest inventory



Classification of Mountain forest and western rain forest is represented by Montane Forest, and costal forest and mangrove forest is classified into each forest type.

Table 2.Number of plots for planning research in each 12 forest type class

Class	Dense	Moderate	Open	Total
Montane Forest	3	3	7	13
Coastal forest	7	7	7	21
Mangrove Forest	-	4	4	8
Dryland Forest	5	6	-	11
Plantation	-	-	7	7
Total				60

The classification of Perennial Cropland (Agro-forest) was surveyed as for Kenyan own country data.

Table 3.Number of plots for planning research in Perennial Cropland class

Class		Number
Perennial Cropland	Agro-forest	7
Total		7

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Method Additional pilot forest inventory

- Implementation of additional pilot forest inventory

- Duration: from the 15th Feburary to the 14th March

- Survey areas: Nyeri (Plantations, Mountain forest)
  : Embu (Perennial crop land)
  : Kibwezi (Dryland forest)
  : Kilifi,Kwale (Coastal forest)
  : Gazi,Kwale (Mangrove forest)

Method Additional pilot forest inventory

- Implementation of additional pilot forest inventory

- Sampling method: Non random sampling
- Plot type: Concentric sample plot

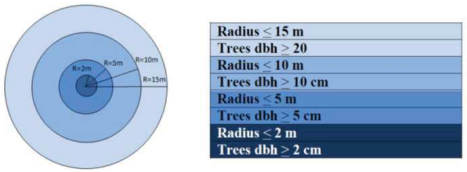

Figure. Concentric sample plots used in the pilot inventory

- Measurement design: According to the ICFRA field manual
  (Measuring Height, DBH, Species)

Method Additional pilot forest inventory

- Implementation of additional pilot forest inventory

Plot setting in Plantation area

Surveying a Plantation plot at Kabaru

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- Analysis for Biomass stock (ton/ha) and Carbon stock (ton/ha)

Result Additional pilot forest inventory

- Total available number of the additional surveyed plots

Table 4. Number of plots for the additional survey in each 12 forest type class

Class	Dense	Moderate	Open	Total
Montane Forest & Western Rain Forest	5	3	6	14
Coastal Forest & Mangrove Forest	8	10	13	31
Dryland Forest	6	6	0	12
Plantation	0	0	7	7
Total				64

Table 5. Number of plots for the results of the survey in Perennial Cropland class

Class		Number
Perennial Cropland	Agro-forest	10
Total		10

Result Additional pilot forest inventory

- Total available number of the additional surveyed plots

- Total number of plots (Including ICFRA data and additional survey data)

Table 6. Total number of plots in each 12 forest type class

Class	Dense	Moderate	Open	Total
Montane Forest & Western Rain Forest	9	7	6	22
Coastal Forest & Mangrove Forest	18	12	16	46
Dryland Forest	8	8	7	23
Plantation	23	6	7	36
Total				127

Table 5. Number of plots for the results of the survey in Perennial Cropland class

Class		Number
Perennial Cropland	Agro-forest	10
Total		10

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Method Calculation

- For additional survey, generally, each values of volume and AGB was calculated by using Allometric equations which were edited by related researches.
  (The equations used in ICFRA was probed, then altered according to appropriate references.)

- BGB was calculated by using the Root/Shoot ratio cited from IPCC guideline (2006).

- Carbon stocks were calculated by using Carbon Fraction (CF) from IPCC guideline (2006).

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Method Calculation

- Calculation of Volume

- For additional survey, volume was calculated by equation (Henry et al. 2011).

$$\text{Volume} = \pi \times (\text{DBH}/200)^2 \times H \times 0.5$$

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Method Calculation of AGB

- Calculation of AGB

- For additional survey, AGB were calculated by using Allometric equations which were improved.

- Equations are as follows below:

Method Calculation of AGB

- Calculation of AGB

- An equation for common trees, *Acacia spp.* and plantation species (*Pinus patula, Eucalyptus and Cupressus*) : (Chave et al. 2009, 2014)

  $AGB=0.0673*(0.598*D^2H)^{0.976}$ (kg)

- An equation for *Rhizophra spp.*: (Fromard et al. 1998, Komiyama et al. 2008)

  $AGB = 0.128 \times DBH^{2.60}$

- An equation for Agro-forest: (Henry et al. 2009)

  $AGB_{Agro\text{-}forest}=e^{(0.93*\log((d\text{^}2*h))-2.97)}$

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- Implementation of additional pilot forest inventory

Result (Additional pilot forest inventory)
- Total available number of the additional surveyed plots

Method (Calculation)
- Calculation of Volume
- Calculation of AGB
- Calculation of BGB

Result (Calculation)
- Analysis for Biomass stock (ton/ha) and Carbon stock (ton/ha)

Method Calculation

- Calculation of BGB

- The belowground biomass was estimated with the Root/Shoot ratio of BGB to AGB (IPCC 2006).

> Montane Forest: 0.27

> Coastal forest: 0.20 (AGB ≤ 125 (ton/ha)), 0.24 (AGB＞125 (ton/ha))

> Mangrove Forest: 0.37 and 0.20 (AGB ≤ 125 (ton/ha)), 0.24 (AGB＞125 (ton/ha))

> Dryland Forest: 0.40 (Kibwezi), 0.27 (Baringo)

> Plantation: 0.27

Method Calculation
- Calculation of AGB Carbon stocks

- The carbon stocks of AGB are calculated by using Carbon fraction: CF of AGB for forest, such as default value (IPCC 2006).

- The CF for AGB for forest is 0.47 (tonne C (tonne d.m.)$^{-1}$).

- The carbon stocks are equal to the value which the AGB multiplies with the CF.

Method Calculation
- Calculation of BGB Carbon stocks

- The carbon stocks of BGB are calculated by using Carbon fraction: CF of AGB for forest (FFPRI 2012).

- The CF for BGB for forest is 0.50 (tonne C (tonne d.m.)$^{-1}$).

- The carbon stocks are equal to the value which the BGB multiplies with the CF.

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Introduction
- Analysis for EF
- Goal of additional pilot forest inventory

Method (Additional pilot forest inventory)
- Gap research for additional pilot forest inventory
- Implementation of additional pilot forest inventory

Result (Additional pilot forest inventory)
- Total available number of the additional surveyed plots

Method (Calculation)
- Calculation of Volume
- Calculation of AGB
- Calculation of BGB

Result (Calculation)
- Analysis for Biomass stock (ton/ha) and Carbon stock (ton/ha)

Result Calculation
- Analysis for Biomass stock and Carbon stock

- Total number of plots (Including ICFRA data and additional survey data)

Table 5. Total number of plots in each 12 forest type class

Class	Dense	Moderate	Open	Total
Montane Forest & Western Rain Forest	9	7	6	22
Coastal Forest & Mangrove Forest	18	12	16	46
Dryland Forest	8	8	7	23
Plantation	23	6	7	36
Total				127

Table 6.Number of plots for the results of the survey in Perennial Cropland class

Class		Number
Perennial Cropland	Agro-forest	10
Total		10

Result Calculation

- Analysis for Biomass stock and Carbon stock

Table 7. Biomass stock (ton/ha) and Carbon stock (ton/ha) of 12 forest type class

Class	Canopy coverage	AGB		BGB		TOTAL	
		Biomass stock	Carbon stock	Biomass stock	Carbon stock	Biomass stock	Carbon stock
Montane Forest & Western Rain Forest	Dense	345.99	162.62	93.42	46.71	439.41	209.32
	Moderate	58.43	27.46	15.78	7.89	74.21	35.35
	Open	23.13	10.87	6.25	3.12	29.38	14.00
Coastal forest & Mangrove forest	Dense	94.09	44.22	27.65	13.82	121.74	58.05
	Moderate	60.45	28.41	13.64	6.82	74.09	35.23
	Open	35.37	16.62	7.50	3.75	42.88	20.38
Dryland Forest	Dense	80.36	37.77	31.72	15.86	112.09	53.63
	Moderate	34.50	16.21	12.99	6.49	47.48	22.71
	Open	14.26	6.70	3.85	1.93	18.12	8.63
Plantation	Dense	437.34	205.55	118.08	59.04	555.42	264.59
	Moderate	116.07	54.56	31.34	15.67	147.42	70.23
	Open	138.22	64.96	37.32	18.66	175.54	83.62
Perennial Cropland	Agro-forest	74.23	34.89	20.04	10.02	94.27	44.91

Result Calculation

- Analysis for Biomass stock and Carbon stock

Table 8. Biomass stock (ton/ha) and Carbon stock (ton/ha) of each forest type class

Class	Canopy coverage	AGB		BGB		TOTAL	
		Biomass stock	Carbon stock	Biomass stock	Carbon stock	Biomass stock	Carbon stock
Montane Forest	Dense	345.99	162.62	93.42	46.71	439.41	209.32
	Moderate	58.43	27.46	15.78	7.89	74.21	35.35
	Open	23.13	10.87	6.25	3.12	29.38	14.00
Coastal forest	Dense	107.99	50.76	23.84	11.92	131.83	62.68
	Moderate	56.60	26.60	11.32	5.66	67.92	32.26
	Open	50.87	23.91	10.17	5.09	61.05	29.00
Mangrove Forest	Dense	80.31	37.75	29.71	14.86	110.02	52.60
	Moderate	65.84	30.94	16.89	8.44	82.73	39.39
	Open	15.44	7.26	4.07	2.04	19.52	9.29
Dryland Forest	Dense	80.36	37.77	31.72	15.86	112.09	53.63
	Moderate	34.50	16.21	12.99	6.49	47.48	22.71
	Open	14.26	6.70	3.85	1.93	18.12	8.63
Plantation	Dense	437.34	205.55	118.08	59.04	555.42	264.59
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	Open	138.22	64.96	37.32	18.66	175.54	83.62
Perennial Cropland	Agro-forest	74.23	34.89	20.04	10.02	94.27	44.91

Result Calculation

- Analysis for Biomass stock and Carbon stock

* For setting EF, Carbon stock value is applicable with AD.

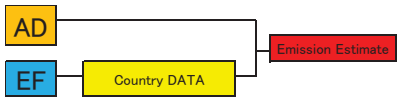

Figure 1. Flow chart for Emission estimate

Table 7. Biomass stock (ton/ha) and Carbon stock (ton/ha) of 12 forest type class

Class	Canopy coverage	AGB		BGB		TOTAL	
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	Moderate	60.45	28.41	13.64	6.82	74.09	35.23
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	Moderate	34.50	16.21	12.99	6.49	47.48	22.71
	Open	14.26	6.70	3.85	1.93	18.12	8.63
Plantation	Dense	437.34	205.55	118.08	59.04	555.42	264.59
	Moderate	116.07	54.56	31.34	15.67	147.42	70.23
	Open	138.22	64.96	37.32	18.66	175.54	83.62
Perennial Cropland	Agro-forest	74.23	34.89	20.04	10.02	94.27	44.91

Result Calculation

- Analysis for Biomass stock and Carbon stock

Table 9. Above-Ground Biomass data in forests from 2006 IPCC Guideline

Class	Canopy coverage	IPCC Ecological zone	Biomass stock (ton/ha)	Carbon stock (ton/ha)	Remarks
Montane Forest	Dense Moderate Open	Tropical mountain systems	40–190	18.8–89.3	Nyeri
Coastal forest	Dense Moderate Open	Tropical moist deciduous forest	260 (160–430)	122.2 (75.2–202.1)	Kilifi, Kwale
Mangrove Forest	Dense Moderate Open	Tropical rain forest Tropical moist deciduous forest	310 (130–510) 260 (160–430)	145.7 (61.1–239.7) 122.2 (75.2–202.1)	Gazi Kwale
Dryland Forest	Dense Moderate Open	Tropical shrubland	70 (20–200)	32.9 (9.4–94)	Kibwezi

Result Calculation

- Analysis for Biomass stock and Carbon stock

Table 10. Above-Ground Biomass data in forests from 2006 IPCC and 2003 IPCC Guide line

Class	Canopy coverage	IPCC Ecological zone	Biomass stock (ton/ha)	Carbon stock (ton/ha)	Remarks
Plantation	Dense Moderate Open	Tropical mountain systems Values from AGB in Forests	40–190	18.8–89.3	Nyeri
Plantation	Dense Moderate Open	Tropical mountain systems Values from AGB in Forest Plantations Africa broad leaf > 20 y Africa broad leaf ≤ 20 y Africa Pinus sp. > 20 y Africa Pinus sp. ≤ 20 y	60–150 40–100 30–100 10–40	28.2–70.5 18.8–47 14.1–47 4.7–18.8	Nyeri
Perennial Cropland	Agro-forest	Cropland (Agro-forest) C to C	41 (29–53)	19.27 (13.63–24.91)	Embu

References

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- Henry, M., Tittonell, P., Manlay, R., Bernoux, M., Albrecht, A., and Vanlauwe, B., (2009). Biodiversity, carbon stocks and sequestration potential in aboveground biomass in smallholder farming systems of western Kenya. Agriculture, Ecosystems and Environment, 129 (1), 238-252.
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- IPCC 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Result Calculation

- Analysis for Biomass stock and Carbon stock

- Key point for submission FRL:
- Until now, more than 20 countries submitted FRL report to the UNFCCC. The value of EF for AGB is required enough number of plots as NFI level.
- The number of plots submitted, such as country DATA is more than 1000 plots.
- It is required the permissible error of the data with *t*-statistic reliability and Standard deviation of each forest types for NFI plot setting with necessary numbers.
- Taking into consideration of these context, we should discuss how to set the EF in Kenya.

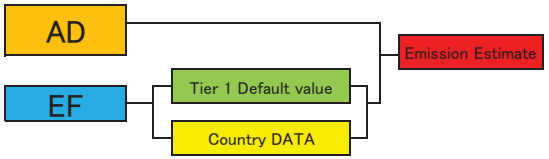

Figure 2. Flow chart for Emission estimate

References

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Thank you for your attention.

IPCC (Tier 1, 2 and 3) method

- Carbon stock data will not be simply equal to EF value of the IPCC .
- IPCC methods are very strict to calculate FRL.
- Step wise approach is advisable.

- Sample method Forest land remaining forest land by IPCC, as shown below:

IPCC (Tier 1, 2 and 3) Gain loss method

- EF value, such as Carbon stock data will not be simply used for IPCC Tier 1 calculation.

EQUATION 2.7
ANNUAL CHANGE IN CARBON STOCKS IN BIOMASS IN LAND REMAINING IN A PARTICULAR LAND-USE CATEGORY (GAIN-LOSS METHOD)

$$\Delta C_B = \Delta C_G - \Delta C_L$$

(IPCC 2006)

- For FRL caluculation

ΔC_B = annual change in carbon stocks in biomass, considering the total area, tonnes C yr^{-1}

ΔC_G = annual increase in carbon stocks due to biomass growth for each land sub-category, considering the total area, tonnes C yr^{-1}

ΔC_L = annual decrease in carbon stocks due to biomass loss for each land sub-category, considering the total area, tonnes C yr^{-1}

IPCC (Tier 1, 2 and 3) Gain loss method

EQUATION 2.9
ANNUAL INCREASE IN BIOMASS CARBON STOCKS DUE TO BIOMASS INCREMENT IN LAND REMAINING IN THE SAME LAND-USE CATEGORY

$$\Delta C_G = \sum_{i,j} \left(A_{i,j} \cdot G_{TOTAL_{i,j}} \cdot CF_{i,j} \right)$$

(IPCC 2006)

- For FRL caluculation

ΔC_G= annual increase in biomass carbon stocks due to biomass growth in land remaining in the same land-use category by vegetation type and climatic zone, tonnes C yr^{-1}

A = area of land remaining in the same land-use category, ha

G_{TOTAL}= mean annual biomass growth, tonnes d. m. ha^{-1} yr^{-1}

i= ecological zone ($i = 1$ to n)

j= climate domain ($j = 1$ to m)

CF = carbon fraction of dry matter, tonne C (tonne d.m.)$^{-1}$

IPCC (Tier 1, 2 and 3) Gain loss method

EQUATION 2.11
ANNUAL DECREASE IN CARBON STOCKS DUE TO BIOMASS LOSSES IN LAND REMAINING IN THE SAME LAND-USE CATEGORY

$$\Delta C_L = L_{wood-removals} + L_{fuelwood} + L_{disturbance}$$

(IPCC 2006)

- For FRL caluculation

ΔC_L = annual decrease in carbon stocks due to biomass loss in land remaining in the same land-use category, (tonnes C yr^{-1})

$L_{wood-removals}$ = annual carbon loss due to wood removals, (tonnes C yr^{-1}) (Equation 2.12)

$L_{fuelwood}$ = annual biomass carbon loss due to fuelwood removals, (tonnes C yr^{-1}) (Equation 2.13)

$L_{disturbance}$ = annual biomass carbon losses due to disturbances, (tonnes C yr^{-1}) (Equation 2.14)

IPCC (Tier 2 and 3) Stock change method

EQUATION 2.8
ANNUAL CHANGE IN CARBON STOCKS IN BIOMASS IN LAND REMAINING IN THE SAME LAND-USE CATEGORY (STOCK-DIFFERENCE METHOD)

$$\Delta C_B = \frac{(Ct1 - Ct2)}{(t2 - t1)} \qquad (a)$$

(IPCC 2006)

- **The Stock-Difference Method**
- Requiring biomass carbon stock inventories for a given land area, at two points in time.
- Annual biomass change is needed the difference between the biomass stock at two points in time too.

IPCC (Tier 2 and 3) Stock change method

EQUATION 2.8
ANNUAL CHANGE IN CARBON STOCKS IN BIOMASS IN LAND REMAINING IN THE SAME LAND-USE CATEGORY (STOCK-DIFFERENCE METHOD)

$$\Delta C_B = \frac{(Ct1 - Ct2)}{(t2 - t1)} \qquad (a)$$

(IPCC 2006)

- For FRL caluculation

ΔC_B= annual change in carbon stocks in biomass

C_{t2}= total carbon in biomass for each land sub-category at time t_2, tonnes C

C_{t1}= total carbon in biomass for each land sub-category at time t_1, tonnes C

C= total carbon in biomass for time t_1 to t_2

Considering to choice of Carbon stocks for EF

- Option 1 – Choice Country data

  Country data > Tier 1 default value

- Option 2 – Choice Tier 1 default value

  Tier 1 default value > Country data

Considering to choice of Tier 1 default value for Plantation

- Option 1 – Choice Tier 1 Forests default value
- Option 2 – Choice Tier 1 Forest Plantations default value

Capacity Development Project for Sustainable Forest Management in the Republic of Kenya
(REDD+ Readiness Component)

Consideration of setting Soil carbon methodology

Forest Inventory
Kazuhiro YAMASHITA
Japan Overseas Forestry Consultants Association
29th March, 2017

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- Setting EF of Soil carbon pool
- Setting Soil carbon methodology
- Setting Soil carbon pool (Summary)

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- Setting EF of Soil carbon pool
- Setting Soil carbon methodology
- Setting Soil carbon pool (Summary)

Setting EF of Soil Carbon pool

- Forest ecosystems are regarded as consisting of five carbon pool.
- This project aimed to set EF for the 3 pools such as AGB, BGB and Soil.
- There is a few case about submission of FRL on Soil carbon pool For UNFCCC: Indonesia (peatland).

Indonesia

- Peatland emission factors: the current approach assumes that deforestation and forest degradation always occur together with peatland drainage. Indonesia's plans to improve data collection on peatlands will lead to a better understanding of their characteristics and to better peatland emission factors.
- The FREL does not distinguish areas with and without drainage.

- References -

- Report on the technical assessment of the proposed forest reference emission level of Indonesia submitted in 2016

Setting EF of Soil Carbon pool

- Countries where dropped the soil carbon pool in the modified document

- Chile

- Guyana

Chile

- Tier level 1 emission factors for soil organic carbon of Degradation and Conservation of Forest Carbon Stocks were calculated. They were derived from the Harmonized World Soil Database by FAO. Though, the details of methodology were not described.

- From TA in March 2017 , SOC was omitted from carbon pools because of the lack of national information to describe the rate of change in this pool from modified submission.

- Reference -

Forest Reference emission Level/ Forest Reference Level of the Chilean Native Forests Preliminary Document 2016

Guyana

- Guyana excluded two pools of litter and soil on modified submission.
- On First submission, the pools were estimated are: AGB, BGB, Dead wood, litter and soil.
- The AT described that the reason of the omission for pools is due to lack of reliability, and they identified the additional treatment for future technical improvement.

- References -

- The Reference Level for Guyana's REDD+ Program (2014)
- The Reference Level for Guyana's REDD+ Program (2015)
- Report on the technical assessment of the proposed forest reference emission level of Guyana submitted in 2014

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- Setting EF of Soil carbon pool
- Setting Soil carbon methodology
- Setting Soil carbon pool (Summary)

Setting Soil carbon methodology (for Tier 1)

Key point

- Data as Tier 1 is available from IPCC guidelines, though it needs other information, such as climate region, soil type and level for stock change factor except Forest land remained forest land.

Setting Soil carbon methodology (for Tier 1)

- The equation for estimating total change in soil carbon stocks

EQUATION 2.24
ANNUAL CHANGE IN CARBON STOCKS IN SOILS

$$\Delta C_{Soils} = \Delta C_{Mineral} - L_{Organic} + \Delta C_{Inorganic}$$

Where:

ΔC_{Soils} = annual change in carbon stocks in soils, tonnes C yr^{-1}

$\Delta C_{Mineral}$ = annual change in organic carbon stocks in mineral soils, tonnes C yr^{-1}

$L_{Organic}$ = annual loss of carbon from drained organic soils, tonnes C yr^{-1}

$\Delta C_{Inorganic}$ = annual change in inorganic carbon stocks from soils, tonnes C yr^{-1} (assumed to be 0 unless using a Tier 3 approach)

(IPCC 2006)

Setting Soil carbon methodology (for Tier 1)

- Forest land remaining forest land

EQUATION 2.24
ANNUAL CHANGE IN CARBON STOCKS IN SOILS

$$\Delta C_{Soils} = \Delta C_{Mineral} - L_{Organic} + \Delta C_{Inorganic}$$

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$L_{Organic}$ = annual loss of carbon from drained organic soils, tonnes C yr^{-1}

$\Delta C_{Inorganic}$ = annual change in inorganic carbon stocks from soils, tonnes C yr^{-1} (assumed to be 0 unless using a Tier 3 approach)

Table 1. Forest land remainning forest land

	Soil carbon in mineral soil	Soil carbon in organic soil
Tier 1	Change in SOC stock is 0, Classification of climate regions and soil type is needed	Equation 2.26 stratified by climate type, Classification of climate regions and soil type is needed EF = 1.36 (Table 4.6)

Setting Soil carbon methodology (for Tier 1)

- Forest land remaining forest land

EQUATION 2.24
ANNUAL CHANGE IN CARBON STOCKS IN SOILS

$$\Delta C_{Soils} = \Delta C_{Mineral} - L_{Organic} + \Delta C_{Inorganic}$$

Where:

ΔC_{Soils} = annual change in carbon stocks in soils, tonnes C yr^{-1}

$\Delta C_{Mineral}$ = annual change in organic carbon stocks in mineral soils, tonnes C yr^{-1}

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Setting Soil carbon methodology (for Tier 1)

- Forest land remaining forest land

EQUATION 2.26
ANNUAL CARBON LOSS FROM DRAINED ORGANIC SOILS (CO_2)

$$L_{Organic} = \sum_c (A \bullet EF)_c$$

Where:

$L_{Organic}$ = annual carbon loss from drained organic soils, tonnes C yr^{-1}

A = land area of drained organic soils in climate type *c*, ha

Note: A is the same area (F_{os}) used to estimate N_2O emissions in Chapter 11, Equations 11.1 and 11.2

EF = emission factor for climate type *c*, tonnes C ha^{-1} yr^{-1}

Table 1. Forest land remainning forest land (IPCC 2006)

	Soil carbon in mineral soil	Soil carbon in organic soil
Tier 1	Change in SOC stock is 0, Classification of climate regions and soil type is needed	Equation 2.26 stratified by climate type, Classification of climate regions and soil type is needed EF = 1.36 (Table 4.6)

Setting Soil carbon methodology (for Tier 1)

- Forest land remaining forest land

TABLE 4.6
EMISSION FACTORS FOR DRAINED ORGANIC SOILS IN MANAGED FORESTS

Climate	Emission factors (tonnes C ha^{-1} yr^{-1})	
	Values	Ranges
Tropical	1.36	0.82 – 3.82
Temperate	0.68	0.41 – 1.91
Boreal	0.16	0.08 – 1.09

Source: *GPG-LULUCF*, Table 3.2.3

(IPCC 2006)

Table 1. Forest land remainning forest land

	Soil carbon in mineral soil	Soil carbon in organic soil
Tier 1	Change in SOC stock is 0, Classification of climate regions and soil type is needed	Equation 2.26 stratified by climate type, Classification of climate regions and soil type is needed EF = 1.36 (Table 4.6)

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

EQUATION 2.24
ANNUAL CHANGE IN CARBON STOCKS IN SOILS

$$\Delta C_{Soils} = \Delta C_{Mineral} - L_{Organic} + \Delta C_{Inorganic}$$

Where:

ΔC_{Soils} = annual change in carbon stocks in soils, tonnes C yr^{-1}

$\Delta C_{Mineral}$ = annual change in organic carbon stocks in mineral soils, tonnes C yr^{-1}

$L_{Organic}$ = annual loss of carbon from drained organic soils, tonnes C yr^{-1}

$\Delta C_{Inorganic}$ = annual change in inorganic carbon stocks from soils, tonnes C yr^{-1} (assumed to be 0 unless using a Tier 3 approach)

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

EQUATION 2.25
ANNUAL CHANGE IN ORGANIC CARBON STOCKS IN MINERAL SOILS

$$\Delta C_{Mineral} = \frac{(SOC_0 - SOC_{(0-T)})}{D}$$

$$SOC = \sum_{c,s,i} \left(SOC_{REF_{c,s,i}} \bullet F_{LU_{c,s,i}} \bullet F_{MG_{c,s,i}} \bullet F_{I_{c,s,i}} \bullet A_{c,s,i}\right)$$

(Note: T is used in place of D in this equation if T is ≥ 20 years, see note below)

(IPCC 2006)

*Setting $\Delta C_{Mineral}$ for Tier 1 can be used default data to set EF with information of Climate region, Soil type on each land type.

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

EQUATION 2.25
ANNUAL CHANGE IN ORGANIC CARBON STOCKS IN MINERAL SOILS

$$\Delta C_{Mineral} = \frac{(SOC_0 - SOC_{(0-T)})}{D}$$

$$SOC = \sum_{c,s,i} \left(SOC_{REF_{c,s,i}} \bullet F_{LU_{c,s,i}} \bullet F_{MG_{c,s,i}} \bullet F_{I_{c,s,i}} \bullet A_{c,s,i}\right)$$

(Note: T is used in place of D in this equation if T is ≥ 20 years, see note below)

F_{LU} = stock change factor for land-use systems or sub-system for a particular land-use, dimensionless

[Note: F_{ND} is substituted for F_{LU} in forest soil C calculation to estimate the influence of natural disturbance regimes.

F_{MG} = stock change factor for management regime, dimensionless

F_I = stock change factor for input of organic matter, dimensionless

(IPCC 2006)

*The stock change factors are very broadly defined and include: a land-use factor (FLU) , a management factor (FMG), an input factor (FI) . It must be decided by some level.

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

*The stock change factors: a land-use factor (FLU) must be decided by some level.

On Cropland

It must need several information to set stock change factor.

TABLE 5.5
RELATIVE STOCK CHANGE FACTORS (FLU, FMG, AND FI) (OVER 20 YEARS) FOR DIFFERENT MANAGEMENT ACTIVITIES ON CROPLAND

Factor value type	Level	Temperature regime	Moisture regime	IPCC defaults	Error	Description
Land use (FLU)	Long-term cultivated	Temperate/ Boreal	Dry	0.80	±9%	Represents area that has been continuously managed for >20 yrs, to predominantly annual crops. Input and tillage factors are also applied to estimate carbon stock changes. Land-use factor was estimated relative to use of full tillage and nominal ("medium") carbon input levels.
			Moist	0.69	±12%	
		Tropical	Dry	0.58	±61%	
			Moist/ Wet	0.48	±46%	
		Tropical montane	n/a	0.64	±50%	
Land use (FLU)	Paddy rice	All	Dry and Moist/ Wet	1.10	±50%	Long-term (> 20 year) annual cropping of wetlands (paddy rice). Can include double-cropping with non-flooded crops. For paddy rice, tillage and input factors are not used.

(IPCC 2006)

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

*The stock change factors are very broadly defined and include: a management factor (FMG) must be decided by some level.

On Cropland

It must need several information to set stock change factor.

Factor value type	Level	Temperature regime	Moisture regime	IPCC defaults	Error	Description
Tillage (FMG)	Full	All	Dry and Moist/ Wet	1.00	NA	Substantial soil disturbance with full inversion and/or frequent (within year) tillage operations. At planting time, little (e.g., <30%) of the surface is covered by residues.
Tillage (FMG)	Reduced	Temperate/ Boreal	Dry	1.02	±6%	Primary and/or secondary tillage but with reduced soil disturbance (usually shallow and without full soil inversion). Normally leaves surface with >30% coverage by residues at planting.
			Moist	1.08	±5%	
		Tropical	Dry	1.09	±9%	
			Moist/ Wet	1.15	±8%	
		Tropical montane	n/a	1.09	±50%	

(IPCC 2006)

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

*The stock change factors: an input factor (FI) must be decided by some level.

On Cropland

It must need several information to set stock change factor.

TABLE 5.5 (CONTINUED)
RELATIVE STOCK CHANGE FACTORS (FLU, FMG, AND FI) (OVER 20 YEARS) FOR DIFFERENT MANAGEMENT ACTIVITIES ON CROPLAND

Factor value type	Level	Temperature regime	Moisture regime	IPCC defaults	Error	Description
Input (FI)	Low	Temperate/ Boreal	Dry	0.95	± 13%	Low residue return occurs when there is due to removal of residues (via collection or burning), frequent bare-fallowing, production of crops yielding low residues (e.g., vegetables, tobacco, cotton), no mineral fertilization or N-fixing crops.
			Moist	0.92	± 14%	
		Tropical	Dry	0.95	± 13%	
			Moist/ Wet	0.92	± 14%	
		Tropical montane	n/a	0.94	± 50%	
Input (FI)	Medium	All	Dry and Moist/ Wet	1.00	NA	Representative for annual cropping with cereals where all crop residues are returned to the field. If residues are removed then supplemental organic matter (e.g., manure) is added. Also requires mineral fertilization or N-fixing crop in rotation.
Input (FI)	High without manure	Temperate/ Boreal and Tropical	Dry	1.04	± 13%	Represents significantly greater crop residue inputs over medium C input cropping systems due to additional practices, such as production of high residue yielding crops, use of green manures, cover crops, improved vegetated fallows, irrigation, frequent use of perennial grasses in annual crop rotations, but without manure applied (see row below).
			Moist/ Wet	1.11	± 10%	
		Tropical montane	n/a	1.08	± 50%	

(IPCC 2006)

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

To Cropland

It must need several information to set stock change factor. (Transient land-use conversion to Cropland)

TABLE 5.10
SOIL STOCK CHANGE FACTORS (FLU, FMG, FI) FOR LAND-USE CONVERSIONS TO CROPLAND

Factor value type	Level	Climate regime	IPCC default	Error #	Definition
Land use	Native forest or grassland (non-degraded)	All	1	NA	Represents native or long-term, non-degraded and sustainably managed forest and grasslands.
		Tropical	1	NA	
Land use	Shifting cultivation – Shorfened fallow	Tropical	0.64	± 50%	Permanent shifting cultivation, where tropical forest or woodland is cleared for planting of annual crops for a short time (e.g., 3-5 yr) period and then abandoned to regrowth.
	Shifting cultivation – Mature fallow	Tropical	0.8	± 50%	
Land-use, Management, & Input	Managed forest	(default value is 1)			
Land-use, Management, & Input	Managed grassland	(See default values in Table 6.2)			
Land-use, Management, & Input	Cropland	(See default values in Table 5.5)			

(IPCC 2006)

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

On Cropland

Organic soils

EQUATION 2.24
ANNUAL CHANGE IN CARBON STOCKS IN SOILS

$$\Delta C_{Soils} = \Delta C_{Mineral} - L_{Organic} + \Delta C_{Inorganic}$$

Where:

ΔC_{Soils} = annual change in carbon stocks in soils, tonnes C yr^{-1}

$\Delta C_{Mineral}$ = annual change in organic carbon stocks in mineral soils, tonnes C yr^{-1}

$L_{Organic}$ = annual loss of carbon from drained organic soils, tonnes C yr^{-1}

$\Delta C_{Inorganic}$ = annual change in inorganic carbon stocks from soils, tonnes C yr^{-1} (assumed to be 0 unless using a Tier 3 approach)

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

On Cropland

Organic soils

TABLE 5.6
ANNUAL EMISSION FACTORS (EF) FOR CULTIVATED ORGANIC SOILS

Climatic temperature regime [1]	IPCC default (tonnes C ha^{-1} yr^{-1})	Error 2
Boreal/Cool Temperate	5.0	± 90%
Warm Temperate	10.0	± 90%
Tropical/Sub-Tropical	20.0	± 90%

1 Climate classification is provided in Chapter 3.
2 Represents a nominal estimate of error, equivalent to two times standard deviation, as a percentage of the mean. Estimates are based on Glenn *et al.*, 1993; Kasimir-Klemedtsson *et al.*, 1997; Freibauer and Kaltschmitt, 2001; Leifeld *et al.*, 2005;Augustin *et al.*, 1996; Nykänen *et al.*, 1995; Maljanen *et al.*, 2001, 2004; Lohila *et al.*, 2004; Ogle *et al.*, 2003; Armentano and Menges, 1986.

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

On Grassland

It must need several information to set stock change factor.

TABLE 6.2
RELATIVE STOCK CHANGE FACTORS FOR GRASSLAND MANAGEMENT

Factor	Level	Climate regime	IPCC default	Error 1,2	Definition
Land use (FLU)	All	All	1.0	NA	All permanent grassland is assigned a land-use factor of 1.
Management (FMG)	Nominally managed (non –degraded)	All	1.0	NA	Represents non-degraded and sustainably managed grassland, but without significant management improvements.
Management (FMG)	Moderately degraded grassland	Temperate /Boreal	0.95	± 13%	Represents overgrazed or moderately degraded grassland, with somewhat reduced productivity (relative to the native or nominally managed grassland) and receiving no management inputs.
		Tropical	0.97	± 11%	
		Tropical Montane3	0.96	± 40%	
Management (FMG)	Severely degraded	All	0.7	± 40%	Implies major long-term loss of productivity and vegetation cover, due to severe mechanical damage to the vegetation and/or severe soil erosion.
Management (FMG)	Improved grassland	Temperate /Boreal	1.14	± 11%	Represents grassland which is sustainably managed with moderate grazing pressure and that receive at least one improvement (e.g., fertilization, species improvement, irrigation).
		Tropical	1.17	± 9%	
		Tropical Montane3	1.16	± 40%	
Input (applied only to improved grassland) (FI)	Medium	All	1.0	NA	Applies to improved grassland where no additional management inputs have been used.
Input (applied only to improved grassland) (FI)	High	All	1.11	± 7%	Applies to improved grassland where one or more additional management inputs/improvements have been used (beyond that is required to be classified as improved grassland).

(IPCC 2006)

Setting Soil carbon methodology (for Tier 1)

- Land converted to other land

On Grassland

Organic soils

TABLE 6.3
ANNUAL EMISSION FACTORS (EF) FOR DRAINED GRASSLAND ORGANIC SOILS

Climatic temperature regime	IPCC default (tonne C ha^{-1} yr^{-1})	Error 1
Boreal/Cold Temperate	0.25	+ 90%
Warm Temperate	2.5	+ 90%
Tropical/Sub-Tropical	5.0	+ 90%

1 Represents a nominal estimate of error, equivalent to two times standard deviation, as a percentage of the mean. These values represent one quarter of the loss on drained croplands (see Table 5.6 in Chapter 5), which is approximately the proportional loss of C on drained grassland relative to croplands according to data presented in Armentano and Menges(1986). These values have a degree of uncertainty as reflected in the error column.

Table of contents

- Setting EF of Soil carbon pool
- Setting Soil carbon methodology
- Setting Soil carbon pool (Summary)

Setting Soil Carbon pool (summary)

Problem point and Suggestion

- Data as Tier 1 is available from IPCC guidelines, though it needs other information, such as climate region, soil type and level for decision of Stock change factor in Other land (Crop land, Grass land etc.).
- Currently, it is difficult to find those information for setting Stock change factor.
- It is a question that the Stock change factor can be set or not.

References

- ENCCRV 2016. Forest Reference Emission Level/ Forest Reference level Native Forests in Chile (2016)
- FAO 2012. Harmonized World Soil Database v 1.2. http://www.fao.org/soils-portal/soil-survey/soil-maps-and-databases/harmonized-world-soil-database-v12/en/
- Government of Guyana 2014. The Reference Level for Guyana's REDD+ Program
- Government of the Cooperative Republic of Guyana 2015. The Reference Level for Guyana's REDD+ Program
- IPCC 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories
- Republic of Indonesia 2016. NATIONAL FOREST REFERENCE EMISSION LEVEL FOR DEFORESTATION AND FOREST DEGRADATION
- UNFCCC 2014. Report on the technical assessment of the proposed forest reference emission level of Guyana submitted in 2014
- UNFCCC 2016. Report on the technical assessment of the proposed forest reference emission level of Indonesia submitted in 2016

Thank you for your attention.

Setting EF of Soil Carbon pool (for Tier 2)

$L_{Organic}$ = annual loss of carbon from drained organic soils, tonnes C yr^{-1}

EQUATION 2.26
ANNUAL CARBON LOSS FROM DRAINED ORGANIC SOILS (CO_2)

$$L_{Organic} = \sum_c (A \bullet EF)_c$$

Where:

$L_{Organic}$ = annual carbon loss from drained organic soils, tonnes C yr^{-1}

A = land area of drained organic soils in climate type *c*, ha

Note: A is the same area (F_{os}) used to estimate N_2O emissions in Chapter 11, Equations 11.1 and 11.2

EF = emission factor for climate type *c*, tonnes C ha^{-1} yr^{-1} (IPCC 2006)

* Setting country EF of $L_{Organic}$ for Tier 2 is required to measurements of annual declines in C stocks for the whole soil profile on forest land, cropland, grassland and other lands. It is required country level data.

Reporting about the assessment of methodology and result of the SLEEK map 2014 by ground truth survey

on

The REDD+ Readiness Component

in

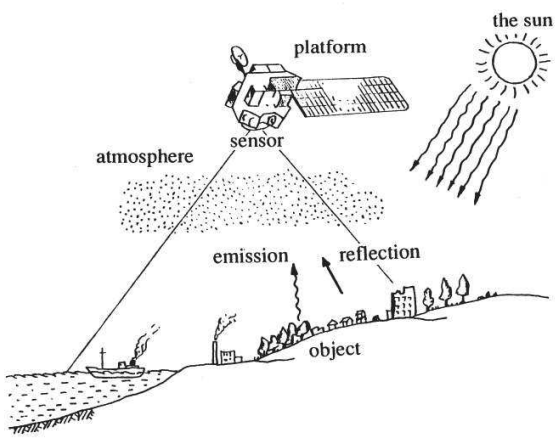
the Capacity Development Project for the Sustainable Forest Management in the Republic of Kenya

By Kei SATO – Forest Remote Sensing / GIS –

2017.3.29

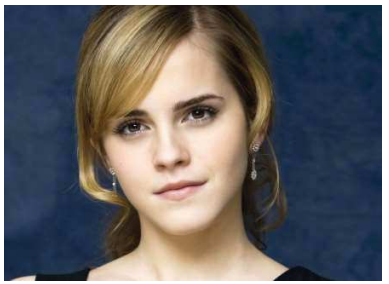
Assessment of methodology

What is Remote Sensing?

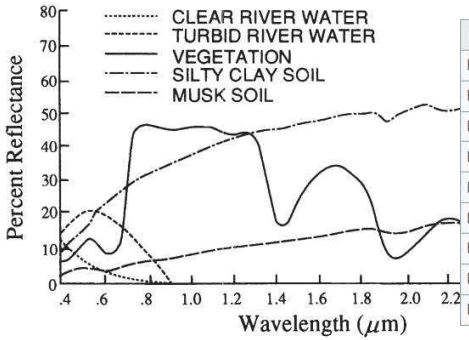


Remote Sensing is defined as the science and technology by which the characteristics of objects of interest can be identified, measured or analyzed the characteristics **without direct contact**.

What is Remote Sensing?



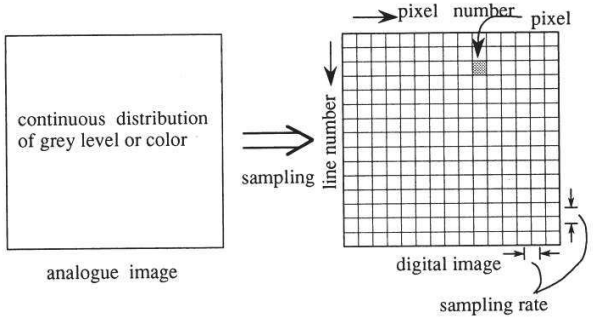
What is Remote Sensing?

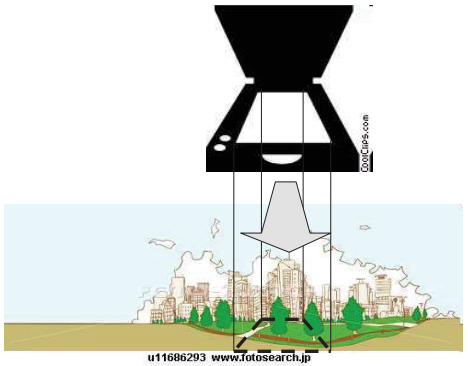


Spectral Band	Wavelength	Resolution	Solar Irradiance
Band 1 - Coastal / Aerosol	0.433 – 0.453 µm	30 m	2031 W/(m²µm)
Band 2 - Blue	0.450 – 0.515 µm	30 m	1925 W/(m²µm)
Band 3 - Green	0.525 – 0.600 µm	30 m	1826 W/(m²µm)
Band 4 - Red	0.630 – 0.680 µm	30 m	1574 W/(m²µm)
Band 5 - Near Infrared	0.845 – 0.885 µm	30 m	955 W/(m²µm)
Band 6 - Short Wavelength Infrared	1.560 – 1.660 µm	30 m	242 W/(m²µm)
Band 7 - Short Wavelength Infrared	2.100 – 2.300 µm	30 m	82.5 W/(m²µm)
Band 8 - Panchromatic	0.500 – 0.680 µm	15 m	1739 W/(m²µm)
Band 9 - Cirrus	1.360 – 1.390 µm	30 m	361 W/(m²µm)

Figure shows **three curves of spectral reflectance** for typical land covers; vegetation, soil and water.

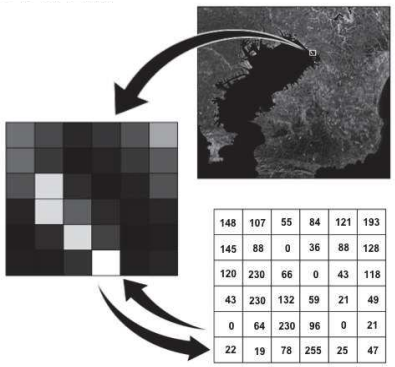
What is Remote Sensing?





What is Remote Sensing?

RSSJ



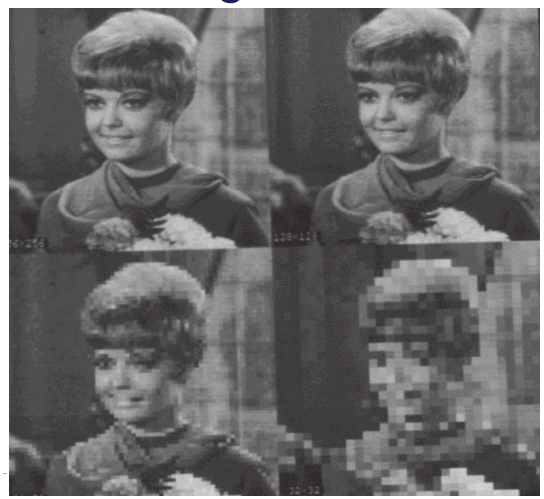
148	107	55	84	121	193
145	88	0	36	88	128
120	230	66	0	43	118
43	230	132	59	21	49
0	64	230	96	0	21
22	19	78	255	25	47

Limitation of Remote Sensing

Effects depend on the different sampling size

8bit Quantization

256X256	128X128
64X64	32X32



Utilized Landsat8 imagery

Landsat 8 has been lunched on February 11, 2013

3	166	57	166057	LC81660572014004LGN00	Dry
4	166	58	166058	LC81660582014020LGN00	Dry
5	166	59	166059	LC81660592014004LGN00	Dry
6	166	60	166060	LC81660602014004LGN00	Dry
7	166	61	166061	LC81660612014196LGN00	Dry

Most imagery was acquired on dry season such as Jan, Jun, Aug, Sep, etc.

And the imagery was selected non cloud image as much as possible i.e. cloud ratio is less than 20%.

Methodology of classification processing

Pixel based classification **Object based classification**

Typical methodology of classification processing

- Multi level slice classifier
- Decision tree classifier
- Minimum distance classifier
- Maximum likelihood classifier
  - Supervised, unsupervised, clustering

Other methodology of classification processing

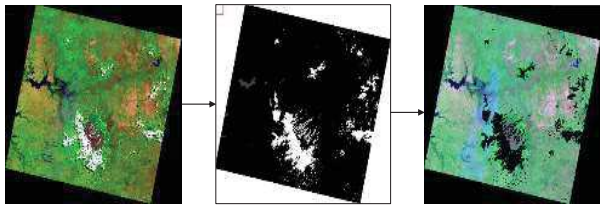
- Fuzzy theory
- Expert system
- Neural Network i.e. AI

Category for class type

Mixed Land cover & Land use

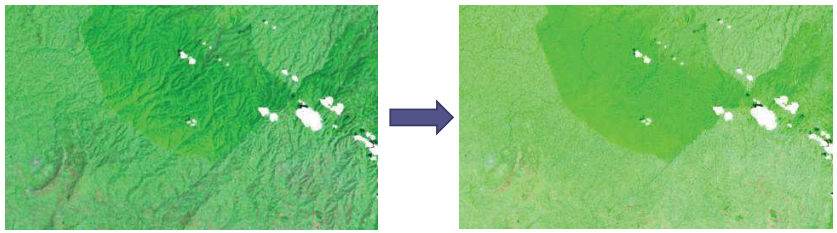
1. Dense Forest (above 65%)
2. Moderate Forest (40 %< 65%)
3. Open Forest (15 %< 40%)
4. Annual Crops
5. Perennial Crops
6. Open Grasses
7. Wooded grass
8. Water body
9. Vegetated Wetland
10. Other

Data correction of Landsat8 imagery

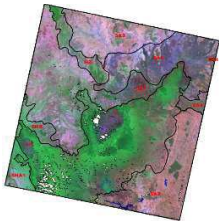


Cloud and shadow masking of a Landsat Scene

Terrain illumination correction of a Landsat Scene



Zoning and division of Landsat8 imagery



Agro-Ecological zoning

Terrain illumination corrected image

Without cloud and shadow image

Each scene

Training site data was collected through GT survey

Supervised classification processing was separately applied to each area / zone / scene

Other

Geographic projection

- Kenyan standard
- National and administrative boundary wad provided by SOK

QA/QC

- Each process has QA/QC step

Benefit of SLEEK approach

Systematic process

- To keep same quality
- Does not depend on individual person skill
- Suitable process to national product level

No manual editing process

- Reduce human power
- Reduce the time and cost

The SLEEK approach is recommendable!!

Assessment of classification result

Ground Truth Survey for verification of result

Period: Sep 26, 2016 – Oct 8, 2016

* Two Kenyan teams had joined this GT survey

Kenyan Team A

26	MON	Field Survey (Nairobi - Nabarnet)
27	TUE	Field Survey (Kabarnet - Timboiwa – Sacho – Tenges –Kabarnet)
28	WED	Field Survey (Kabarnt – Kipcherera – Kapchekor – Tirimionin - Kabarnet)
29	THU	Field Survey (Kabarnet – Chebloch – Biretwo – Tambach – Kessup – Iten - Eldoret)
30	FRI	Field Survey (Eldoret –Kipkabus – Kaptagat - Eldoret)
1	SAT	Field Survey (Eldoret – Soy – Kitale)
2	SUN	Data arrangement / day off (Kitale)
3	MON	Field Survey (Kitale - Kaptalelia – Cheptais - Kitale)
4	TUE	Field Survey (Kitale – Kapenguria - Cherangani– Kitale)
5	WED	Field Survey (Kitale – Lodwar)
6	THU	Field Survey (Lodwar - Lodwar)
7	FRI	Field Survey (Lodwar - Lodwar)
8	SAT	Field Survey (Lodwar - Eldoret)
9	SUN	Field Survey (Eldoret - Nairobi)

Kenyan Team B with JICA team

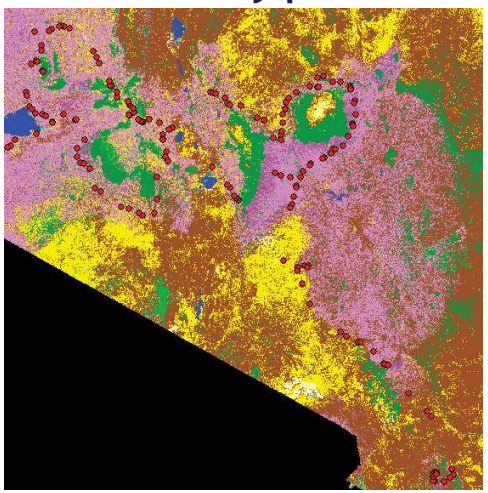
26	MON	Field Survey (Nairobi – kimende – Naivasha - Nakuru)
27	TUE	Field Survey (Nakuru - Sobea – Mau Samit – Londiani – Molo - Elburgon – Njoro –Nakuru)
28	WED	Field Survey (Nakuru – Total – Timboroa – Burnt Forest - Eldoret)
29	THU	Field Survey (Eldoret – Turbo – Kipkaren – Webuye – Malava – Lubao(Kakamega Forest) – Mukumu – Maragori – Vihiga – Kiboswa - Kisumu)
30	FRI	Field Survey (Kisumu – Ahero – Awach-Kendu Bay- Homa Bay – Kisumu)
1	SAT	Field Survey (Kisumu -Ahero – Awasi-Kericho - Bomet - Narok - Mau Narok - Nakuru)
2	SUN	Data arrangement / day off (Nakuru)
3	MON	Field Survey (Nakuru – Nyahururu – Nyeri –Naro Moru - Nanyuki)
4	TUE	Field Survey (Nanyuki – Timau – Meru – Chogoria – Chuka - Embu)
5	WED	Field Survey (Embu –Kutus - Sagana –Muranga - Maragua - Thika)
6	THU	Field Survey (Thika - Nairobi – Machakos – Salama – Kibwezi - Voi)
7	FRI	Field Survey (Voi –Mwatate - Wundanyi - Voi)
8	SAT	Field Survey (Voi - Nairobi)

Team Members

	Group A	Group B
Supervisor	Serah Kahuri	Faith Mutwiri
KFS	Eunice Maina	Kioko Nzioka
	Safi Ibrahim	Antony Ngari
	Jira Chimanyi	Eric Nganga (RCMRD)
Other institution	Tom Kemboi (AWF)	John Ngugi (KEFRI)
	Antony Macharia (SOK)	Merceline Ojwala (DRSRS)

JICA Team: Kei SATO, Sahori MATSUMOTO

Route and survey points



- To consider accessibility
- To consider number of points per day
- To consider balance of class type
- To consider interested class type
- To consider accommodation possibility

File Note

FIELD NOTE for Remote Sensing Analysis

No.	015	Date	27/09/2016
		Surveyor	Sirayo Peter
Category Type (LC/LU Map)	3	UTM(X)/Lat	S 00° 32' 34.1"
Category Type (QT)	3	UTM(Y)/Long	E 35° 58' 09.9"
County	Nakuru	Elevation	2589
		Remark	

1. Forest land

Type	Natural forest (regeneration)
Height	6M
Density(Crown)	Open
Remark	

Comments: People used to live but removed in 2011, *Dombeya goetzenii* species dominant

2. Non-Forest Land

Land use	
Remark	

Photo

North : Opent forest, Adjacent is cropland

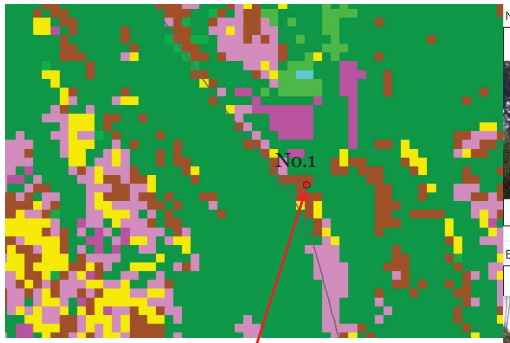
South: Open forest

East: Open forest, Adjacent is cropland

West: Open forest

Ground Truth Survey

Example of Land Cover/Land Use Map with Filed Note



Verification Points

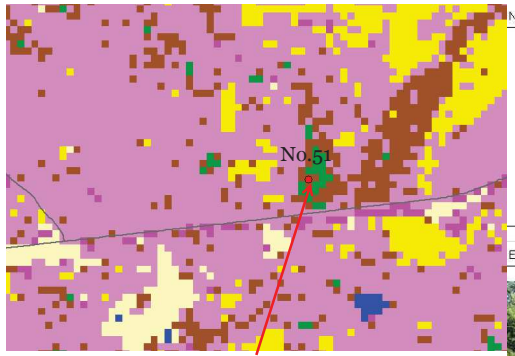
North : Open forest

South: Open forest

East: Open forest

West: Open forest

Example of Land Cover/Land Use Map with Filed Note



Verification Points

North :

No Photo

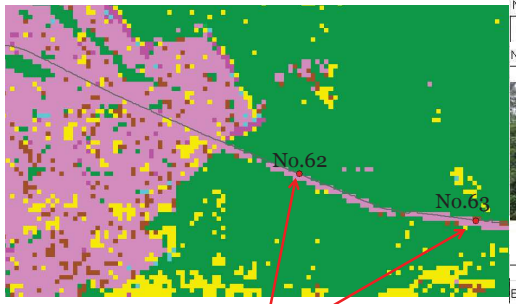
South: Wooded grassland

East: Wooded grassland

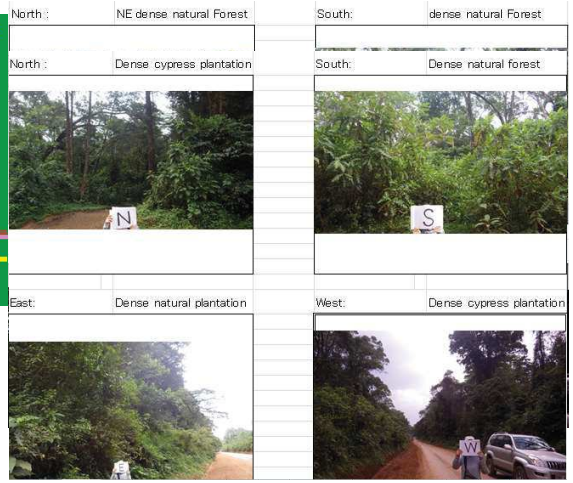
West:

No Photo

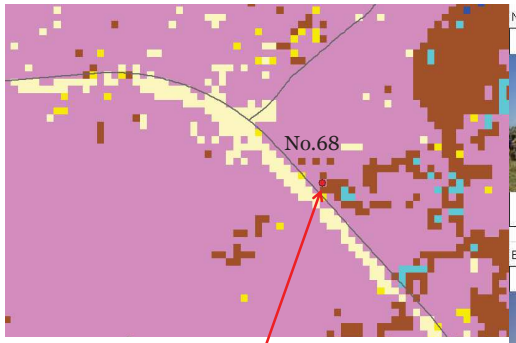
Example of Land Cover/Land Use Map with Filed Note



Verification Points

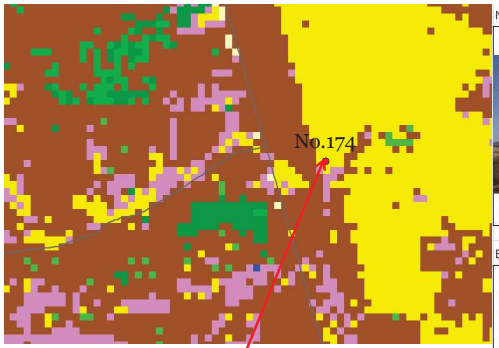


Example of Land Cover/Land Use Map with Filed Note



Verification Points

Example of Land Cover/Land Use Map with Filed Note



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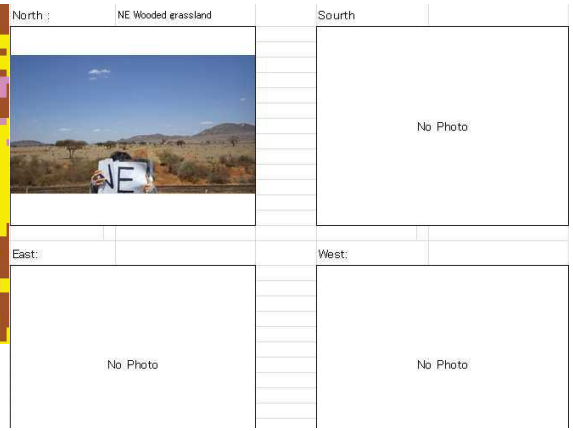


Result

Correctness Table by Verification Survey (SLEEK and JICA Consultant team)

Class Name	Land Cover / Land Use	Number of correct	Accuracy Ratio
Dense Forest	312	239	76.6%
Moderate Forest	221	152	68.8%
Open Forest	150	97	64.7%
Wooded Grassland	984	761	77.3%
Open Grassland	581	406	69.9%
Perennial Cropland	205	165	80.5%
Annual Cropland	989	748	75.6%
Vegetated Wetland	95	70	73.7%
Open Water	47	40	85.1%
Other Land	215	174	80.9%
TOTAL	**3799**	**2852**	**75.1%**

Class Name	Land Cover / Land Use	Number of correct	Accuracy Ratio
Forest	683	488	71.4%
Wooded Grassland	984	761	77.3%
Open Grassland	581	406	69.9%
Perennial Cropland	205	165	80.5%
Annual Cropland	989	748	75.6%
Vegetated Wetland	95	70	73.7%
Open Water	47	40	85.1%
Other Land	215	174	80.9%
TOTAL	**3799**	**2852**	**75.1%**

Thank you very much!

Contact address: koetia2696@pasco.co.jp

LAND USE LAND COVER MAPS ASSESSMENT

Faith Mutwiri
GIS and Remote Sensing Department
Kenya Forest Service

Overview

- Introduction
- Analysis
- Results
- Way Forward

Introduction

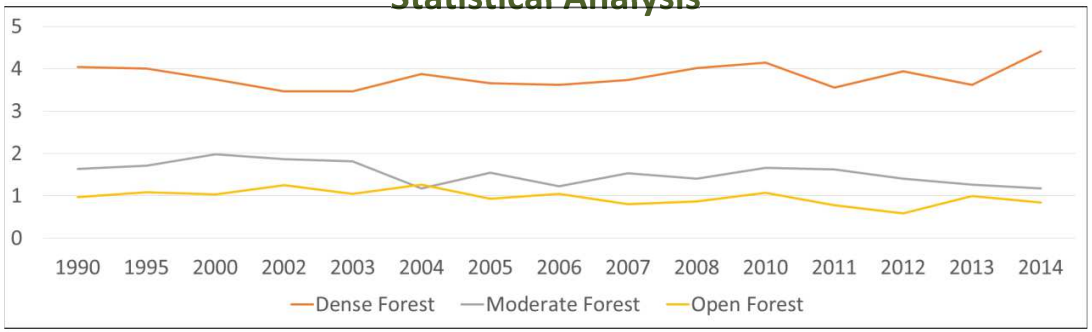
- Mapping done in support of the SLEEK to establish robust MRV (Measurement, Reporting and Verification) system to track land-based emissions and land cover and change information required for national land based greenhouse gas estimation
- A multi-institutional Technical Working Group established to do the mapping,
- Work strongly guided by a Technical and process manual.
- The maps were adopted for the REDD+ process

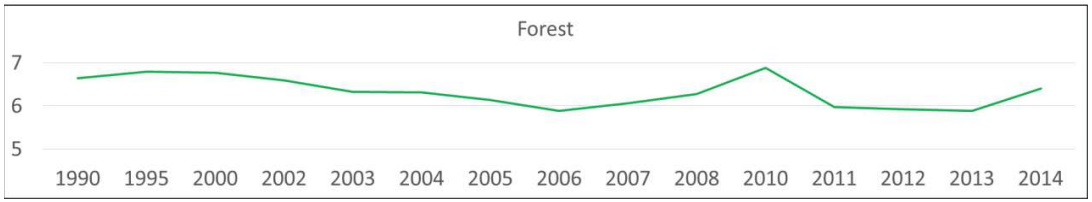
Methodology

1. Each step was guided by the Technical and the process manual
2. Stakeholder consultation has played an important role in the improvement of the maps

ANALYSIS

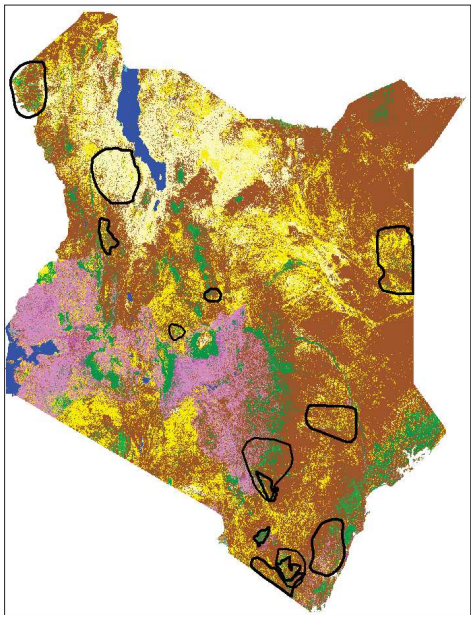
Statistical Analysis





Graphical analysis

Identifying areas with issues in Forest coverage year 2010



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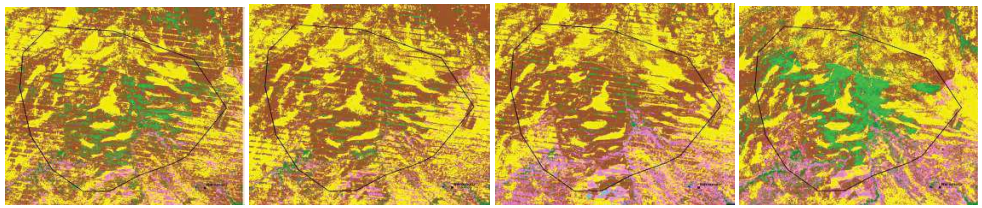
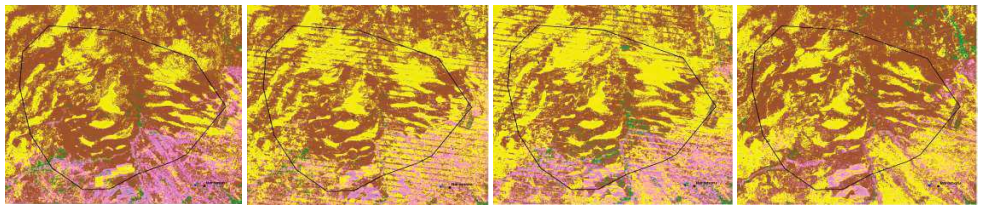
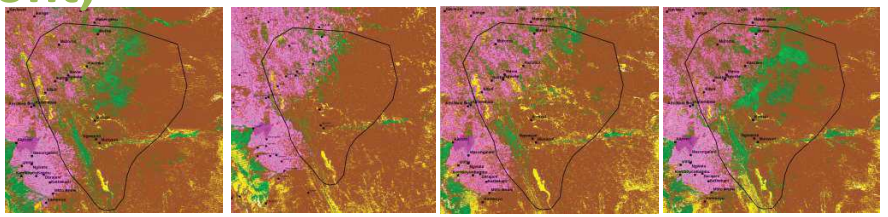


2006 2007 2008 2010

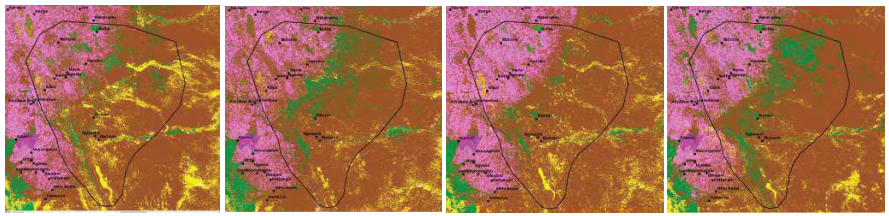


2011 2012 2013 2014

Cont,



2006 2007 2008 2010



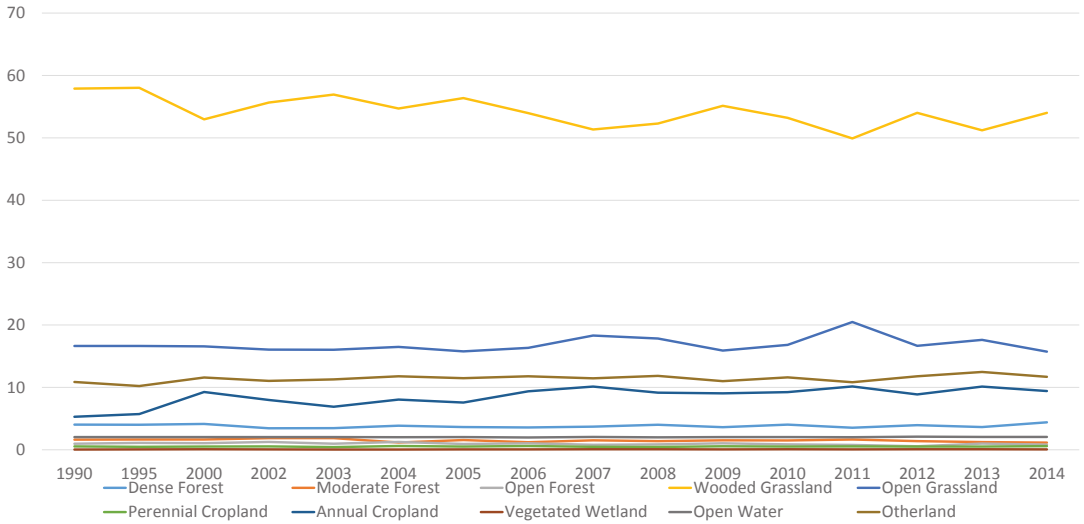
2011 2012 2013 2014

Results

10 LULC Classes Statistics ; Percentage

	1990	1995	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Dense Forest	4.05	4.02	4.15	3.45	3.48	3.86	3.64	3.60	3.72	4.02	3.64	4.04	3.54	3.95	3.65	4.41
Moderate Forest	1.63	1.66	1.66	1.87	1.86	1.17	1.57	1.22	1.53	1.40	1.53	1.50	1.64	1.40	1.23	1.15
Open Forest	0.97	1.11	1.07	1.25	0.98	1.27	0.94	1.06	0.80	0.87	1.04	0.87	0.78	0.58	1.00	0.84
Wooded Grassland	57.90	58.03	52.97	55.66	56.95	54.70	56.37	53.96	51.35	52.30	55.14	53.21	49.91	54.00	51.21	54.01
Open Grassland	16.65	16.64	16.59	16.07	16.04	16.50	15.78	16.34	18.33	17.83	15.91	16.83	20.50	16.67	17.62	15.73
Perennial Cropland	0.54	0.48	0.53	0.54	0.44	0.61	0.53	0.60	0.48	0.47	0.58	0.53	0.56	0.53	0.52	0.60
Annual Cropland	5.30	5.72	9.28	8.00	6.90	8.04	7.59	9.38	10.14	9.17	9.05	9.25	10.15	8.88	10.15	9.42
Vegetated Wetland	0.05	0.06	0.10	0.07	0.05	0.04	0.07	0.08	0.10	0.08	0.08	0.10	0.07	0.09	0.09	0.07
Open Water	2.04	2.04	2.05	2.05	2.03	2.02	2.03	1.99	2.06	2.00	2.04	2.05	2.02	2.11	2.06	2.07
Otherland	10.87	10.23	11.60	11.05	11.28	11.79	11.47	11.78	11.47	11.85	11.00	11.61	10.83	11.79	12.48	11.70

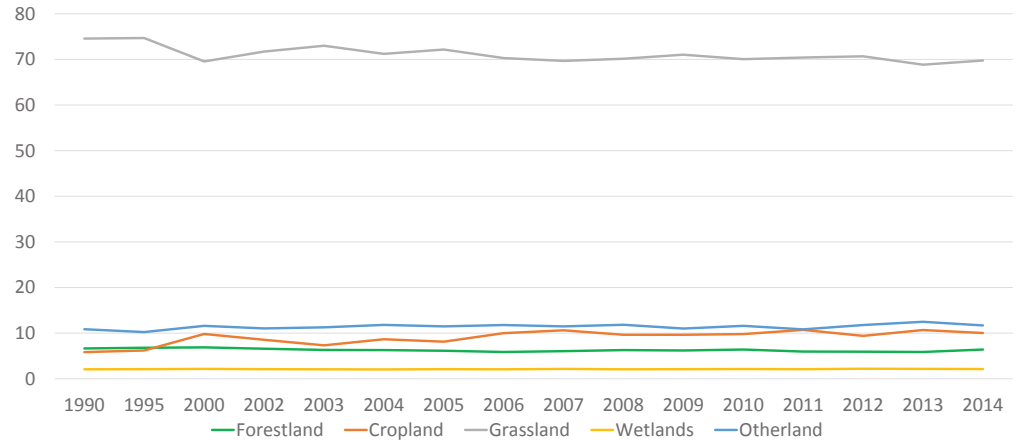
10 LULC Classes Line graph 1990-2014



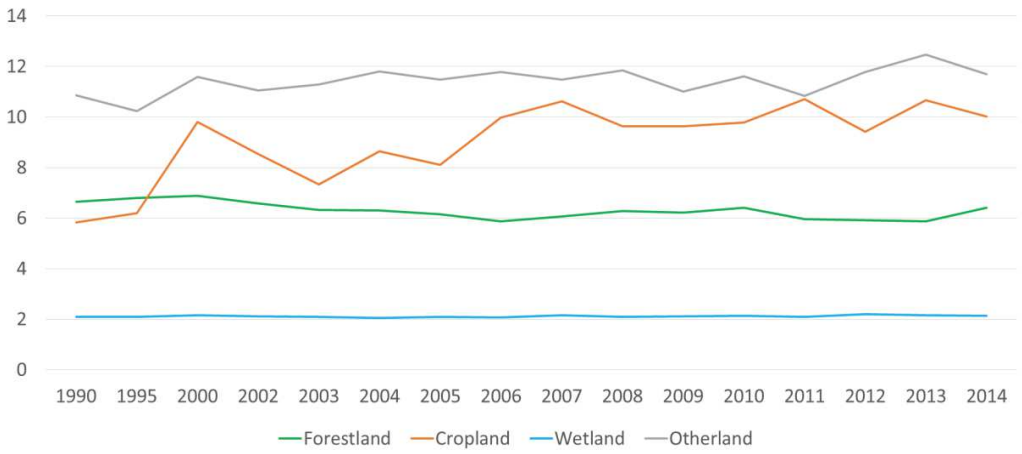
IPCC Classes Statistics

	1990	1995	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Forestland	6.65	6.79	6.88	6.57	6.32	6.30	6.15	5.87	6.06	6.29	6.21	6.42	5.96	5.93	5.88	6.40
Cropland	5.84	6.21	9.81	8.54	7.33	8.65	8.11	9.99	10.63	9.64	9.63	9.78	10.71	9.41	10.66	10.01
Grassland	74.56	74.67	69.56	71.73	72.98	71.20	72.16	70.29	69.68	70.14	71.04	70.04	70.41	70.67	68.83	69.75
Wetland	2.09	2.10	2.15	2.11	2.08	2.06	2.10	2.07	2.16	2.09	2.12	2.15	2.09	2.20	2.15	2.14
Otherland	10.87	10.23	11.60	11.05	11.28	11.79	11.47	11.78	11.47	11.85	11.00	11.61	10.83	11.79	12.48	11.70

IPCC classes Line graph 1990-2014

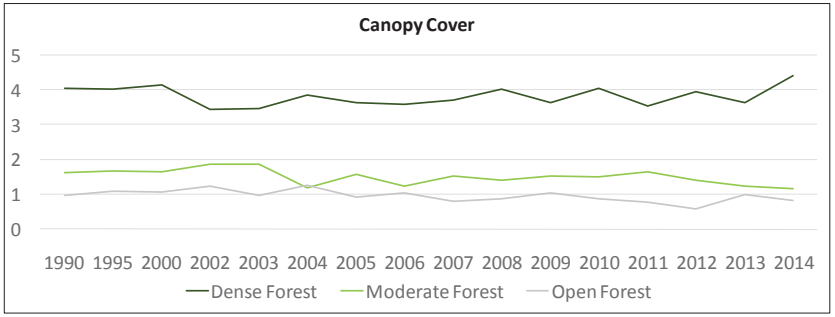


1990-2014 LULC classes Line graph Excluding Grassland



Forest Canopy Cover trend 1990-2014

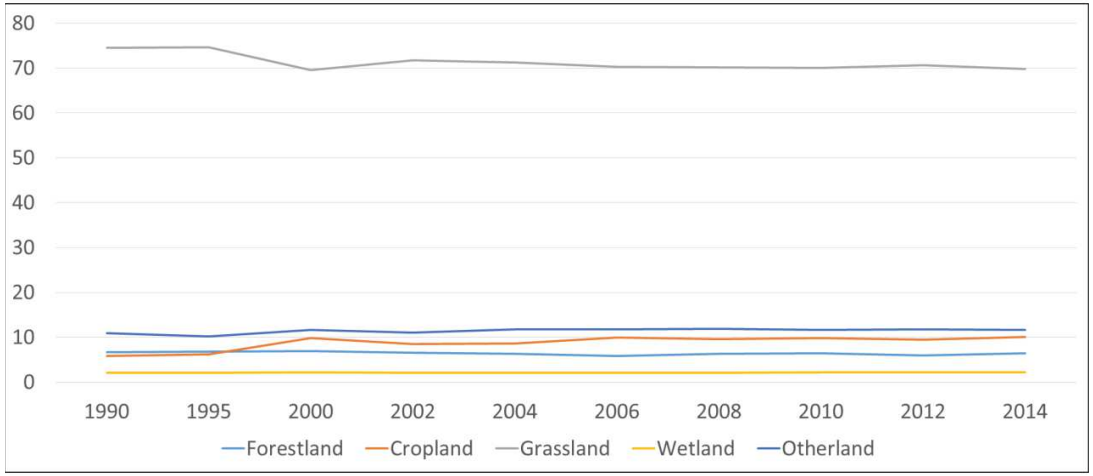
	1990	1995	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Dense Forest	4.05	4.02	4.15	3.45	3.48	3.86	3.64	3.60	3.72	4.02	3.64	4.04	3.54	3.95	3.65	4.41
Moderate Forest	1.63	1.66	1.66	1.87	1.86	1.17	1.57	1.22	1.53	1.40	1.53	1.50	1.64	1.40	1.23	1.15
Open Forest	0.97	1.11	1.07	1.25	0.98	1.27	0.94	1.06	0.80	0.87	1.04	0.87	0.78	0.58	1.00	0.84

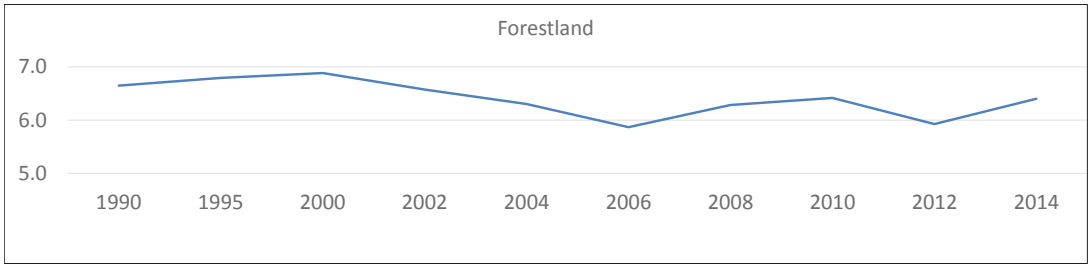


LULC trend at a 2 year interval

	1990	1995	2000	2002	2004	2006	2008	2010	2012	2014
Forestland	6.65	6.79	6.88	6.57	6.30	5.87	6.29	6.42	5.93	6.40
Cropland	5.84	6.21	9.81	8.54	8.65	9.99	9.64	9.78	9.41	10.01
Grassland	74.56	74.67	69.56	71.73	71.20	70.29	70.14	70.04	70.67	69.75
Wetland	2.09	2.10	2.15	2.11	2.06	2.07	2.09	2.15	2.20	2.14
Otherland	10.87	10.23	11.60	11.05	11.79	11.78	11.85	11.61	11.79	11.70

Graph at a 2 year interval




Forestland
7.0
6.0
5.0
1990
1995
2000
2002
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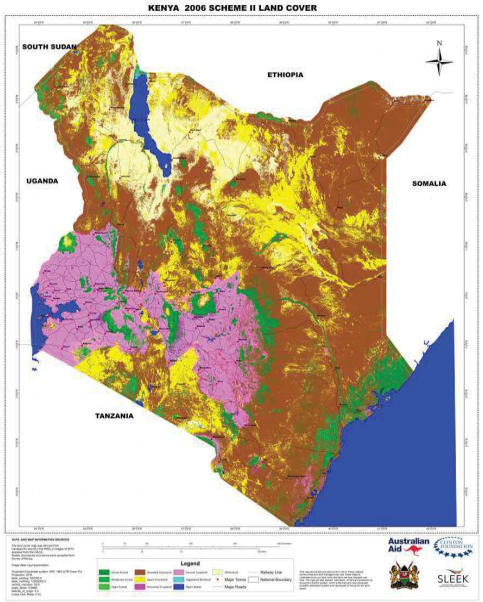
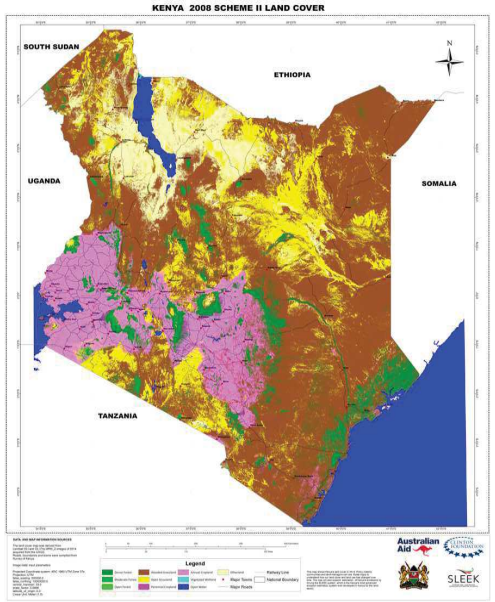
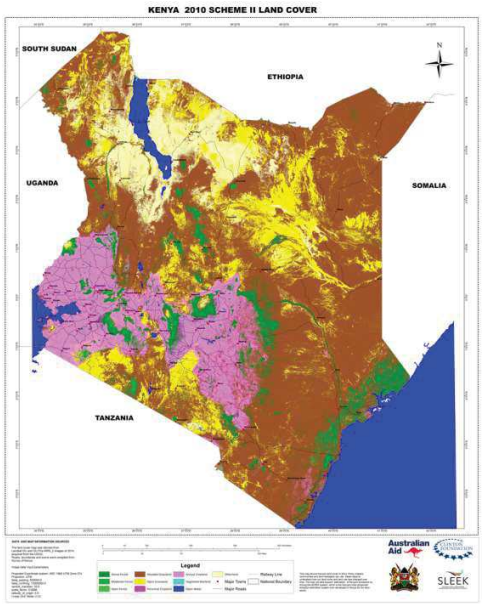
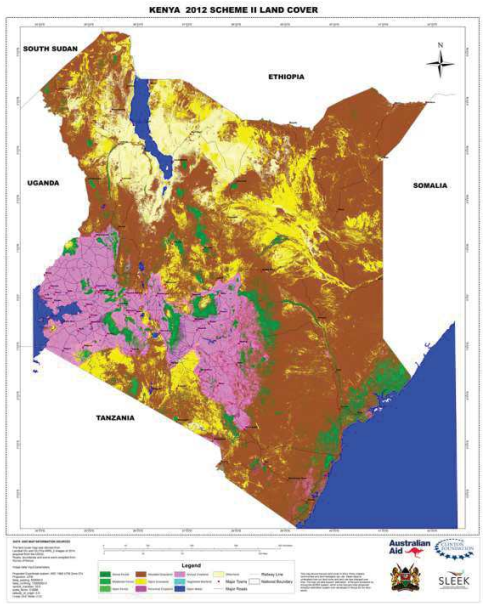
2006
2008
2010
2012
2014


KENYA 2006 SCHEME II LAND COVER
SOUTH SUDAN
ETHIOPIA
UGANDA
SOMALIA
TANZANIA
Legend
Australian Aid
SLEEK


KENYA 2008 SCHEME II LAND COVER
SOUTH SUDAN
ETHIOPIA
UGANDA
SOMALIA
TANZANIA
Legend
Australian Aid
SLEEK


KENYA 2010 SCHEME II LAND COVER
SOUTH SUDAN
ETHIOPIA
UGANDA
SOMALIA
TANZANIA
Legend
Australian Aid
SLEEK


KENYA 2012 SCHEME II LAND COVER
SOUTH SUDAN
ETHIOPIA
UGANDA
SOMALIA
TANZANIA
Legend
Australian Aid
SLEEK

WAY FORWARD

THANK YOU

Training Plan

The REDD+ Readiness Component in the Capacity Development Project for the Sustainable Forest Management in the Republic of Kenya

By Kazuhisa KATO - Compornent3 Team Leader

2017.3.28

MRV training Plan

	Title	Place	Target	Duration	Style
July 2017	MRV for REDD+	Nairobi city	National and county staff (20-30 person)	2days	Open style
July 2018		-	-	-	-
July 2019		-	-	-	-
July 2020		-	-	-	-

Training on participatory carbon monitoring and/or participatory forest monitoring for local people will be discussed for the trainings from next year.

Point whether the training should be implemented or not:

1) Whether Kenya side can disseminate the methodology of PCM to other areas/counties or not
2) Whether participants can implement PCM from the viewpoint of management issues including budgets and logistics or not

Training contents

Day 1		Day 2	
Class 1	Outline of REDD+	Class 1	Development of NFMS and National Forest Platform
Class 2	Trend of International Discussion and International transaction	Class 2	Approaches to develop Activity Data
Class 3	Kenya's REDD+ Progress	Class 3	Development of the land use/land cover Map in Kenya
Class 4	Outline of MRV	Class 4	Development of EF (National Forest Inventory and Biomass survey)
Class 5		Class 5	Development of EF in Kenya

MINUTES OF STAKEHOLDER WORKSHOP ON REDD+ PROGRESS IN KENYA HELD AT MASADA HOTEL, NAIVASHA ON 1ST DECEMBER 2017.

REPUBLIC OF KENYA

Ministry of Environment and Natural Resources

Kenya Forest Service

Program for REDD+ Wider Stakeholders Workshop

Date: 1st December,2017

Venue: Masada Hotel, Naivasha
Purpose: To share with stakeholders the progress made towards setting up FRL for Kenya and eventual submission of Kenyan FRL to UNFCCC

Day 1	Topic	Contents	Presentation
9:00-9:10	Opening remarks and Introduction	-	Mr. Alfred Gichu
9.10-9.40	Presentation on REDD+ elements	-	Mr. Alfred Gichu
9.40-10.10	Background Information on FRL and NFMS	-	Mr. Peter Nduati
10.10-10.30	Plenary		
10.30-11.00	Tea Break		
11.00-12.00	Construction of FRL	・Mapping ・Activity Data	Ms.Faith Mukabi
12.00-12.30	Emission Factors	-	Ms.Serah Kahuri
12.30-12.45	Emission Levels	-	Mr. Peter Nduati
12.45-13.00	Plenary		
13.00-14.00	Lunch		
14.00-14.40	National Circumstances	・Result on National circumstance study in Kenya	Mr.Fredrick Ogoro Mokua
14.40-15.10	NFMS and FIP	・Result on National circumstance study in Kenya	Mr.Charles Mwangi
15:10-15:40	Plenary		
15.40-16.00	Recommendations		
16.00-16.30	Tea Break and End of Workshop		

PARTICIPANTS OF STAKEHOLDER WORKSHOP AT MASADA HOTEL, NAIVASHA HELD ON 1ST DEC 2017.				
	NAME	ORGANIZATION	TEL. NO	EMAIL ADDRESS
1	Psamson Nzioki	Transparency Intl. Kenya		
2	James M Kimondo	KEFRI		
3	Fiesta Warinwa	AWF		
4	Richard Mwangi	KFS		
5	Tecla Chumba	NACOFA		
6	Rosa Roman Cuesta	Cifor		
7	Christina Ender	Conservation int'l		
8	Gladys Gatiba	Green Africa Foundation		
9	Zipporah Muthama	COG		
10	George Tarus	KFS		
11	Margaret M.Ouma	DRSRS		
12	David B. Adegu	MENR/CCA		
13	Merceline Ojwala	DRSRS		
14	Dr. Winnie Musila	KWTA		
15	Maurice N. Otieno	NEMA		
16	Mwangi Kinyanjui	Karatina University		
17	Charles Mundia	DeKut		
18	Fredrick Mokua	GEO- ENVI Solutions		
19	Alphonce Guzha	USFS_IP		
20	Laura Mukwama	CIFOR		
21	Judy Ndichu	UNDP		
22	Felix Mutua	JKUAT		
23	Mwangi Githiru	Wildlife Works		
24	Phobe Oduor	RCMRD		
25	Shintaro ISHIZUKA	JICA consultant		
26	Kenichi TAKANO	CADEP-SFM		
27	Kazuhiro YAMASHITA	JICA expert		
28	Kazuhisa KATO	JICA expert		
29	Kei SATO	JICA consultant		
30	Mwajuma Abdi	Forest Association Network		
31	Jackson Bambo	KFWG		
32	Peter Ndunda	WRI		
33	Peter Nduati	KFS		
34	Florence Tuukuo	JOFCA- CADEP _SFM		
35	Sahori FUJIMURA	JICA Expert		
36	Alfred Gichu	KFS		

MIN 1/ 1/12/2017 Opening Remarks

Mr. Gichu (National REDD+ Coordinator) called the meeting to order at 9.15 am and requested Tecla to begin with word of prayer. He then told the stakeholders that this was a sensitization workshop which was meant to explain to them the progress of REDD+ program in Kenya as well as get their expert opinion on the same. The work should belong to all institutions with a stake in REDD+ matters and hence bringing those stakeholders on board is paramount to the success on the program that in addition have the capability to strengthen and support it.

MIN 2/ 1/12/2017 Presentation on REDD+ Elements

Presentation by Alfred Gichu

He gave an introduction to REDD+ stating that it is country specific and it should be aligned with other forestry sector activities to establish success as a whole. REDD+ -Reducing Emissions from Deforestation and forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. It is guided by policies which include: Climate Change Act, National Climate Change Response Strategy, Forest policy and others all geared towards orientation on National climate change efforts. REDD+ is proposed Climate change mitigation process in the forest sector that seeks to reduce GHG emissions and promote GHG removals; it is made up by Readiness Activities which are intended to ensure the country is ready for REDD+ implementation once the policy frameworks and positive incentives are concluded at the UNFCCC.

These REDD+ Readiness are:

I. A national strategy for implementation and the institutional and legal implementation framework,
II. A Reference Emission Level and/or Forest Reference Level for greenhouse gases (GHG) emissions from deforestation and/or forest degradation;
III. A National Forest Monitoring system to assess the effect of the REDD strategy on GHG emissions, livelihoods and other benefits.
IV. A Safeguard Information System

REDD+ Implementation has faced some challenges e.g.

a. Forest resource assessment and monitoring capabilities
b. Land, forest and carbon tenure rights,
c. Land-use conflicts
d. Benefit sharing and benefit distribution,
e. Access to forest resources for communities and VMGs,
f. Transparency in decision making and governance;
g. Community representation
h. Access to information

Reactions

- Institutional arrangement for Forest Reference Level and National Forest Monitoring System should be discussed in detail; there are strategies that need to be met and the government has involved all stakeholders in order for the process to be understood hence a consultative process has been planned for in the next two years where strategy will be set after wide consultations within the national government, county governments and private sector.
- Have there been plans/ efforts to involve stakeholders in setting the strategy? Several meetings have been organised but all issues may have not been fully exhausted thus continuous engagements will be prepared.

Conclusion

In order for FRL and NFMS to be successfully implemented in Kenya, various organizations need to actively participate in REDD+ activities by supporting and taking charge of the responsibilities that fall within their mandate this will ensure there is harmony in operation as well as contribute to the greater goal of increasing forest cover which is outlined in Vision 2030. In this light also, the role of the community should be clear to enhance incorporation of user needs.

MIN 3/ 1/12/2017 REDD+ Technical Working group decisions to support AD collection

By George Tarus

These decisions were guided by Food and Agricultural Organization of United Nations (FAO), United Nations Development Programme (UNDP), Convention on Biological Diversity (CBD) and United Nations Convention on Climate Change (UNFCCC).

The decisions include

1) **Forest Definition**

The forest definition for Kenya has been agreed as follows:

Forest is A minimum area of land of 0.5 hectare with a Canopy cover of more than 15 per cent and Trees with the potential to reach a minimum height of 2 metres at maturity

2) **Forest Land Stratification**

Forest land stratification was guided by the following logical criterion:

i. Significant differences in growth increment;
ii. Significant variations carbon stock per ha;
iii. Significant variation in carbon flux and response to disturbances;
iv. The spatial extent of the forest
v. Economics-does it make economic sense to allocate resources

Based on the criteria, these are the strata for forest in Kenya;

A. Plantation forests
B. Coastal and mangrove forest
C. Montane, Western rainforest and bamboo forest
D. Dryland forests

• Further to the above stratification forest types will be stratified on the basis of canopy closure of: 15-40% (Open), 40-65%(Moderate) and above 65%(Dense).

A description of the strata was given explaining what each class entails.

3) **Carbon Pools Assessment and GHGs**

Two carbon pools will be reported on for Kenya:

- Aboveground biomass,
- Below-ground biomass

Only Carbon Dioxide shall be considered as GHG.

Reactions

- Was spectral difference considered in making the decision on stratification of forest into the various classes? And is it possible to tell the type of forest by use of Remote Sensing techniques? Canopy stratification is impossible to differentiate using spectral difference however, a suggestion was made to try and look into it before finalizing on categories since differentiating the current forest categories is not possible by spectral analysis.
- Does the process and decisions made so far include private owners of forest and small-scale farmers? The mapping for now is wall-to-wall which does not consider ownership but efforts are in place to include such later.
- There should be integration for people and data working on FRL and NFMS since it is the same team.
- Do the decisions take into account forest economic sense? The economies used consider the forest cover area like what is involved in combining two classes.
- Precision levels for REDD+ and SLEEK are different where REDD+ is 2 and SLEEK is 1 hence there is need to be more precise; a response was given that the team working on SLEEK considered this and made REDD+ as Tier 3 which took care of precision problem.

Conclusion

Differentiation of the categories by spectral reflectance should be carried out to identify whether Remote Sensing techniques can be used in separating one forest type from the other. At some point, all forest sector players will be involved in REDD+ activities to deliver on a national accounting level hence the project level activities work towards determination of Emission Factors from the various sectors.

MIN 4/ 1/12/2017 Construction of FRL

MIN 4.1/ 1/12/2017 MAPPING PROCESS AND AD

Presented by Marceline Ojwala

She gave an outline of the institutions included in the process of FRL construction then she stated that Mapping work was done earlier to support SLEEK where it would be used to establish a robust Measurement, Reporting and Verification (MRV) system so as to track land based emissions. The mapping team which constituted members from the various institutions followed guidance of technical and process manuals to produce Land cover and Land Change information for national greenhouse gas estimation. After going through trainings that were supported by Commonwealth Scientific and Industrial Research (CSIRO) and Food and Agriculture Organization of the United Nations (FAO) the team kicked off with the mapping process. Steps followed included:

1. **Testing of classification techniques**

Various classification techniques that had been used by different organizations were tested and the mapping team settled on Classification using Random forest, it was chosen because it is:

i. Open source

ii. Store probability's
iii. Accurate
iv. Easy to implement

2. Data selection criterion

i. Cloud cover_ desired 0% cloud cover but low cloud cover 20 % is acceptable.
ii. Season _ dry season which is January to February and July to August.
iii. Sensor_ Landsat 5, Landsat 7 SLC-on and Landsat 8 were preferred over Landsat 7 SLC-off.
iv. Date_ Dates of neighbouring scenes were considered

3. Data Preparation

This included cloud and shadow masking, Terrain illumination correction, projection to the Kenyan Coordinate system and Land Use Land cover classification by making classes for Land Cover Change mapping, these classes are; Forest, Cropland, Grassland, Wetland, Settlement and Otherland this was then followed by stratification in spectral stratification zones based on Kenya Agro-ecological zones.

4. Classification using Random Forests.

It was carried out by running R-Scripts.

5. QA/QC of the Classification

Done for purposes of checking for consistency of classification results across scenes and zone boundaries, accuracy assessment was carried out to check for correctness of the map. Conditional Probability Network (CPN) was used to fill data gaps identified in the maps; this mathematical model uses time series maps and probability bands developed during classification. For accuracy assessment, verification survey was done by SLEEK and JICA consultant team and the accuracy were found to be 75.1%.

6. **AD Statistics generated for the Reference Year**

In order to determine reference year and interval, data screening was carried out which involved checking satellite imagery for stripping effect especially from May 2003, after that; certain years were chosen based on results these were; 1990, 2000,2010 and 2014, with 10-year interval and 2014 being the latest reference year.

Images selected, had to fit into forest definition for Kenya which is described as mapping unit area of 0.5ha as the minimum, canopy cover ≥15% and based on this definition, elimination of pixels that do not fit into Forest definition was done by selecting more than 6 pixels.

Other discussions and engagement with experts of UNDP, FAO and CfRN on Activity Data were incorporated. Also, Green Climate Fund decisions at the 18th Board meeting on 30th September to 2nd October 2017 were considered. These include:

i. Less than 5yrs or More than 20yrs of reference period is **FAIL**
ii. 5 – 9yrs or 16 – 20yrs **LOW SCORE**
iii. 10 – 15yrs **HIGH SCORE**

From the above decisions the options available for Kenya are:

Options

1. 1990, 2000, 2010, 2014 – Previous decision

2. 2000, 2010, 2014

3. 1995, 2000, 2010, 2014

4. 2000, 2005, 2010, 2014

5. 2000, 2014

Ms. Ojwala explained that years 2000 and 2014 had good maps due to the data quality hence suggesting that Kenya could use the two as reference years. Option 2 was also considered however she said that 2010 had 'moderately good maps' which is characterised by some unrealistic changes.

Reactions

- How does the classification translate into REDD+? - REDD+ is defined by four activities for Kenya which is captured for all forest categories.
- Joining together all REDD+ activities will be complicated hence working on them individually will even increase chances of receiving funding without them affecting each other. For a country to combine the REDD+ activities the sinks must be very powerful. Also, no one has the capability to support them all together after integration.
- Consultations need to be done widely on how to separate REDD+ activities for Kenya.
- Is the FRL report Open Source? Not yet because it has not been refined but upon finalising, it shall be made accessible to the stakeholders.

Conclusion

The four REDD+ activities considered in the case of Kenya can be separated so as to receive finance based payments for each individually, however, consultations need to be carried out on how to perform projection for individual activity by considering countries that have same conditions like Kenya for instance Ghana. The country shall report on a national scale rather than a sub -national which is fit for countries that report on regional forest cover. The country needs to invest in the four REDD+ activities them to be effectively implemented.

MIN 4.2/ 1/12/2017 PROCEDURE FOR SETTING FRL

Presented by Mwangi Kinyanjui

He explained how Emission Estimates were for three- year points and two-year point by comparing FRL values for different reference years from 2000 to 2014 by average method.

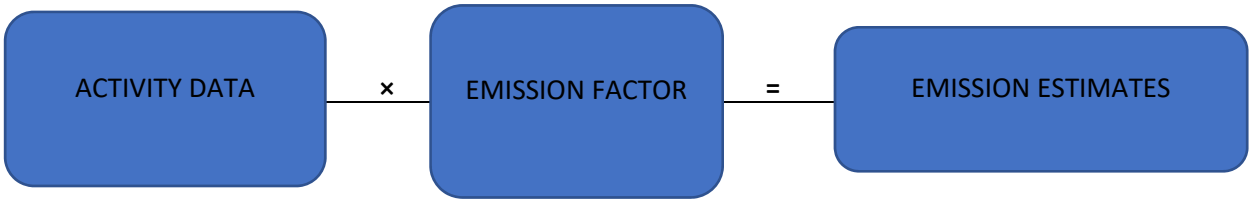
- By three points

Period	**2000-2010**	**2010-2014**	**2000-2014**
FRL (tCO_2/year)	**-7,374,735**	**-7,374,735**	**-7,374,735**

- By two points

Period	**2000-2014**
FRL (tCO_2/year)	**-7,369,087**

He then explained that those emissions are estimated by multiplying Activity data by Emission Factor



Emission estimates were then broken down for monitoring Land Cover Land Use changes by use of REDD+ Activities considered in the case of Kenya i.e***. Deforestation, Forest Degradation, Sustainable Management of Forests and Enhancement.*** The values that make up the activities were clearly exemplified which was also aided by use of different colours for each activity in a matrix format.

The participants were then taken through the procedure to be followed for setting Forest Reference Level for Kenya. Activity Data and Emission Factor shall be used to calculate emission estimates by either Use of Average method or National Circumstance method.

AD: To be made by Land Cover Land Use change map data calculated by the Land Cover /Land Use maps in the different points of time for each period expressed in ha/yr.

EF: To be acquired by the default data from IPCC 2006 guidelines or country data this is from Forest Inventory expressed as tCO2/ha

Using a matrix to illustrate changes from one forest type to another, REDD+ activities were well captured to depict the transitions that have occurred within the reference period. The exact figures within the forest area were clearly explained by breaking the matrix into AD and EF figures, then multiplication of these figures resulted into emissions estimate delineating emission/removal in the amount of CO_2 as weight per year in ton/year.

Explanation of how Forest Reference Level will be set;

i. Average Method

FRL will be set by each year which shall be provided by reference period. The average value for emission estimates in different years will be the basis of projection for National Circumstances. However, if National Circumstance is not projected, the average value will be FRL. By this method, emission estimation figures for each REDD+ activity are as shown below:

Period	
Deforestation	20, 254,838
Forest Degradation	2,883,723
Sustainable Management of Forests	-787, 332
Enhancement	-29,720,316

Total (Emission Estimates/ Net)	-7,369,087
FRL	**-7,369,087**

ii. FRL Setting by National Circumstance

National Circumstance can be projected by calculation taking historical trend as average method. Forest Reference Level will be set with the result of analysis for National Circumstance. This was also illustrated by use of graphs.

FRL REPORT

This was presented in two sections:

1) Documentation Process

Explanation an outline of the schedule for development and submission of Forest Reference Level to United Nations Convention on Climate Change. This also included overview table of Technical Assessment time frames for 2018/2019.

2) Table of contents of FRL Report

An overview of what the FRL document entails.

MIN 5/ 1/12/2017 National Circumstance

Presentation by Mr Mokua

This highlighted focus areas for National Circumstance consideration. Forests have a variety of benefits to Kenya's population and this is as a result of the people being within the forest area where the benefits are direct or by indirectly using resources acquired from forests. The current status of Kenya's Forests 6.99% of total land area by 2010 where they are categorized as Montane, Western rainforest, Bamboo, Afro-montane undifferentiated forest, Coastal and Dryland forests. However major changes occurring within the forest area can be captured by considering National Circumstance which includes:

a) Forest Sector Governance

b) Economic Profile

c) Energy Management

d) Infrastructural, and industrial developments

e) Agricultural Development

f) Forest Management

g) Development Priorities

Under each circumstance detailed discussion was given of what they entail.

Forests in Kenya are managed by various institutions. These was explained in the following sections:

i. Forest types,
ii. Forest policy, legislation and strategies;

iii. Forest management practices
iv. Forest management challenges and future scenarios

Also included was the forest types in Kenya, the region in which they are found and drivers of change for the forest types.

Reactions

- The reference year used in projection does not reflect the latest TWG decision to use 2000 and 2014, the issue is still under discussion due to the fact that the model was using 1990 data.
- A suggestion was given that National Circumstance should consider broadening benefits area.
- Also, integration of other global policies like Nationally Determined Contribution and AFRI 100 should be reflected.

Conclusion

A decision was made to first use the two recommended years; 2000 and 2014 which will help in determining whether National Circumstance shall be included in setting Forest Reference Level for Kenya. The section to be added in FRL report should address all issues considered in determining what National Circumstance are likely to affect FRL in future while explaining the model used in projection, this will provide evidence at the Technical Assessment as well as provide a basis for inclusion in future FRLS.

MIN 6/ 1/12/2017 Development of NFMS in Kenya

By Peter Nduati

The presentation focused on Definition of National Forest Monitoring Systems (NFMS) under UNFCCC which are guided by;

i. 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"
ii. Decision 11/ Cp.19 "Modalities for national forest monitoring systems"

The two decisions are made up by various conditions which were clearly outlined by use of pictorial representation. UN-REDD NFMS strategy describes two key functions of NFMS which are; Monitoring and Measurement, Reporting and Verification (MRV) functions.

Monitoring function of the NFMS is primarily a domestic tool to allow countries to assess a broad range of forest Information, including in the context of REDD+ activities and comprises of;

- Remote Sensing
- Web Interface
- Community Monitoring
- Other monitoring systems related to Forest.

The MRV function for REDD+, on the other hand, refers to the estimation and international reporting of national-scale forest emissions and removals and it includes;

- Satellite Land Monitoring System
- National Forest Inventory
- GHG Inventory

NFMS for Kenya will be established from two aspects; Monitoring function and Data Management Function

The monitoring function;

This will include estimation of anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stock and forest area changes and forest reference level, information of policy and measure biodiversity and registration of forest related project.

Data management Function

It is a database to input the information and data gathered by monitoring function and provide them for implementing forest management including REDD+. After determining the activities to be carried out for each function, the questions of how, who, what, where and when shall be considered such that it will be clear until completion of the functions.

The contents of the proposed NFMS document were outlined

Chapter 1	Background and Purpose	
Chapter 2	UNFCCC Requirements	
Chapter 3	Basic conditions for NFMS	3.1 Scale
		3.2 REDD+ Activity
		3.3 Forest Definition
		3.4 Carbon Pool
		3.5 Scope of GHG
Chapter 4	Conceptual design of the NFMS in Kenya	4.1 Composition of NFMS
		4.1.1 Monitoring Function
		4.1.2 Data Management Function
		4.2 Phased Approach
		4.3 Relation with Other Activities
Chapter 5	NFMS Components	5.1 Activity Data
		5.2 Emission Factor
		5.3 Forest Cover Change Monitoring
		5.4 Providing information to SIS
		5.5 Data Management System in the Forest Information System

Chapter 6	Institutional Arrangement for NFMS	6.1 Institutional Arrangement for Monitoring Function
		6.2 Institutional Arrangement for Data Management Function
Chapter 7	Calendar of NFMS	

For Kenya, the objective of NFMS is gathering accurate and transparent data and information related with Kenya forest management and providing it to inform interested stakeholders on the forest status, to report to international conventions and to make use of sustainable forest management in Kenya.

In addition, the methodologies for how the NFMS functions shall be carried out were described and in accordance with each particular activity. Also, methodology for monitoring was explained by dividing it into monitoring of AD and Monitoring of EF, AD monitoring is guided by Forest Definition and stratification by use of class zoning while EF monitoring is done by following guidance of SLEEK procedure.

NFMS contributes to Safeguards Information Systems by providing relevant information in the following manner;

Safeguards Information System (SIS)	**National Forest Monitoring System (NFMS)**
1. Consistency with the national forest policy	Satellite analysis (AD)
2. Transparent and effective forest governance	Forest carbon stock (EF)
3. Respect for the knowledge and rights of indigenous peoples	GHG inventory
4. Full and effective participation of relevant stakeholders	Forest area change Monitoring
5. Consistency with the conservation of natural forests and biological diversity	FRL
6. Actions to address the risks of reversals	Policy and Measures
7. Actions to reduce displacement of emissions	Biodiversity
8	Project registration

Institutional arrangement will be taken into account to ensure that all items that contribute to success of REDD+ are well taken care of. Also itemised were the tasks to be carried out for NFMS development.

Reactions

- On institutional arrangement, the role and responsibility of each organisation should be clear to allow for harmonization and hence agreement should be reached on to determine what institution takes on what role within the monitoring system. Kenya Forest Service is the Lead organization but other institutions also play very crucial roles in ensuring success of the National Forest Monitoring System, these should be assigned roles that fit their expertise area for example Remote Sensing to RCMRD. The NFMS document should strengthen development of the strategy for Kenya hence both should seamlessly complement each other.

- Designing the monitoring system is on-going and it will take into consideration basic conditions within the forestry sector, the contents presented are not final as they will continue to be enriched.
- How will reporting be done within the monitoring system, will it include registry? The monitoring system as explained is composed of two functions i.e. monitoring and MRV function; FIP shall address the reporting part, also from guidance provided by international players; REDD+ will have to report through Nationally Determined Contribution hence a chapter on Reporting will be important in the NMFS document.

Conclusion

The system should be able to provide information on biodiversity thus relevant institutions need to be brought on board in designing the NFMS which will ensure that none of the crucial sectors is left out this include; Kenya Wildlife Service, National Environmental Management Authority and National Museums of Kenya(NMK). Although the institutions have different mandates, their overall contribution in NFMS should be clear. In this light also, the water sector will be included in NFMS as it is important in forest conservation. Inclusion of communities in NFMS development should be supported with a documentation of the roles they throughout the process.

MIN 7/ 1/12/2017 Development of FIP

The Forest Information Platform will be developed to serve the following objectives:

1）To grasp the quantities of the carbon accumulation, emissions and absorption of the forest with GIS through past, present, future (NFMS）

2）To provide the information and data which contribute to REDD＋Safeguard information system （NFMS)

3）To grasp the deforestation monitoring with the factor about the practical "Real time” timing （NFMS）

4）To Provide REDD+ strategy which can be historically grasped

5）To provide the data which contribute to draw up a forest management plan

6）To confirm the report and the verification of MRV

The following functions will help the FIP to achieve the above objectives:

i. Replacement of KFIS’s functionality with the Web Portal Service with ArcGIS Enterprise
ii. Using the Portal for ArcGIS Server with limited access to the contents.
iii. Utilization of ArcGIS Online as the gateway to the accessible contents
iv. Supporting PDA devices for the data collection activities at the field
v. Supporting the other external system data with the static link

FIP will basic components that shall support its operation;

After accessing data from Forest Management Information System, the shape files generated are imported into database after which it is enhanced by Arc GIS online services then used for web, mobile and desktop applications.

After this a diagrammatic illustration of The FIP was shown and it incorporates data collection tools and techniques and how it will be utilised within the various organizations until it is disseminated to the public.

FIP entails 8 main components namely:

- FRL
- MRV
- Safeguards
- Forest Removal /emissions monitoring
- National REDD+ strategy and Rerated information
- Forest administrative information
- Other relevant data
- Project Registry

The FIP has four contents which can be accessed by various persons depending on access rights set. A detailed description of who has access was given in this presentation. Inventory data which shall be of most important for FIP shall be collected using Survey 123 and PDA client after which the data shall be analysed and made available to users. Within the FIP, plantation data shall be linked with shapefile data and stored in the Portal for ArcGIS.

The schedule for FIP development was given where it is to be done throughout the project life cycle and as of now program design is ongoing.

Reactions

- The FIP seems complicated for a community stakeholder to understand hence a suggestion was raised to simplify it for the community players to make useful contribution while understanding what it is all about.
- Estimation of Emission Factors was done using the available data from survey done earlier by the KFS inventory section because undertaking a Forest Inventory requires time and it is expensive.
- On registry, M of MRV shall take care of reporting part of monitoring system which shall prevent double counting both at project level and national level, also the system is still a draft thus more contents can be included.
- How is the NFMS linked to the REDD+ website? The website

Conclusion

There may be more support next year for NFMS which will be directed towards FIP hence reporting will be much easier, but a linkage needs to be created with platform which will cater for financial support needed to make National Forest monitoring a success. FIP is part of NFMS as data management function but it can also have other types of data this can be included in REDD+ section within the Kenya Forest Service website for information sharing hence the platform can be connected to it and a user should be able to view what concerns REDD+, it can also report on other functions within the forestry sector.

Closing Remarks.

Mr. Gichu thanked the stakeholders for attending the workshop and making important contributions while urging them to continually support the process of REDD+ as it will be a country success, he also said that FRL document shall be shared with the stakeholders after completion for their comments and inputs. The materials for the workshop were to be shared with participants for internalisation.

The meeting was adjourned at 4.10pm.

REPUBLIC OF KENYA

Ministry of Environment and Natural Resources

Kenya Forest Service

Program for REDD+ Stakeholders Consultation and Sensitization Workshop

Date: 1st December, 2017

Venue:Masada Hotel, Naivasha

Purpose: To share with stakeholders the progress made towards setting up the National FRL and the National Forest Monitoring System

Day 1	Topic	Contents	Presentation
9:00-9:15	Opening remarks and Introduction		Alfred Gichu
9.15-9.30	Presentation on REDD+ elements		Alfred Gichu
9.30-10.00	Decisions made by stakeholders to support FRL and NFMS work	• Major decisions that have been made by REDD+ TWG to support AD development and setting the National FRL for Kenya	George Tarus
10.00-10.15	Plenary		
10.15-10.30	Tea Break		
10.30-11.15	Construction of Forest Reference Level(FRL)	• Mapping • Activity Data	Merceline Ojwala
11.15-12.00		• Emission Factors(EF), Activity Data(AD) and Forest Reference Level(FRL) • Calculation of FRL using EF and AD	Dr. Kinyanjui
12.30-13.00	Plenary		
13.00-14.00	Lunch		
14.00-15.00	National Forest Monitoring System (NFMS) and FIP	• Design elements and process of construction • Forest Information Platform	Peter Nduati and Mwangi
14.30-15.00	National Circumstances	・Result on National circumstance study in Kenya	Fredrick Mokua
15:00-15.30	Plenary		
15.30-16.00	Official Closing of the Workshop		
16.00-16.30	Tea Break and Departure		

REDD+ Process in Kenya

Alfred N. Gichu,
REDD+ Coordinator

Contents

- Context
- Definition
- Objectives of Kenya's REDD+ Strategy
- Priority Areas
- Readiness activities

Context

- Kenya is a **signatory to UNFCCC** and commits to conserving carbon storehouses;
- policies and laws exist for orienting CC efforts, including climate change policy and law, NCCRS, Green economy strategy, NDC .
- Forestry recognized as a key vehicle for realizing CC goals.
- Forestry sector is a **source of emission** of GHGs - unsustainable utilization, land use changes, fires, Charcoal burning, logging etc;
- Forests are **carbon storehouses** and provide **carbon sinks** and therefore a CC solution.
- Forests can be a key adaptation strategy- water conservation, Strengthening community resilience in areas experiencing reduced rainfall and periodic crop failures;

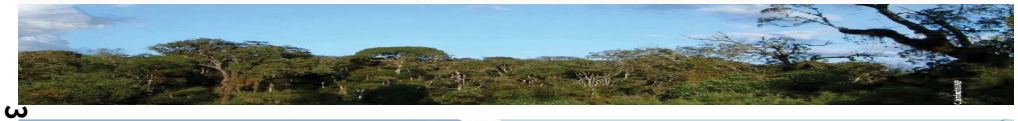
Introduction

- **REDD+** -Reducing Emissions from Deforestation and forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.
- A proposed CC mitigation process in the forest sector that seeks to reduce GHG emissions and promote GHG removals;
- REDD+ is country driven, voluntary and performance- based
- Kenya has already expressed its desire to implement REDD+ as a mitigation mechanism.
- The UNREDD and the FCPF are two major initiatives supporting Kenya in the process.

Objectives of REDD+

Kenya is participating in REDD+ Readiness to support :

- Realization of Constitutional ,vision 2030 and Green Economy strategy objectives;
- Design of policies and measures to protect and improve forest resources;
- realization of the NCCRS goals.
- Contribution to global climate change goals.
- Access to International carbon finance to support forestry development;



Priority Areas of Strategy Focus

1. Reducing pressure to clear forests for agriculture, settlements and other land uses;
2. Promoting sustainable utilization of forests by promoting efficiency, energy conservation;
3. Improving governance in the forest sector by strengthening national capacity for FLEG , advocacy and awareness ;
4. Enhancement of carbon stocks through forestry extension, incentives for commercial forestry, addressing the fire problems

REDD+ Readiness Activities

- Intended to ensure the country is ready for REDD+ implementation once the policy frameworks and positive incentives are concluded at the UNFCCC.
- **Readiness activities include**
  - A **national strategy for implementation** and the institutional and legal implementation framework,
  - A **Reference Emission Level and/or Forest Reference Level** for greenhouse gases (GHG) emissions from deforestation and/or forest degradation; and
  - A **National Forest Monitoring system** to assess the effect of the REDD strategy on GHG emissions, livelihoods and other benefits.
  - **A Safeguard Information System**

REDD+ Readiness Process

1. **National Strategy and implementation framework** will require:
   - Clear understanding of drivers of forest cover change
   - Transparent, equitable and accountable benefit sharing/benefit distribution mechanisms,
   - Inclusive participation of stakeholders;
   - SESA
   - Developing safeguards and grievance mechanisms to protect the interests of stakeholders;
   - Clarification of national land, forest and carbon tenure rights.

Readiness Process

2. **REL/FRL and NFMS** should be established to serve multiple functions including:
   - Performance of REDD+ activities
   - National greenhouse gas inventory and reporting
   - Access to result-based finance for REDD+
   - Compliance with Constitutional and legal requirements
   - Reporting to FAO &other International bodies
   - Support to forest sector planning and decision making

Challenges to REDD+ Implementation

- Forest resource assessment and monitoring capabilities
- land, forest and carbon tenure rights,
- Land-use conflicts
- benefit sharing and benefit distribution,
- access to forest resources for communities and VMGs,
- Transparency in decision making and governance;
- Community representation
- Access to information

REDD+ Safeguards

Policies to protect against undue negative consequences of REDD+ implementation.

- Consistency with NFP and international agreements (policy coherence)
- Transparent and effective governance structures
- Respect for knowledge and rights of local communities
- Full and effective participation of relevant stakeholders
- Consistency with conservation of biodiversity and ensuring against conversion of natural forests
- Addressing risk of reversals (ensuring permanence)
- Reducing displacement of emissions (addressing leakage)

REDD+ TWG DECISIONS TO SUPPORT ACTIVITY DATA COLLECTION

1

Forest Definition for Kenya

- The forest definition for Kenya has been agreed as follows:
- Forest is
  - A minimum area of land of 0.5 hectare ;
  - Canopy cover of more than 15 per cent;
  - Trees with the potential to reach a minimum height of 2 metres at maturity.

2

Forest Land Stratification

- Forest land stratification was guided by the following logical criterion:
  - ✓Significant differences in growth increment;
  - ✓Significant variations carbon stock per ha;
  - ✓Significant variation in carbon flux and response to disturbances;
  - ✓The spatial extent of the forest
  - ✓Economics–does it make economic sense to allocate resources

3

Forest Land Stratification

- The strata based on above criterion are:
  - ✓Plantation forests
  - ✓Coastal and mangrove forest
  - ✓Montane, Western rainforest and bamboo forest
  - ✓Dryland forests
  - Further to the above stratification forest types will be stratified on the basis of canopy closure of: 15–40%, 40–65% and above 65%.

4

Plantation Forests

- Areas with even aged monocultures and mixed species
- Grown for specific objectives and therefore depicts defined characteristics
- Subjected to silvicultural treatments
- Easily delineated from other forest types
- Species include;Cypress,Pine and Eucalyptus

5

Coastal Forests and Mangroves

The coastal forests:

- These are the forests found in the coastal region of Kenya within a 30km strip from shoreline for example;Arabuko–sokoke forest, Shimba hills forest
- **The Mangroves**
- Mangroves have been defined as trees and shrubs that have adapted to life in saline environments

6

Montane and Western rain forests

- **Montane forests:** These are forests in high altitude regions of Kenya (above 1,500m). They are the most extensive and have been described as water towers due to their support to water catchments (DRSRS and KFWG, 2006)

- **Western rain forests**: These are forests with characteristics of the Guineo–Congolean forests and include Kakamega forest, the North and South Nandi forest and Nyakweri forest in Transmara Sub–County

7

Dry land Forests

- These are the forests found in the arid and semi–arid regions of Kenya. Their tree composition is dominated by Acacia–Commiphora species but also include *Combretum, Platycephelium voense, Manilkara, Lannea, Balanites aegyptiaca, Melia volkensii, Euphorbia candelabrum* and *Adansonia digitata*.
- The category also includes riverine forests in dry areas

8

Land Use Classification

- Six IPCC classes adopted
- Forest Degradation to be consider as its an important driver i.e source of emission in the forest cover mapping
- Perennial crops may also be classified as forest depending on whether they meet forest definition and usage
- Its most likely species like tea and coffee qualify as forests, but agricultural usage may limit its usefulness as carbon store
- Tree component in agricultural systems where they meet forest definition should be captured as forests, however a policy intervention may be required

Carbon Pools Assessment and GHGs

- **The following carbon pools will be reported**
  - Aboveground biomass,
  - Below–ground biomass
- **GHGs to be reported;**
  1. Carbon Dioxide

Thanks for Listening

REPUBLIC OF KENYA

REDD+ STAKEHOLDER WORKSHOP

FOREST REFERENCE LEVEL

Date: 1st Dec 2017

Merceline Ojwala & Faith Mutwiri

8

OUTLINE

- Introduction
- Methodology
- Decisions on the Reference Period

Introduction

- A multi-institutional Technical Working Group established to do the mapping with members from;
  - Kenya Forest Service (KFS)
  - Directorate of Resource Survey and Remote Sensing (DRSRS)
  - Survey of Kenya (SoK)
  - Kenya Forestry Research Institute (KEFRI)
  - National Environment Management Authority (NEMA)
  - Regional Centre for Mapping of Resources and Development (RCMRD)
  - African Wildlife Foundation (AWF)
  - Environmental Research Mapping and Information Systems in Africa (ERMIS Africa)
  - Jomo Kenyatta University of Agriculture and Technology (JKUAT)
  - Dedan Kimathi and Karatina Universities
- Work strongly guided by a Technical and process manual.
- Technical support provided by JICA and FAO

Introduction

- Mapping done in support of the SLEEK to establish robust MRV (Measurement, Reporting and Verification) system to track land-based emissions.
- SLEEK designed to track all emissions and removals in the land-sector;
- The mapping team provides land cover and change information required for national land based greenhouse gas estimation

Capacity building

- Several trainings have been undertaken by FAO and CSIRO

1. CSIRO (Commonwealth Scientific and Industrial Research Organization)

- ➢ Random Forest scripts used in the classification.
- ➢ Terrain illumination correction

2. FAO (Food Agricultural Organization)

- ➢ Accuracy Assessment
- ➢ Change detection using Google Earth Engine
- ➢ Land Cover Classification System (LCCS)
- ➢ Data collection using collect earth

3. RECAREDD Project under the RCMRD

Mapping Methodology

1. Testing of methods
   - **Four methods were tested and the best was selected for classification Random forest.**

2. Data acquisition and preparation
   - **Land Sat data from the USGS website was selected following the technical manual guidance – e.g. minimum cloud cover and date of acquisition (dry season) .**
   - **Data processing followed Standard procedure from Survey of Kenya e.g. Projection systems**

3. Land Use Land Cover Classification

❖ **Land cover classes for LCC Mapping**

I. Forest
1. Dense Forest > 65% canopy cover
2. Moderate Forest 40 – 65% canopy cover
3. Open Forest 15 – 40% canopy cover

II. Cropland
1. Annual Cropland
2. Perennial cropland

III. Grassland
1. Open Grassland
2. Wooded grassland

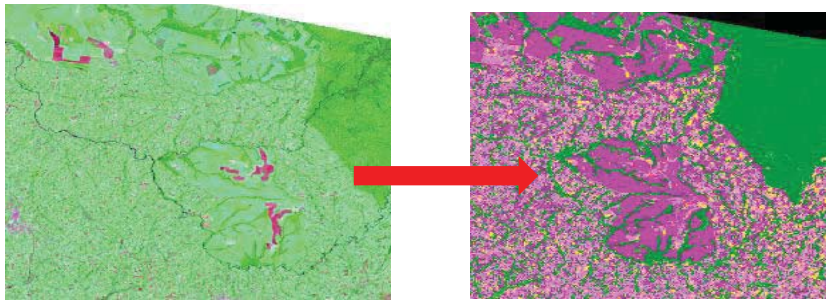
IV. Wetland
1. Open Water
2. Vegetated wetland

V. Settlement

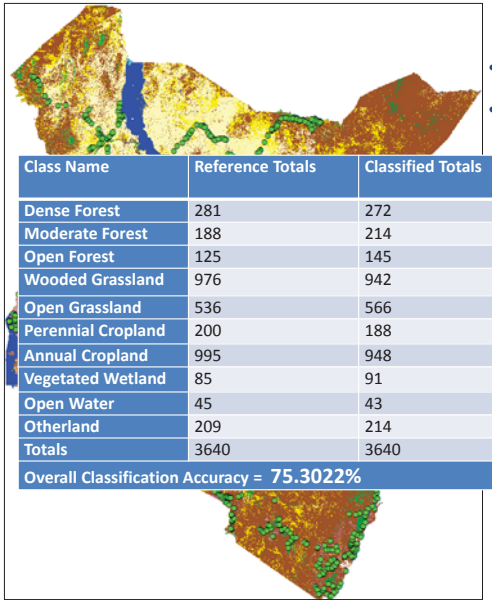
VI. Otherland

4. Classification using Random Forests

- **Running R-Scripts**



Landsat Image *Output: Classified Image*



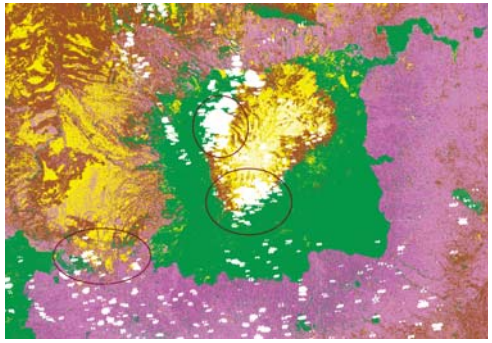
5. Accuracy Assessment

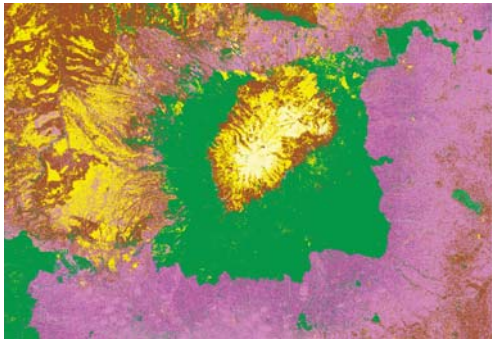
- **Checking the correctness of the map**
- **Sampling Procedure -** *Proportionate stratified random*

Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy
Dense Forest	281	272	216	76.87%	79.41%
Moderate Forest	188	214	148	78.72%	69.16%
Open Forest	125	145	94	75.2%	64.83%
Wooded Grassland	976	942	737	75.51%	78.24%
Open Grassland	536	566	395	73.69%	69.79%
Perennial Cropland	200	188	150	75%	79.79%
Annual Cropland	995	948	726	72.96%	76.58%
Vegetated Wetland	85	91	66	77.65%	72.53%
Open Water	45	43	36	80%	83.72%
Otherland	209	214	173	82.78%	80.84%
Totals	3640	3640	3640		
Overall Classification Accuracy = 75.3022%					

6. CPN (Conditional Probability Network)

- **Due to data gaps a mathematical model known as a conditional probability network (CPN) is used to fill.**
- **It uses the time series maps and the probability bands developed during classification**

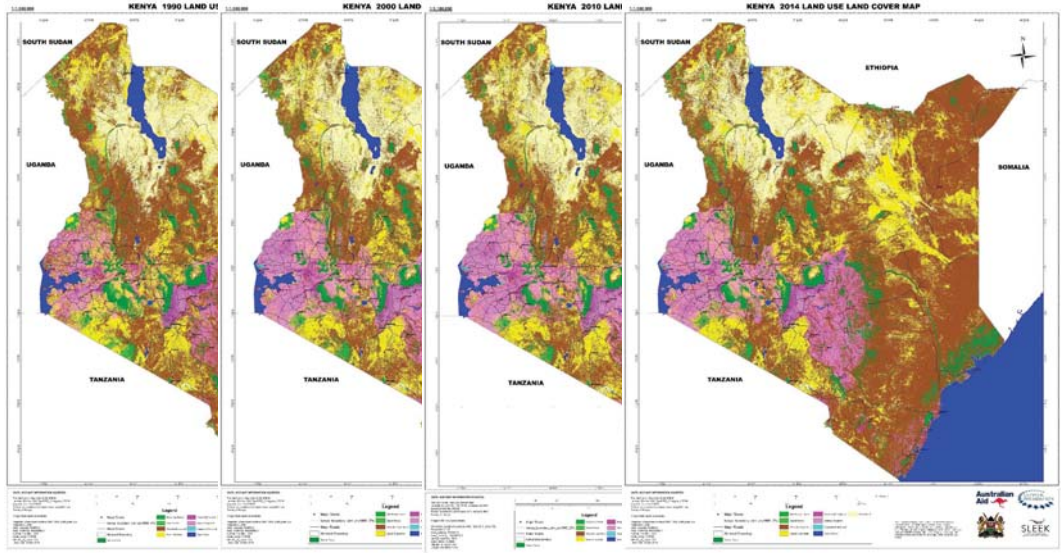




7. Time series maps

- **Maps developed**
  - **1990**
  - **1995**
  - **2000**
  - **2002**
  - **2003**
  - **2004**
  - **2005**
  - **2006**
  - **2007**
  - **2008**
  - **2009**
  - **2010**
  - **2011**
  - **2012**
  - **2013**
  - **2014**

Time Series Maps



Decisions on Reference Period

- The reference period for forest reference level was determined by
  - **Quality of the maps**
    - **Data availability**
    - **Cloud cover**
  - **Latest Decisions of the GCF**
    - **Score board**

AD Decisions

- **Reference Period – Data screening**

	1990	1995	2000	2002	2003	2004	2005	2006
No DATA (%)	10.59%	14.35%	6.50%	6.53%	8.56%	23.77%	20.86%	23.13%
LANDSAT4 (scene)	26	0	0	0	0	0	0	0
LANDSAT5 (scene)	8	34	0	0	0	0	0	0
LANDSAT7 (scene)	0	0	34	34	34	34	34	34
Missing scenes	0	0	0	0	0	0	0	0
LANDSAT8 (scene)	0	0	0	0	0	0	0	0
Stripping Effect (scene)	0	0	0	0	0	34	34	34
Ratio of Stripping Effect (%)	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**100.00%**	**100.00%**	**100.00%**

	2007	2008	2009	2010	2011	2012	2013	2014
No DATA (%)	26.14%	28.00%	15.85%	6.81%	12.51%	20.85%	16.98%	3.75%
LANDSAT4 (scene)	0	0	0	0	0	0	0	0
LANDSAT5 (scene)	0	0	11	24	15	0	0	0
LANDSAT7 (scene)	34	34	23	9	19	34	13	0
Missing scenes	0	0	0	1	0	0	0	0
LANDSAT8 (scene)	0	0	0	0	0	0	21	34
Stripping Effect (scene)	34	34	23	9	19	34	13	0
Ratio of Stripping Effect (%)	**100.00%**	**100.00%**	**64.60%**	**26.50%**	**55.90%**	**100.00%**	**38.20%**	**0.00%**

10 Year's epoch to be utilized and 2014 as recent Activity Data

Other decisions

- Further discussions and engagement with experts from FAO, UNDP and CfRN on AD
- 18th meeting of the Board between 30thSep -2nd Oct 2017 - Based on Decisions of the Board;
  - Less than 5yrs or More than 20yrs of reference period is **FAIL - 0**
  - 5 – 9yrs or 16 – 20yrs **LOW SCORE -1**
  - 10 – 15yrs **HIGH SCORE -2**

Options

1. 1990, 2000, 2010, 2014 – *Previous decision*
2. 2000, 2010, 2014
3. 1995, 2000, 2010, 2014
4. 2000, 2005, 2010, 2014
5. 2000, 2014

Agreed : Option 5 ; 2000 to 2014

		2000		2014	
Montane Forest / Western Rain Forest / Bamboo (10)	Dense (1)	978,308.0		1,110,721.2	
	Moderate (2)	249,410.7		203,080.5	
	Open (3)	131,976.5		104,791.7	
Costal Forest and Mangroves (20)	Dense (1)	177,555.6		421,452.5	
	Moderate (2)	373,598.4		125,038.6	
	Open (3)	22,956.6		6,241.4	
Dryland Forest (30)	Dense (1)	971,645.3		970,632.4	
	Moderate (2)	532,561.0		287,009.3	
	Open (3)	333,873.6		305,131.7	
Plantation (40)	Dense (1)	41,099.5		53,045.6	
	Moderate (2)	2,216.1		1,073.2	
	Open (3)	868.2		546.4	
	Forest Total	**3,816,069.4**	**6.4%**	**3,588,764.4**	**6.1%**
Crops (50)	Annual Crops (1)	4,227,297.7		5,900,262.5	
	Perennial Crops (2)	222,931.9		299,515.2	
Glass Land (60)	Open Grasses (1)	9,773,591.9		8,825,587.5	
	Wooded Grass (2)	33,239,061.5		32,375,230.9	
Wetland (70)	Water body (1)	1,215,703.4		1,224,234.2	
	Vegetated Wetland (2)	20,411.6		38,844.6	
Other (80)	~~Settlement (1)~~	-		-	
	Other (2)	6,685,673.2		6,948,302.5	
		59,200,741		**59,200,742**	

Thank you very much!

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Procedure of FRL setting

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December 1st 2017

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➢Activity data (AD) and EF (Emission Factor)

➢The method of calculation of Emission estimates

➢FRL setting: 1）Using Average method
2）National circumstance

➢ Activity data (AD) and EF (Emission Factor)

- Requisite items: AD and EF for FRL setting
- AD: to be made by the Land cover/Land use change map data calculated by the Land cover/Land use maps in the different two point of times for each period
- EF: to be acquired by the default data from 2006 IPCC Guidelines or the country data which was from the forest inventory data
- The unit of AD: ha/years, as area data
- The unit of EF: tCO_2/ha

Monitoring Land Cover/Land Use Changes (IPCC Approach 3)

Area in 20XX				Area in 20XX+(X)													
				Forest												Non Forest	
				Montane Forest/ Western Rain Forest/ Bamboo			Costal Forest and Mangroves			Dryland Forest			Plantation Forest			Glass land	Other Non-forest
				D	M	O	D	M	O	D	M	O	D	M	O		
Forest	Montane Forest/ Western Rain Forest/ Bamboo	D		n	dg	dg										df	df
		M		e	n	dg										df	df
		O		e	e	n										df	df
	Costal Forest and Mangroves	D					n	dg	dg							df	df
		M					e	n	dg							df	df
		O					e	e	n							df	df
	Dryland Forest	D								n	dg	dg				df	df
		M								e	n	dg				df	df
		O								e	e	n				df	df
	Plantation Forest	D											n	s	s	s	s
		M											s	n	s	s	s
		O											s	s	n	s	s
Non Forest	Glass land			e	e	e	e	e	e	e	e	e	s	s	s		
	Other non Forest			e	e	e	e	e	e	e	e	e	s	s	s		

df Deforestation (F→NF)
n No Change (F→F)
dg Forest Degradation (F→F(Degraded))
s Sustainable Management of Forest (F→F, F→NF, NF→F)
e Enhancement (F→F(Improved) ,NF→F)

AD

Table . Area of Land Cover/Land Use change in each reference periods (ha)

			2014															
			Montane Forest / Western			Costal Forest and Mangroves			Dryland Forest			Plantation			Cropland	Grassland	Wetland	Other land
			Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open				
2000	Montane Forest / Western	Dense	779,153	32,764	11,616										77,272	76,551	313	638
		Moderate	82,637	76,106	13,035										18,383	58,617	542	90
		Open	28,938	12,476	24,814										15,932	49,609	30	177
	Costal Forest and	Dense				130,627	14,833	662							1,164	29,472	259	539
		Moderate				149,591	70,442	2,636							7,748	141,966	377	838
		Open				2,185	2,034	255							1,410	16,942	14	116
	yland Fore	Dense							332,633	35,600	21,645				68,841	509,522	1,881	1,523
		Moderate							117,258	64,698	25,926				28,462	291,866	1,618	2,734
		Open							33,943	31,767	50,164				11,169	200,729	1,432	4,669
	Plantation	Dense										31,612	535	315	4,602	4,027	6	3
		Moderate										1,381	127	14	192	498	3	0.90
		Open										650	10	2	87	119	0.09	0
	Cropsland		48,784	4,234	1,827	2,304	303	18	16,298	1,757	421	4,931	74	51				
	Glassland		170,496	77,251	53,204	134,762	36,754	2,624	462,326	148,951	194,297	14,365	326	164				
	Wetland		262	13	6	1,209	476	42	3,577	1,359	843	0	0	0				
	Other land		452	236	289	775	196	4	4,597	2,877	11,836	107	0.63	0				

Class	Canopy coverage	AGB				BGB			TOTAL		
		Volume*	Biomass stock	Carbon stock**	CO_2 amount	Biomass stock***	Carbon stock****	CO_2 amount	Biomass stock	Carbon stock	CO_2 amount
Montane Forest & Western Rain Forest	Dense	437.86	344.75	162.03	594.11	93.08	46.54	170.65	437.83	208.57	764.76
	Moderate	69.59	58.36	27.43	100.57	15.76	7.88	28.89	74.12	35.31	129.46
	Open	26.23	23.02	10.82	39.67	6.22	3.11	11.39	29.23	13.93	51.06
Coastal forest & Mangrove forest	Dense	97.35	92.82	43.62	159.95	27.39	13.70	50.22	120.21	57.32	210.17
	Moderate	64.53	60.45	28.41	104.17	13.64	6.82	25.01	74.09	35.23	129.18
	Open	41.92	35.24	16.57	60.74	7.48	3.74	13.71	42.72	20.30	74.45
Dryland Forest	Dense	98.55	79.27	37.26	136.62	31.29	15.64	57.36	110.56	52.90	193.98
	Moderate	38.74	33.83	15.90	58.31	12.72	6.36	23.32	46.55	22.26	81.63
	Open	16.00	14.26	6.70	24.58	3.85	1.93	7.06	18.12	8.63	31.64
Plantation Forest	Dense	539.23	436.68	205.24	752.54	117.90	58.95	216.15	554.58	264.19	968.69
	Moderate	137.79	113.54	53.36	195.67	30.66	15.33	56.20	144.20	68.69	251.87
	Open	174.54	138.22	64.96	238.20	37.32	18.66	68.42	175.54	83.62	306.62

* Volume does not include volume of Climber.
** The values were calculated by CF(0.47) (IPCC 2006).
*** The values were calculated by R/S ratio in Table. 7.
****The values were calculated by CF(0.5) (Hirata et al 2012).

EF

Table Matrix of EF setting for Country data (Forest) with Default data (Non forest) CO_2(ton/ha) Emission

			The end year of the period															
			Montane Forest/Western Rain			Coastal Forest and Mangroves			Dryland Forest			Plantation			Cropland	Grassland	Wetland	Other land
			Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open				
The beginning year of the period	Mountane Forest /Western Rain Forest/Bamboo	Dense	0	635.30	713.70	–	–	–	–	–	–	–	–	–	764.76	748.81	764.76	764.76
		Moderate	−635.30	0	78.40	–	–	–	–	–	–	–	–	–	129.46	113.51	129.46	129.46
		Open	−713.70	−78.40	0	–	–	–	–	–	–	–	–	–	51.06	35.11	51.06	51.06
	Coastal Forest and Mangroves	Dense	–	–	–	0	80.99	135.72	–	–	–	–	–	–	210.17	194.22	210.17	210.17
		Moderate	–	–	–	−80.99	0	54.73	–	–	–	–	–	–	129.18	113.23	129.18	129.18
		Open	–	–	–	−135.72	−54.73	0	–	–	–	–	–	–	74.45	58.50	74.45	74.45
	Dryland Forest	Dense	–	–	–	–	–	–	0	112.35	162.33	–	–	–	193.98	178.03	193.98	193.98
		Moderate	–	–	–	–	–	–	−112.35	0	49.98	–	–	–	81.63	65.68	81.63	81.63
		Open	–	–	–	–	–	–	−162.33	−49.98	0	–	–	–	31.64	15.69	31.64	31.64
	Plantation	Dense	–	–	–	–	–	–	–	–	–	0	716.82	662.07	968.69	952.74	968.69	968.69
		Moderate	–	–	–	–	–	–	–	–	–	−716.82	0	−54.75	251.87	235.92	251.87	251.87
		Open	–	–	–	–	–	–	–	–	–	−662.07	54.75	0	306.62	290.67	306.62	306.62
	Cropland		−764.76	−129.46	−51.06	−210.17	−129.18	−74.45	−193.98	−81.63	−31.64	−968.69	−251.87	−306.62				
	Grassland		−748.81	−113.51	−35.11	−194.22	−113.23	−58.50	−178.03	−65.68	−15.69	−952.74	−235.92	−290.67				
	Wetland		−764.76	−129.46	−51.06	−210.17	−129.18	−74.45	−193.98	−81.63	−31.64	−968.69	−251.87	−306.62				
	Other land		−764.76	−129.46	−51.06	−210.17	−129.18	−74.45	−193.98	−81.63	−31.64	−968.69	−251.87	−306.62				

➢ The method of calculation of Emission estimates

- Method of calculation: multiplication between AD and EF
- Emission estimates: indicated by the emission/removal in the amount of CO_2 as weight per year (ton/year)
- The unit of Emission estimates: tCO_2/year.

Multiplication of AD and EF

Table . The value of Multiplication of AD and EF in each reference periods*

			2014														
			Montane Forest / Western Rain Forest / Bamboo			Costal Forest and Mangroves			Dryland Forest			Plantation			Cropland	Glassland	Wetland	Settlement and Other land
			Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open				
2000	Montane Forest / Western Rain Forest / Bamboo	Dense	0	20,814,837	8,290,505	–	–	–	–	–	–	–	–	–	59,094,416	57,322,517	239,729	487,648
		Moderate	−52,466,780	0	1,021,936	–	–	–	–	–	–	–	–	–	2,379,640	6,653,849	70,213	11,652
		Open	−20,652,779	−978,091	0	–	–	–	–	–	–	–	–	–	813,554	1,741,979	1,549	9,058
	Costal Forest and Mangroves	Dense	–	–	–	0	1,201,342	89,860	–	–	–	–	–	–	244,635	5,724,061	54,420	113,361
		Moderate	–	–	–	−12,115,84	0	144,255	–	–	–	–	–	–	1,000,522	16,074,969	48,703	108,288
		Open	–	–	–	−296,556	−111,302	0	–	–	–	–	–	–	104,991	991,120	1,059	8,604
	Dryland Forest	Dense	–	–	–	–	–	–	0	3,999,774	3,513,743	–	–	–	13,353,566	90,709,099	364,880	295,494
		Moderate	–	–	–	–	–	–	−13,174,202	0	1,295,833	–	–	–	2,223,184	19,168,366	132,057	223,188
		Open	–	–	–	–	–	–	−5,510,184	−1,367,905	0	–	–	–	353,418	3,150,146	45,327	147,733
	Plantation	Dense	–	–	–	–	–	–	–	–	–	0	393,538	208,492	4,458,151	3,836,910	5,754	2,441
		Moderate	–	–	–	–	–	–	–	–	–	−969,640	0	−774	48,306	117,587	748	227
		Open	–	–	–	–	–	–	–	–	–	−430,153	567	0	26,603	34,663	28	0
	Cropland		−37,307,679	−548,142	−93,276	−484,314	−38,196	−1,360	−3,181,402	−143,378	−13,311	−4,776,977	−18,656	−15,702				
	Glassland		−127,668,914	−8,769,011	−1,888,216	−26,173,795	−4,161,760	−153,514	−82,307,020	−9,782,429	−3,049,188	−13,685,952	−76,863	−47,691				
	Wetland		−200,497	−1,724	−315	−254,036	−61,457	−3,122	−693,904	−110,936	−26,685	0	0	0				
	Settlement and Other land		−345,725	−30,597	−14,775	−162,806	−25,287	−288	−891,691	−234,824	−374,938	−104,096	−159	0				

* Units are tCO_2/14 year between 2000 and 2014. The values of emission estimates should be divided by the period of years.

➢ FRL setting (Step 1): Using Average method

1. Average method will be set by each year.
2. Emission estimate of each reference period will provide the value of emission estimates of each reference period. According to Reference years which are calculated in different points of time, reference periods can be decided in different points of time.
3. The average of each emission estimate in different years will be the basis of the projection of the National circumstances.

✓ Unless the National circumstances are projected, the average of Emission estimates can be FRL.

✓Figures shown as below describe the current result of Emission estimates and other values.

The result of Emission estimates

by the Average method and other values

Table Emission estimates (tCO_2/year)

Period	2000–2014
Net Emisssion	−7,369,087
Gross Emission	23,790,276
Gross Removal	−31,159,363
FRL	−7,369,087

Table Total emissions/removals for each REDD+activity (tCO_2/year)

Period	2000–2014
Deforestation	20,254,838
Degradation	2,883,723
Sustainable management of forest	−787,332
Enhancement	−29,720,316
Total (Emission estimates (Net))	−7,369,087
FRL	−7,369,087

Emission estimates and other values

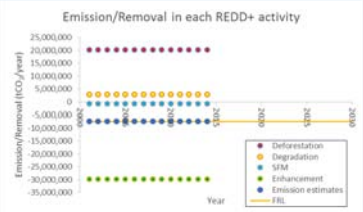


Figure FRL liner projection, and Emission and Removal in each REDD+ Activity

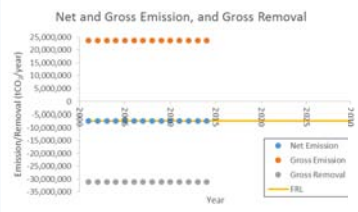


Figure. FRL liner projection, Net and Gross Emission, and Gross Removal

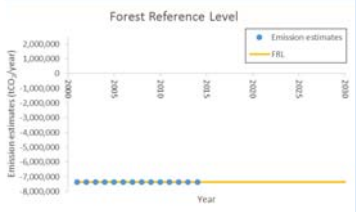


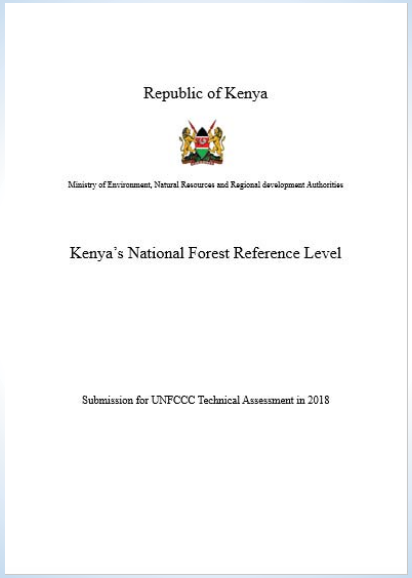
Figure. FRL liner projection and Emission estimates in each year

➢ FRL setting (step 2): National circumstance

◆National circumstances can be projected by the calculation based on the Historical trend as Average method. FRL with National circumstance will be set by the result of analysis for National circumstance.

Progress of Drafting FRL Report

Kazuhiro YAMASHITA
Japan Overseas Forestry Consultants Association
The 30th November 2017


Republic of Kenya

Ministry of Environment, Natural Resources and Regional development Authorities

Kenya's National Forest Reference Level

Submission for UNFCCC Technical Assessment in 2018

➢ Drafting FRL Report

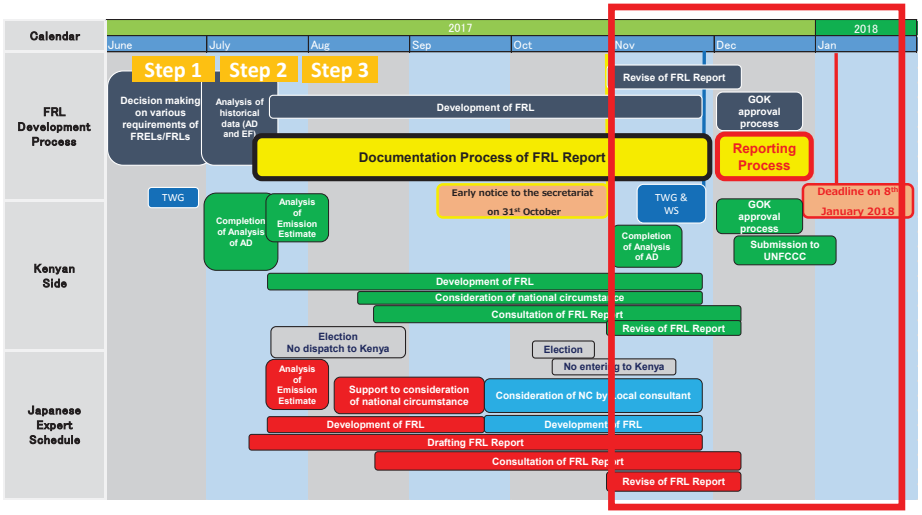
✓Documentation Process
✓Table of Contents of FRL Report

➢ Drafting FRL Report

✓Documentation Process

✓Table of Contents of FRL Report

Outline of schedule for development and submission of FRL to UNFCCC



Annex

Overview table on the indicative time frames of the technical assessment of reference levels in 2018 and 2019[3]

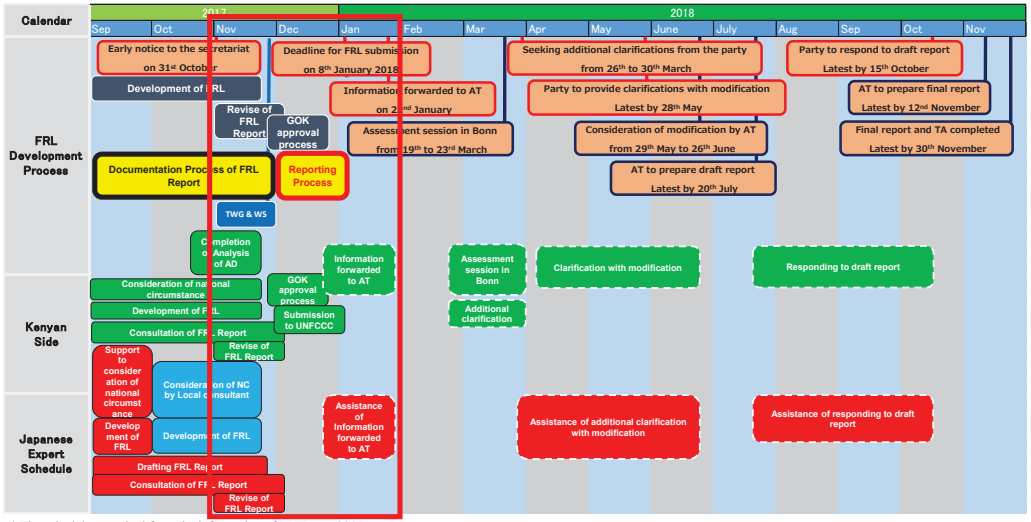
	Technical assessment 2018	Technical assessment 2019
Early notice to the secretariat	Latest by 31 October 2017	Latest by 29 October 2018
Deadline for reference level submission (no later than 10 weeks before the assessment session)	Latest by 8 January 2018	Latest by 7 January 2019
Information forwarded to assessment team (8 weeks before the assessment session)	Latest by 22 January 2018	Latest by 21 January 2019
Assessment session in Bonn (1 week)	**19 – 23 March 2018**	**18 – 22 March 2019**
Seeking additional clarifications from the Party (up to 1 week)	26 – 30 March 2018	25 – 29 March 2019
Party to provide clarifications (8 weeks), including submission of a modified submission, if appropriate.	Latest by 28 May 2018	Latest by 27 May 2019
4 weeks for assessment team to consider modified reference level (applicable in the case that the Party modifies its submitted reference level)	29 May – 26 June 2018	28 May – 25 June 2019
Assessment team to prepare draft report	Latest by 20 July 2018	Latest by 19 July 2019
Party to respond to draft report (12 weeks)	Latest by 15 October 2018	Latest by 14 October 2019
Assessment team to prepare final report within four weeks following the Party's response	Latest by 12 November 2018	Latest by 11 November 2019
Final report published and technical assessment completed	30 November 2018	29 November 2019

* For planning purposes, dates indicate the maximum time frames required in accordance with decision 13/CP.19.

[3] Dates for 2019 are indicative and the exact dates may still change in case of clashes with events which are difficult to envisage at this point of time.

Reference: "UNFCCC 2017. Information on the submission of proposed forest reference emission levels and/or forest reference levels by developing country Parties, on a voluntary basis, when implementing the activities referred to in decision 1/CP.16, paragraph 70, and on the technical assessments of these submitted reference levels in 2018 and 2019"

Outline of the whole schedule* for FRL Report to UNFCCC



* The schedule was cited from the information of UNFCCC 2017.

➢ Drafting FRL Report

✓Documentation Process

✓Table of Contents of FRL Report

➢Table of Contents of FRL Report

1. Introduction
   1.1 Relevance
2. The Building Blocks of the Forest Reference Level
   2.1 Forest definition
   2.2 Forest stratification
      2.2.1 Montane forest, Western rain forests and Bamboo
      2.2.2 Mangrove and Coastal forest
      2.2.3 Dryland forest
      2.2.4 Plantation forests
      2.2.5 Non Forest areas
   2.3 Scope
      2.3.1 REDD+ Activities
      2.3.2 Carbon pools
   2.4 Scale
   2.5 Green House Gases (GHG)
   2.6 Historical data (Activity Data (AD))
   2.7 Emission Factor (EF)
   2.8 National circumstances
      2.8.1 Qualitative analysis of XXXXXXXX
      2.8.2 Adjustment for National circumstances
   2.9 Construction method

➢Table of Contents of FRL Report

3. Forest Reference Level
   3.1 The figure of Historical average
   3.2 Projection of National circumstances
4. Accuracy
   4.1 Accuracy of AD
   4.2 Accuracy of EF
5. Improvements

References

Thank you for your attention.

THE FOREST SECTOR IN KENYA

THE NATIONAL CIRCUMSTANCES

1st DECEMBER 2017

Outline

I. Introduction
II. Project Objectives
III. National Circumstances
   a) Forest Sector Governance
   b) Economic Profile
   c) Energy Management
   d) Infrastructural, and industrial developments
   e) Agricultural Development
   f) Forest Management
   g) Development Priorities
   h) Projection of emissions

Introduction

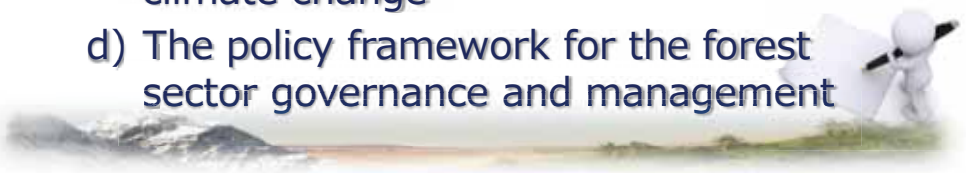
- Benefits of Kenya's Forests.
  - Forests are the most important natural resource and seen as critical assets with economic, environmental, social and cultural values.
  - the formal forest sector employs 18,000–50,000 people directly and 300,000–600,000 indirectly, making it a source of employment particularly In the rural areas of Kenya (FAO, 2014; KFS 2015b)
  - More than 530,000 households living within a radius of 5 kilometers from the forest reserves (WWF Kenya, sustainability 2016)

Introduction

- Benefits of Kenya's Forests.
  - Sustainable supply of raw materials to the wood industry has been found crucial to protection and conservation of natural forest.
  - The forests act as *carbon sinks* as well as offering water catchments and biodiversity conservation functions.

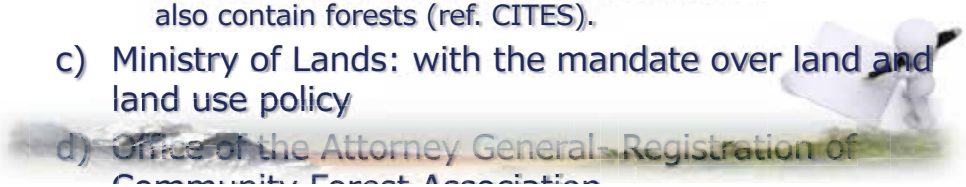
Forest Sector Governance

- Information on governance of the forest sector.
  a) Brief overview of the overall governance of forests in Kenya
  b) Roles and responsibilities for forest management.
  c) Approaches to the cooperation of the government institutions related to climate change
  d) The policy framework for the forest sector governance and management



Forest Sector Governance

- Roles and responsibilities for forest management.
  a) National Environmental Management Authority (NEMA)
     - Policy coordination and harmonization,
     - EIA and compliance under the EMCA and resolution of inter-sectoral/ cross sectoral disputes through the Environmental Tribunal.
  b) Kenya Wildlife Services:
     - enforcement of the rules and regulations governing the management of wildlife in parks and nature reserves that also contain forests (ref. CITES).
  c) Ministry of Lands: with the mandate over land and land use policy
  d) Office of the Attorney General- Registration of Community Forest Association

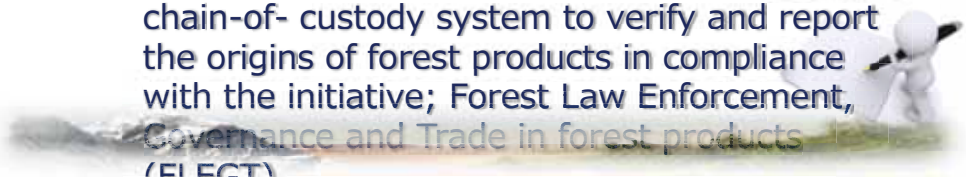


Forest Sector Governance

- Roles and responsibilities for forest management.
  a) Forest Research institutions (KEFRI, Universities)
     - research and piloting on issues that touch on FLEG.
  b) The National Museum of Kenya
  c) County Governments:
     a) With mandate over trust local authority forests under their jurisdiction
  d) Kenya police service;
     - with the mandate of law enforcement and prosecution
  e) Ministry of Water-
     - with mandate for gazettement of water catchment

Forest Sector Governance

- Policy
  a) The New Constitution of 2010, Article 69 (1)(b) requiring that Kenya increases its total forest cover to 10%,
  b) Vision 2030 which recognizes the need for low carbon development pathway
  c) The Agriculture Act of 2009, and with it, the Farm Forestry Rules which requires that 10% of farm land
  d) Forest Conservation and Management Act, 2016, which among other things provides for a chain-of- custody system to verify and report the origins of forest products in compliance with the initiative; Forest Law Enforcement, Governance and Trade in forest products (FLEGT)



Forest Sector Governance

- Policy
  a) Climate Change Act, 2016
  b) The Energy Act, Cap 314, 2006- Act calls for policies to develop renewable forms of energy
  c) The Charcoal Rules of 2009 promulgated by the Kenya Forest Service – enables the growing of trees for energy,
  d) Wildlife Conservation and Management Act, 2013
  e) Natural Resources Benefit Sharing Bill,

Forest Sector Governance

- Policy
  a) Environmental Management and Coordination (Amendment) Act, 2015
  b) County Government Act, 2012 (revised 2013)
  c) Kenya Green Economy Strategy and Implementation Plan (2015):
  d) Kenya Vision 2030:
  e) National Climate Change Response Strategy (2010):
  f) Community Land Bill, 2015

Forest Sector Governance Challenges

- Economic Efficiency, Equity and Incentives
  - Poor governance, including weak institutions, corruption, illegal logging, weak law enforcement.
  - Weak community participation in forest management
  - Inadequate benefit sharing from forest resources (including revenue sharing)
  - Local authorities do not value their forests
  - Communal land systems - lack of private ownership of the resources/land
  - Unclear tenure and access to forest resources
  - (e.g. Local Authority forests)

Economic Profile

- Economic growth
  - Green Economy Strategy Implementation Plan 2015 (GoK, 2015a), the natural resource-related sectors contribute about 42% of Kenya's GDP and 70% of overall employment. *(National Forest Programme 2016–2030)*
    - *Forests contribute 3.6% to the GDP excluding environmental services and contributions to other sectors.*
  - The country's Gross Domestic Product (GDP) – is hypothesized to strongly affect forest cover change and is thus worth examining the national economic growth to consider sufficient forest resources

Energy Resource Management

- Information on energy resource management in relation to the forest sector.
  a) Total primary energy supply and energy consumption,
  b) Market structure, Prices and Trends,
  c) Taxes, and subsidies
  d) Key national energy plans/strategies and future demands

Energy Resource Management

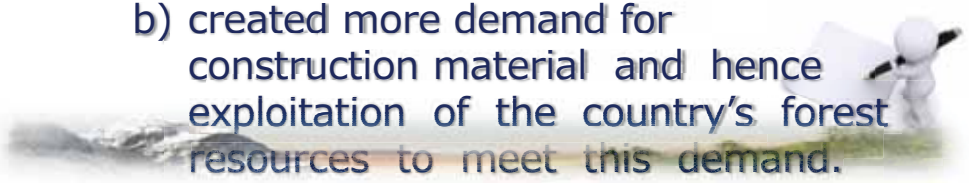
- Information on energy resource management in relation to the forest sector.
  a) Over 80% of the national energy supply is met from fuel wood.
  - Current wood deficit is projected to increase from 10 million to at least 15 million cubic meters per year by 2030 9 (*National Forest Programme 2016–2030)*

Infrastructural, and industrial developments

- Information on Infrastructural, and industrial developments in relation to the forest sector.
  a) Key developments in transportation sector, including major recent and planned infrastructure developments
  b) Structure (market, major industry branches/processes and age structure)
  c) Key developments in industrial sector, including planned construction of industrial zones or complexes
  d) Trends in urbanization
  e) Key urban developments including major city developments planned

Infrastructural, and industrial developments

- Trends in urbanization
  a) Establishment of new cities and municipalities has caused deforestation and forest degradation in two ways.
    a) Designated areas for such cities, municipalities and towns have been cleared of vegetation.
    b) created more demand for construction material and hence exploitation of the country's forest resources to meet this demand.



Infrastructural, and industrial developments

- Trends in urbanization
  a) The increasing population translates into more demand for construction wood and timber.
  b) The increased population has also meant more demand for food items and hence more pressure to clear (forest) land to provide for the demanded food.
  c) With over 60% of the urban population dependent on fuel wood (especially charcoal) for cooking, means more pressure on exploitation of surrounding dry land forests

Infrastructural, and industrial developments

- Planned Infrastructural, and industrial developments
  a) Key developments in industrial, transport, energy sector infrastructure, including planned construction of industrial zones or complexes
  b) The implementation of the developments will result in clearing huge hectares of (forest) land, resulting on massive deforestation and degradation
     a) dry woodland areas could be adversely affected

Infrastructural, and industrial developments

- Planned Infrastructural, and industrial developments
  a) Konza technology city
  b) Isiolo Port
  c) Lamu port, LAPSET Project, comprising of a road, rail and pipeline connecting Kenya to South Sudan and Ethiopia
  d) The Northern Corridor Transport Project
  e) Construction of a standard gauge railway line from Mombasa to Kisumu
  f) Creation of a one-million-ha irrigation scheme in the Tana Delta Region and in Kitui County

Agricultural Development

- Information on Agricultural Development in relation to the forest sector.
  a) Structure by sector (e.g. Major crops, livestock and geographic distribution)
  b) Growth of the agricultural sector, trends management practices
  c) Sectoral developments such as agricultural policies, laws and strategies or plans on proposed expansion of irrigated agriculture

Agricultural Development

- Information on Agricultural Development in relation to the forest sector.
  a) the area under sugarcane has increased from 127,560 ha in 1997 to 179,269 ha in 2011
  b) total area under tea has increased from 117,350 ha in 1997 to 187,800 ha in 2000
  c) This increased expenditure on farm inputs (especially improved seed and fertilizer) improved farm productivity thus reducing the pressure to put more land under agricultural production and hence reduced deforestation resulting from agricultural expansion.

Development Priorities

- Information on development Priorities in relation to the forest sector.
  a) Key sectors or areas of development
  b) Development strategies/plans, if any, and national legislation aiming to implement these strategies
  c) Progress towards the UN Sustainable Development Goals, UNFCCC, MEAs
  d) Barriers likely to impact in the implementation of the development priorities

Development Priorities

a) Sustainable Forest Conservation and Management is key to the realization of Kenya's Vision 2030 and the Global Sustainable Development Goals (SDGs).
b) The Forest Sector will directly implement and report on SDG 15 and also contribute to the realization of SDGs; 1, 2, 3, 5, 6, 7, 8, 12, 13 and 14.

The Management of Forest

- Information on the forest sector.
  a) Forest types,
  b) Forest policy, legislation and strategies;
  c) Forest management practices
  d) Forest management challenges and future scenarios

Projection of Emission

❑Methodology

Weighting expected rates of change for relevant intervention or changes in the management practices/activity based on the level of implementation and spatial extent as given in equation

$$E_S(t) = \sum_k P_{s,k}\left[A_{s,k}(t)\right] * EF_{s,k}(t)$$

Projection of Emission

- Where
  - ES (t) =the estimates of the projected emission for a given time t,
  - P = intervention and change of policy and legislation implementation
  - A s.k (t) =the activity share of a given intervention or changes in the management practices/activity within a given forest sector,
  - $EF_{S,K}$ =the emission factor for a given intervention and
  - k = the type of intervention or changes in the management practices/activity.

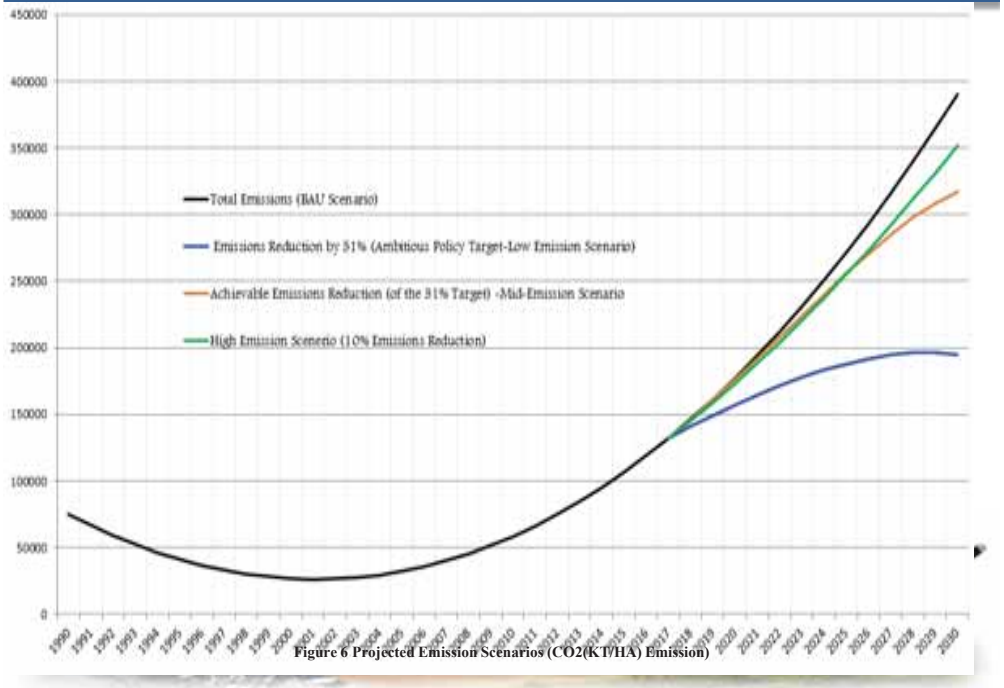
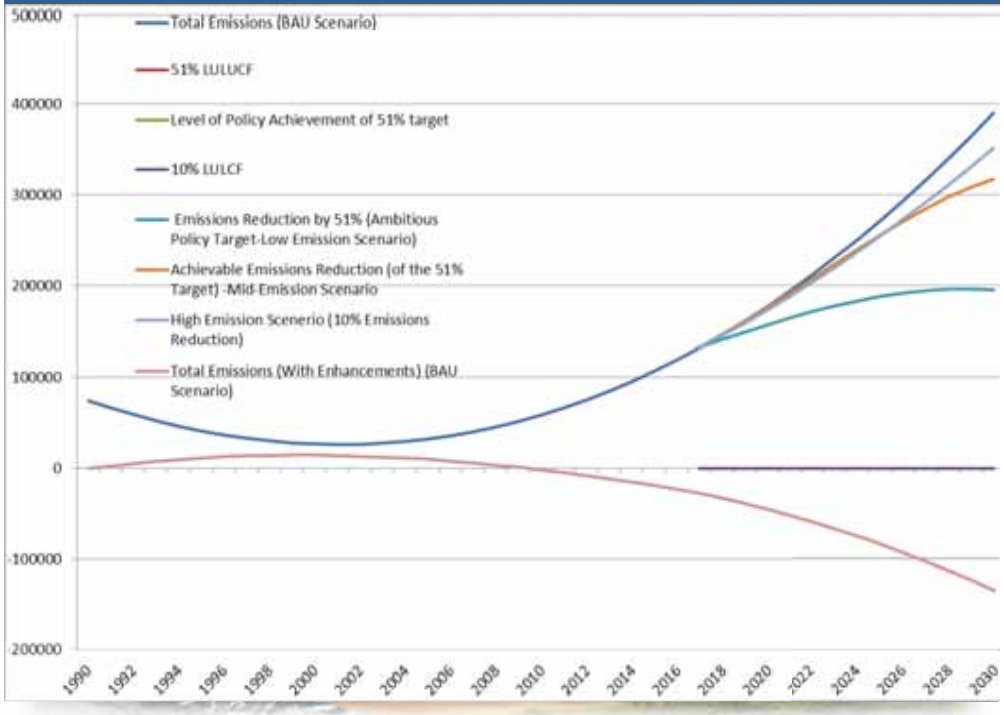


Figure 6 Projected Emission Scenarios (CO2(KT/HA) Emission)



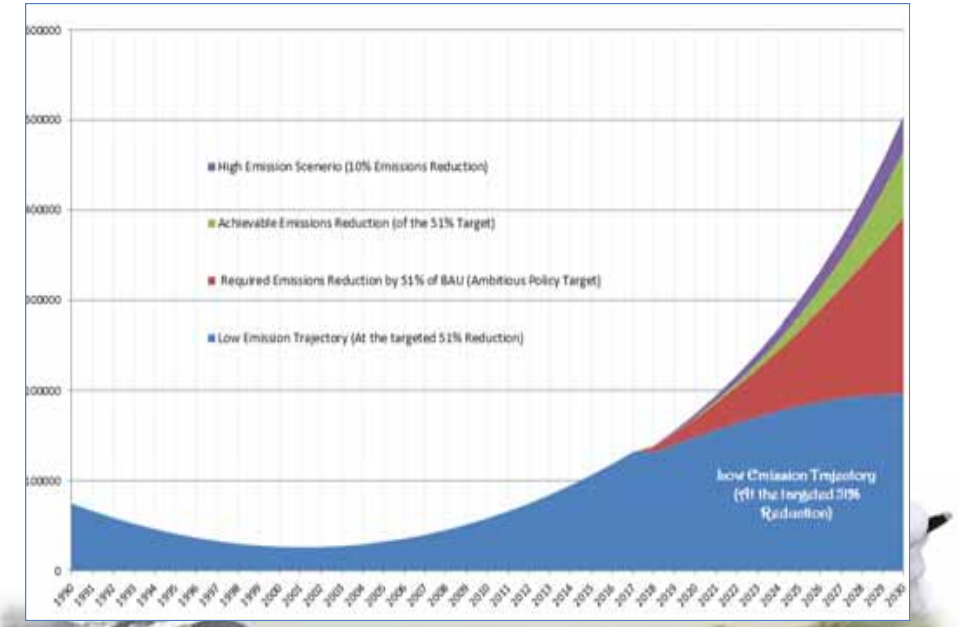


Figure 1 Required Emissions Reductions per Scenerio (CO2(KT/HA) Emission)

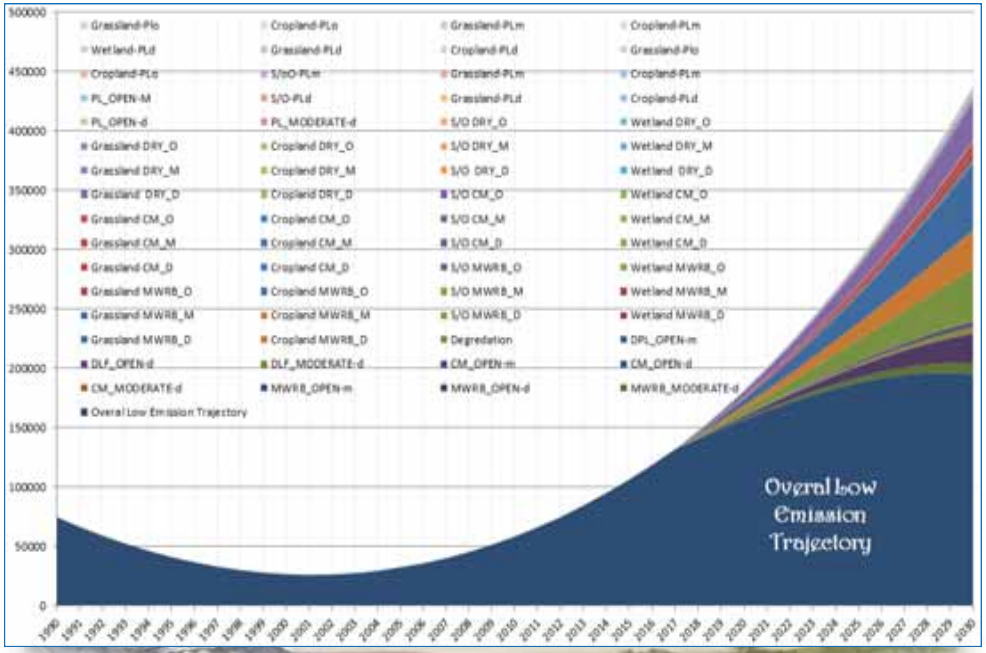


Figure 1 Overal Low Emission Pathway and Required Emission Reductions bySource (CO2(KT/HA) Emission)

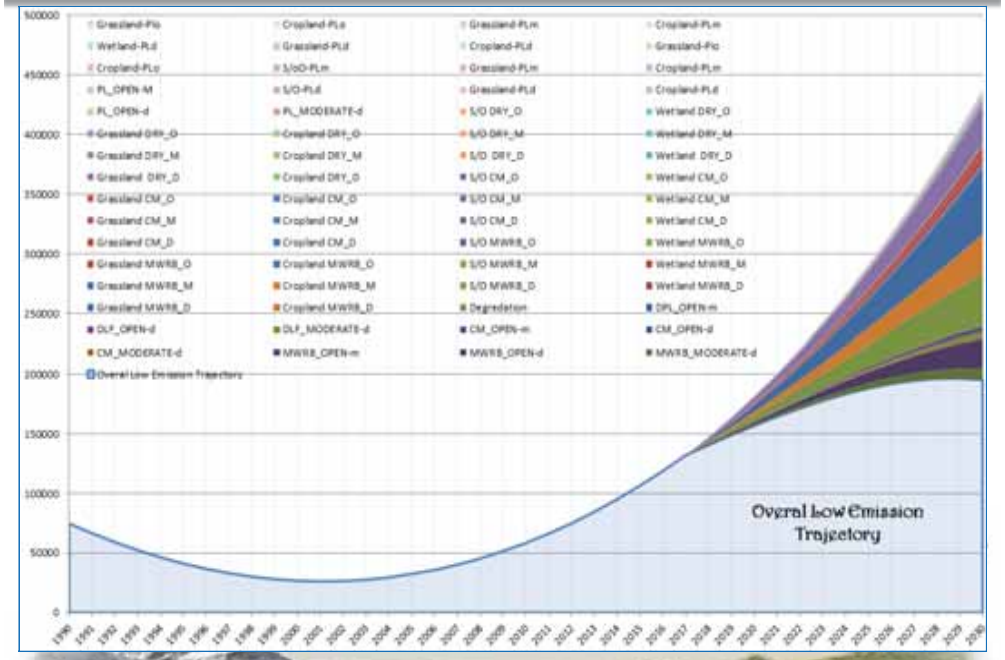


Figure 1 Required Emission Reductions by Source to Meet Policy Targets(CO2(KT/HA) Emission)

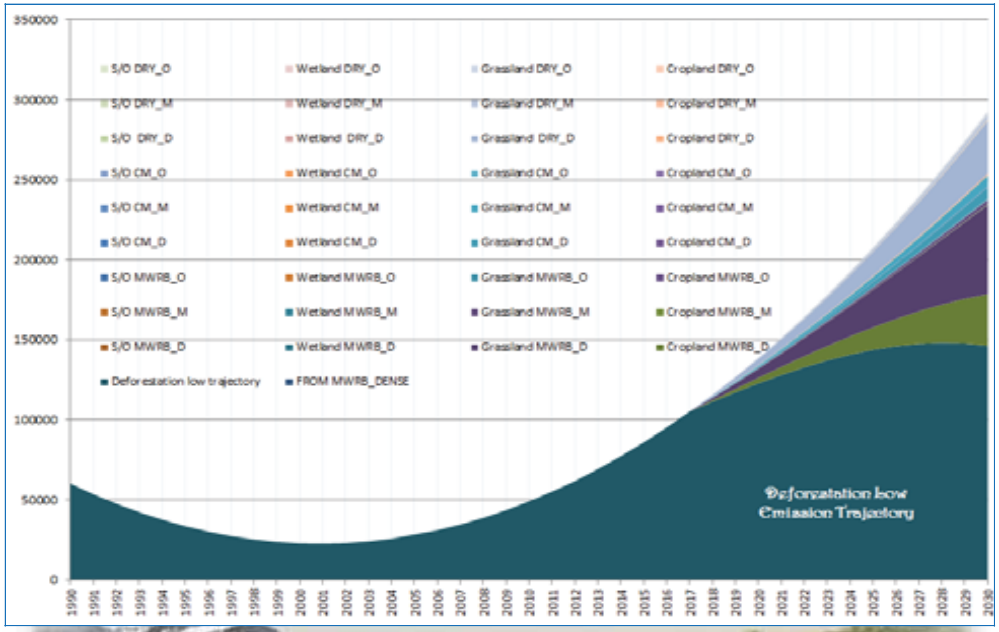


Figure 1 Deforestation Low Emission Pathway and Required Emission Reductions by Source(CO2(KT/HA) Emission)

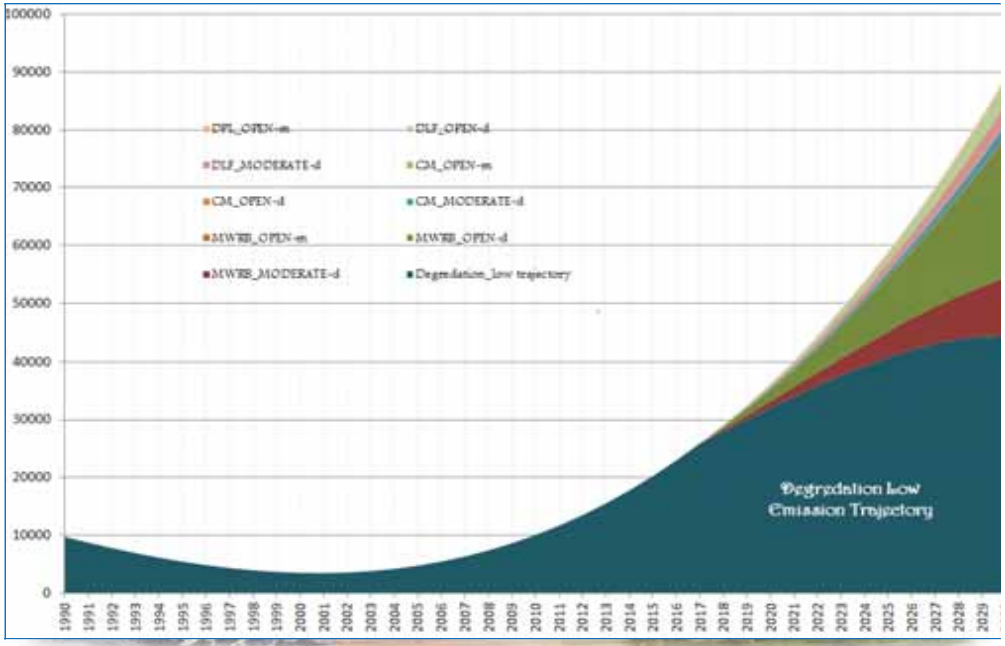


Figure 1 Degradation Low Emission Pathway and Required Emission Reductions by Source (CO2(KT/HA) Emission)

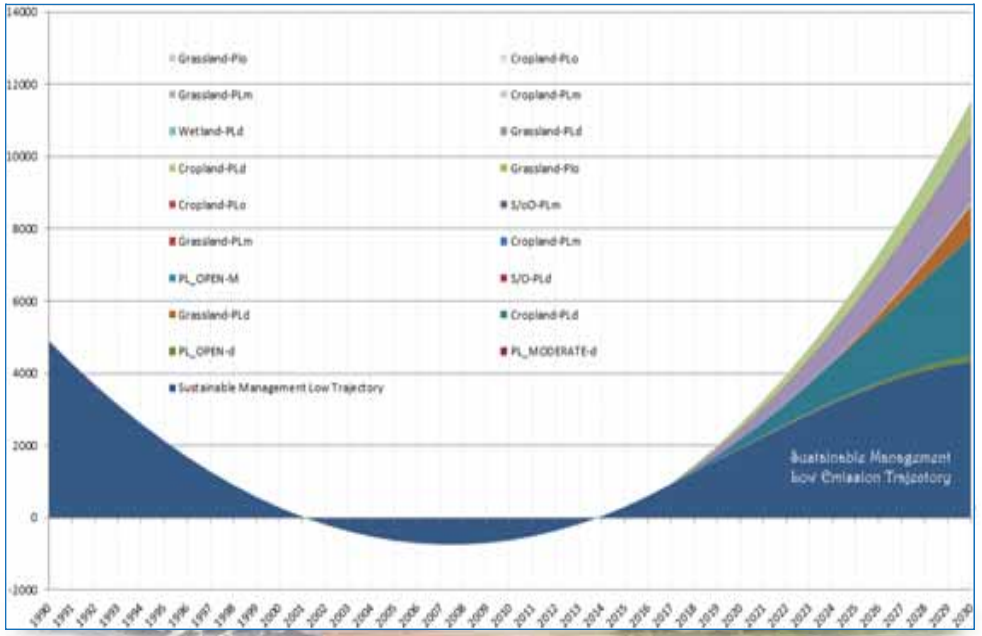


Figure 1 Sustainable Management Low Emission Pathway and Required Emission Reductions by Source (CO2(KT/HA) Emission)

REDD+ STAKEHOLDERS CONSULTATION AND SENSITIZATION WORKSHOP

MASADA HOTEL – NAIVASHA
1st December,2017

Development of NFMS in Kenya

1st December, 2017
Peter Nduati

Contents of the Presentation

1. Definition of NFMS in UNFCCC
2. Proposed NFMS in Kenya
3. Detail of Monitoring function of NFMS
4. Contribution for Safeguard Information System (SIS)
5. Consideration of Institutional arrangement

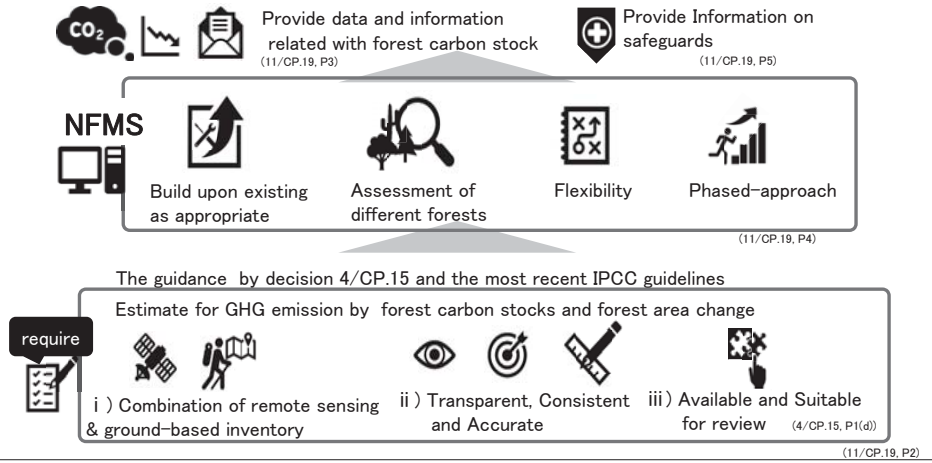
1. Definition of NFMS in UNFCCC

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

(i) Use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating, anthropogenic forest-related GHG emissions.
(ii) Provide estimates that are transparent and accurate.

1. Definition of NFMS in UNFCCC

NFMS in UNFCCC decisions



2. Proposed NFMS in Kenya

NFMS in Kenya will be established from two aspect.

Monitoring function

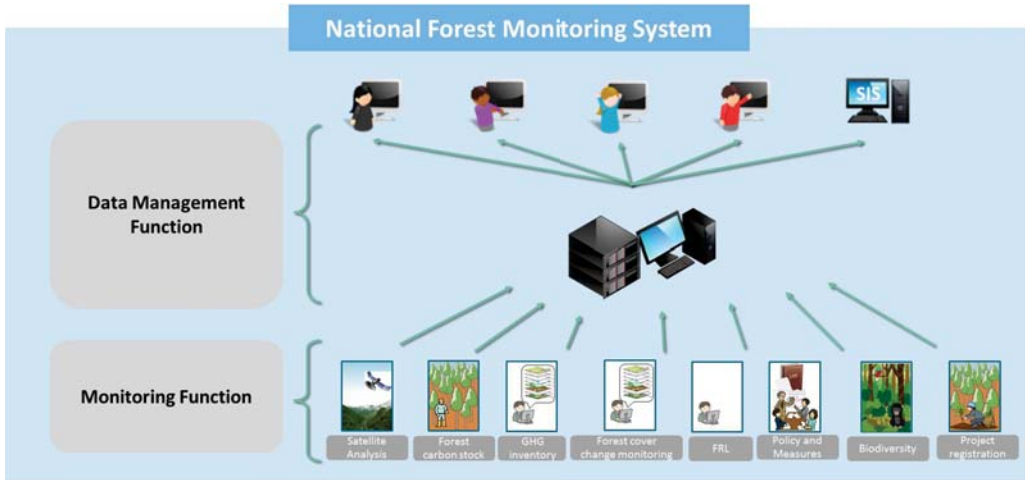
It is included estimation of anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks, forest carbon stock and forest area changes and forest reference level, information of policy and measure and biodiversity and registration of forest related project.

Data management function

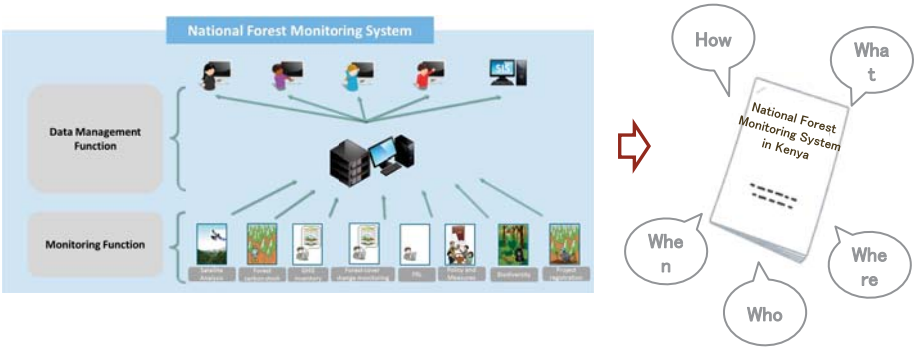
It is a database to input the information and data gathered by monitoring function and provide them for implementing forest management including REDD+.

All of NFMS in Kenya will be described in detail in the "NFMS document in Kenya" to ensure transparency.

2. Proposed NFMS in Kenya



2. Proposed NFMS in Kenya



Contents of NFMS document

Chapter 1	Background and Purpose	
Chapter 2	UNFCCC Requirements	
Chapter 3	Basic conditions for NFMS	3.1 Scale
		3.2 REDD+ Activity
		3.3 Forest Definition
		3.4 Carbon Pool
		3.5 Scope of GHG
Chapter 4	Conceptual design of the NFMS in Kenya	4.1 Composition of NFMS
		4.1.1 Monitoring Function
		4.1.2 Data Management Function
		4.2 Phased Approach
Chapter 5	NFMS Components	5.1 Activity Data
		5.2 Emission Factor
		5.3 Forest Cover Change Monitoring
		5.4 Providing information to SIS
		5.5 PaMs monitoring
		5.6 Data Management System in the Forest Information System
Chapter 6	Institutional Arrangement for NFMS	6.1 Institutional Arrangement for Monitoring Function
		6.2 Institutional Arrangement for Data Management Function
Chapter 7	Calendar of NFMS	

3. Detail of the Monitoring function of NFMS

Methodology for AD monitoring

– **Forest Definition:**

Minimum surface area	**0.5ha**
Minimum Height	2m
Minimum Cover	15%

–**Stratification: SLEEK stratification will be used**

Forest Class
Montane Forest, Western Rain Forest and Bamboo Forest
Mangrove Forest and Coastal Forest
Dryland Forest
Plantation

X

Canopy coverage class
Dense
Moderate
Open

= 12 forest types

*Each forest class is set by zoning

10

30

Methodology for EF monitoring

– **Measurement method in the plots:**

• ICFRA proposal: As mentioned in the table

Table .Measurement on the circular sample plots.

	DBH/ diameter (cm)	Height/ length (m)	Plot radius (m)	Plot area (m^2)
Tree	≥ 2	≥ 1.3	2	12.6
Tree	≥ 5	≥ 1.3	5	78.5
Tree	≥ 10	≥ 1.3	10	314.2
Tree (Strata 2 and 4)	≥ 20	≥ 1.3	15	706.9
Tree (Strata 1 and 3)	≥ 20	≥ 1.3	20	1256.6
Climber	≥ 2	≥ 1.3	2	12.6
Climber	≥ 5	≥ 1.3	15	706.9
Bamboo		≥ 1.3	10 or 2 × 2.0	314.2 or 25.13
Lying dead wood	≥ 10	≥ 1.0	15	706.9
Shrub		≥ 1.3	15 or 2 × 2.0	706.9 or 25.13
Stump			15	706.9
Regeneration	< 2	≥ 0.10	2 × 1.5	14.13

*ICFRA 2016. Proposal for National Forest Resources Assessment (NFRA) in Kenya.

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4. Seven Safeguards which should be promoted on implementation of REDD+ activities

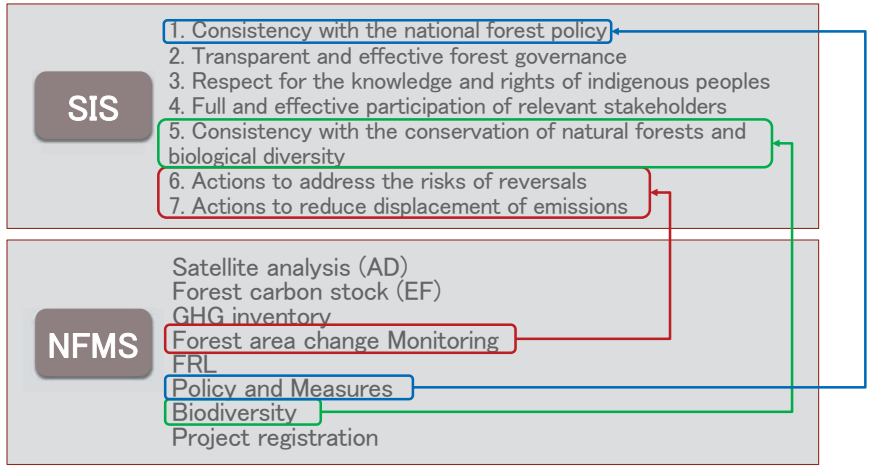
1. Consistency with the national forest policy
2. Transparent and effective forest governance
3. Respect for the knowledge and rights of indigenous peoples
4. Full and effective participation of relevant stakeholders
5. Consistency with the conservation of natural forests and biological diversity
6. Actions to address the risks of reversals
7. Actions to reduce displacement of emissions

Safeguard Information System

Provide relevant information

NFMS

Decision 11/CP.19 Modalities for national forest monitoring systems



Information which is gathered by NFMS will be provided to SIS as relevant information

5. Consideration of Institutional arrangement

Item	Responsible body	Related institution
NFMS	KFS	KEFRI, KWS
Forest carbon stock (EF)	KFS(Inventory section??)	KEFRI? College
Satellite analysis (AD)	DRSRC or KFS ??	SLEEK member
GHG inventory	MEMR?	KFS
Forest cover change Monitoring	KFS (GIS, remote sensing section?)	SLEEK member
FRL	KFS	TWG member of FRL
Policy and Measures	KFS, MEMR ??	KEFRI
Biodiversity	KWS	KFS, KEFRI
Project registration	KFS(Forest Information Systems section??)	
FIP	KFS(Forest Information Systems section??)	

Forest Information Platform for NFMS , REDD+ and SFM

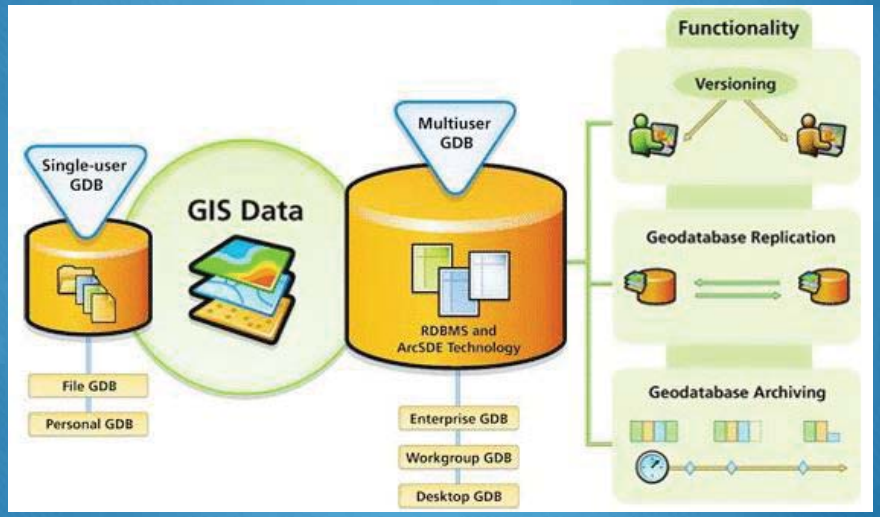
Richard N Mwangi
Geo-database Administrator/ GIS Developer

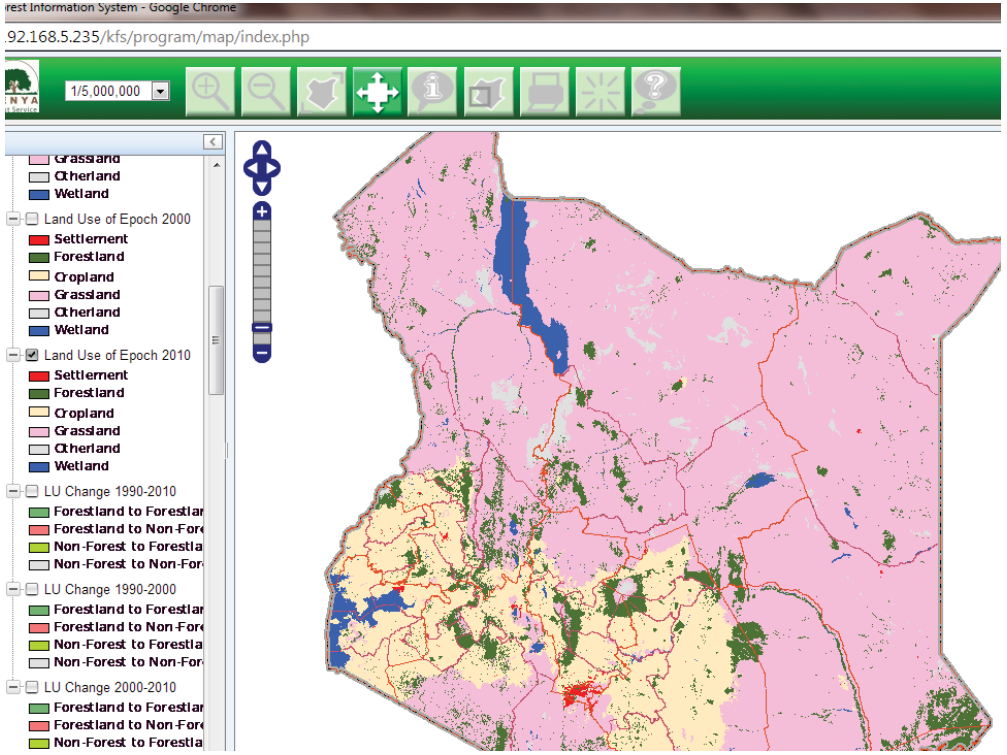
1st December 2017

Presentation Content

- Current Systems and Gaps
- FIP Objectives.
- FIP Components.
- Proposed FIP Design.
- Forest Inventory Collection Tool.

Current FIS System





FIP Objectives

Concrete Objectives of Forest Information Platform

1) To grasp the quantities of the carbon accumulation, emissions and absorption of the forest with GIS through past, present, future. (NFMS)

2) To provide the information and data which contribute to REDD＋Safegard information system (NFMS)

3) To grasp the deforestation monitoring with the facor about the practically "Real time " timing (NFMS)

4) To Provide REDD+ strategy which can be histrically grasped

5) To provide the data which contribute to draw up a forest management plan

6) To confirm the report and the varification of MRV

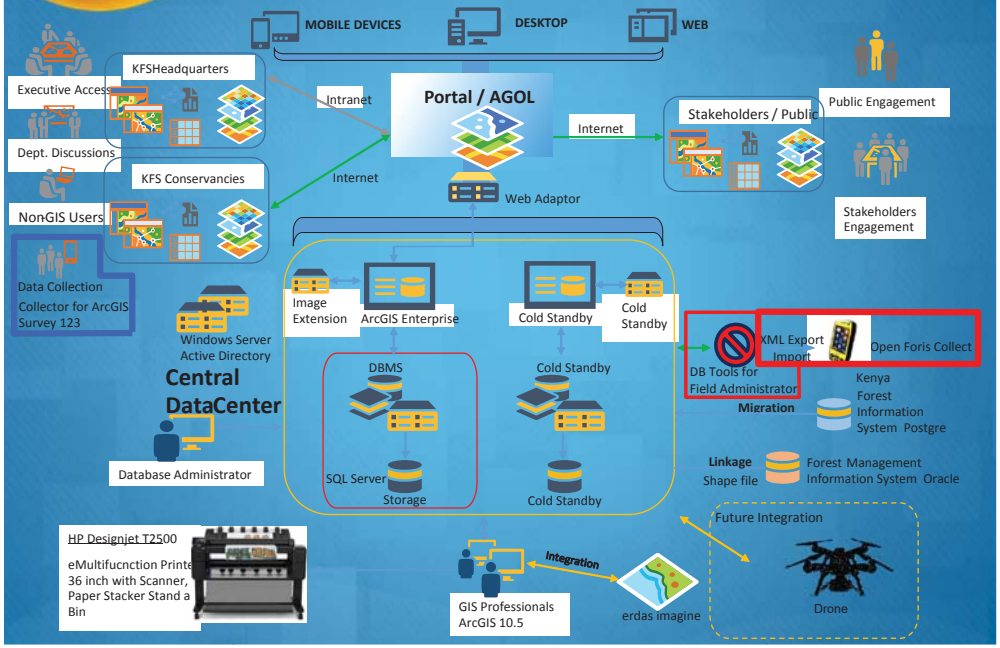
FIP Main 8 Components(Draft)

Forest Information Platform

- FRL
- MRV
- Safeguards
- Forest Removal /emissions monitoring
- National REDD+ strategy and Rerated information
- Forest administrative information
- Other relevant data
- Project Registry

FIP Basic Components

Forest Information Platform (overview design)



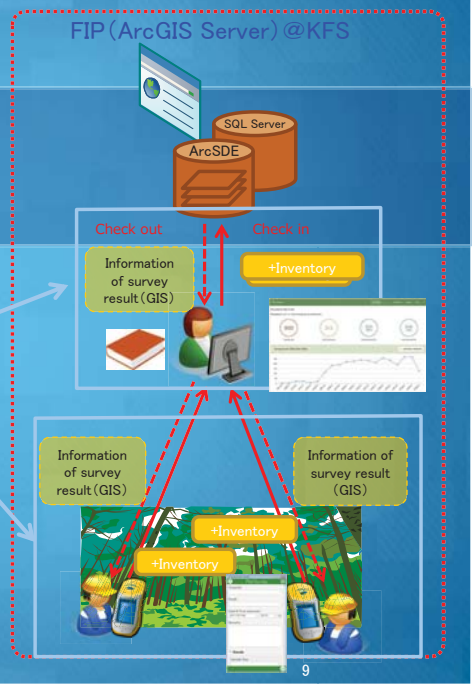
Survey 123

Survey 123 is the software based on ArcGIS Online Solution. Because FIP takes ArcGIS Online as a web service core software for open data survey 123 will be adapted for the data collection at field survey.

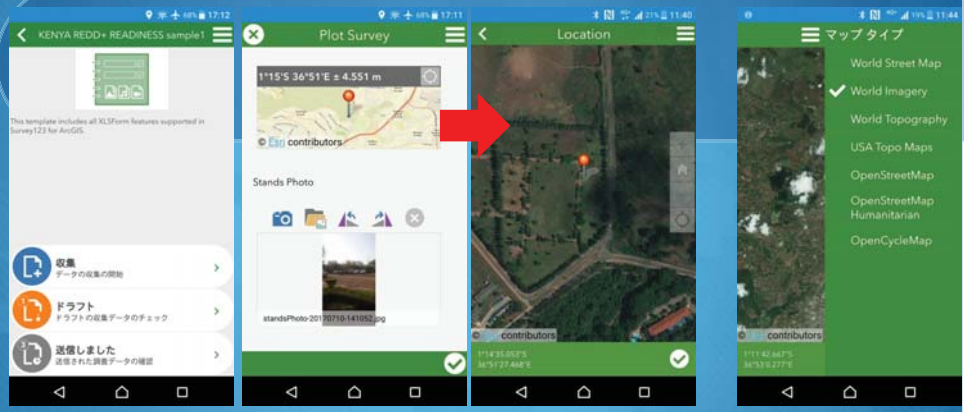
[Developed Items]

- To develop the functionality of submission of the inventory data to the FIP with security control.
- To develop interface for inventory data registration as same as Open Foris Collect, further more with Map and Satellite imagery.

*Interface and function will be developed based on the function of ArcGIS Server



PDA Client



MINUTES FOR REDD+ TWG AND STAKEHOLDERS MEETING IN NAIVASHA HELD ON 9TH AND 10TH DECEMBER 2019

Date: 9th and 10th December 2019

Venue: Lake Naivasha Resort

Purpose: Creation of awareness on Kenya's Progress in Forest Reference Level (FRL) development.

Monday 9th December		
Time	**Activity**	**Responsible**
8.00 -8.30 am	Registration	Florence /Regina
8.30 – 8.45 am	Introduction	Peter Nduati
8.45 -9.00 am	Opening remarks	Alfred Gichu
9.00 - 9.30 am	Importance of FRL and its components	Alfred Gichu
9.30 am- 10.30 am	FRL Road map and Comments from last stakeholders' meetings	Alfred Gichu
10.30 - 11.00 am	Health break	ALL
Key Decisions Informing FRL in the country		
11.00 -11.30 am	Forest Cover Mapping Process and Results	Faith Mutwiri
11.30 – 12.00 pm	Forest Cover changes and REDD+ activities data	George Tarus
12.00 – 12.30 pm	Data collection (Pilot Nfi)	Peter Nduati
12.30 – 1.00 pm	Emission Factors EF	Peter Sirayo
1.00 – 2.00 pm	Lunch break	ALL
2.00 – 3.00 pm	Plenary	Mwangi Kinyanjui
3.00 – 3.30 pm	Assigning Emission Factors to REDD+ Activities	Mwangi Kinyanjui
3.30 – 4.00 pm	Presentation of emissions	Mwangi Kinyanjui
4.00 - 4.30 pm	Tea break	
4.30 -5.00 pm	Plenary	
Tuesday 10th December		
Time	**Activity**	**Presenter**
8.30 -9.00 am	Recap of Previous days discussions/agreements	Prof Balozi
9.00 – 9.15 am	National Circumstances	Peter Nduati
9.15 – 9.30 am	Projection of Emissions	Mwangi Kinyanjui
9.30 - 9.45 am	Uncertainty of AD	Faith Mutwiri/Kinyanjui
9.45 - 10.00 am	Uncertainty of EF	Faith Mutwiri/Kinyanjui
10.00 - 10.15 am	Uncertainty of FRL	Faith Mutwiri/Kinyanjui
10.15 -10.45 am	Plenary	Peter Nduati

10.45 – 11.00 am	Tea break	
11.00 – 11.30 am		
11.30 – 12.00 pm	Way forward & Future improvements	Mwangi Kinyanjui
12.00 -1.00 pm	Plenary	Peter Nduati
1.00 pm	Lunch break	
2.00 pm	Departure	

The meeting started at 9:15 am with the Chairperson- Peter Nduati welcoming participants to the two-day workshop. He invited Tecla Chumba to open the meeting with Prayers. This was followed by a self-introduction session whereby all participants stated roles they have played in the development of Kenya's Forest Reference Level.

MIN 1/09/12/2019 OPENING REMARKS

Four REDD+ elements should be developed for Kenya, these are; National Forest Monitoring System, National Strategy/Action Plan, Safeguards Information System and Forest Reference Level of these four elements, only FRL should be submitted to UNFCCC for assessment. The first attempt to submit FRL for Kenya was done in 2017 but after subjecting the document to stakeholders in a workshop, it emerged the document was not good enough for submission to FRL hence FRL has been improved since 2017 by employing advanced technologies to make the document assessible by UNFCCC.

If stakeholders agree that the current FRL document has met the required standards, it can be submitted to UNFCCC by January 6th 2020 for review.

MIN 02/09/12/2019 BACKGROUND OF FRL

Plan Idea Note was submitted in 2010 when Kenya decided to participate in REDD+ process. Therefore, Kenya embarked on the REDD+ process by participating in various forums and conferences organized for REDD+. FRL informs on the status of forest up-to-date, by using historical trend to determine the changes in forest status overtime. Kenya should work towards being a country that will show REDD+ Readiness. It was decided that each country has to determine and decide on the various elements that make up the FRL those decisions have guided the development of FRL including: Approach, Activities, Pools, Gases, Reference Period, Forest Definition, Forest strata and Projection. As informed by the expertise in the country concrete decisions were made for these aspects.

Progress of Activity Data.

Activity Data was generated to cover 2002, 2006, 2010. 2014 and 2018, these were selected from the 15-time series maps available. After the selection, uncertainty of change was assessed.

Progress of EF

After identification of four strata, stocks were assigned to each stratum by pilot NFI the Changes in stocks were estimated from land cover change activities in the specific areas. The document has been improved since 2017 by sharing with stakeholders on various forums including REDD+ Academy and Council of Governors.

Progress on Intention to submit

Kenya through the Ministry of Environment and Forestry already made an early notification in October to UNFCCC on the intention to submit FRL by 6th January 2020. ***Reactions***

The FRL to be submitted should consider public opinion, as much as it seeks to satisfy the UN requirements.

Only 5 maps were used for activity data calculation, the number of maps used it was determined by considering consistency with other processes for instance the Greenhouse Gas Inventory.

Historical data or national circumstance? The decision was to use the historical data because it reflects truly what has been happening to the forest sector over time.

MIN 3/09/12/2019 NATIONAL LAND AND FOREST COVER MAPPING

Kenya is categorized as a low forest cover country with less than 10% forest cover, it is also a low deforestation country. The mapping was done for various reasons including; Policy Requirement like reporting on forest status to parliament, for global commitments like reporting to UNFCCC, support decision making and strategic planning for Kenya and for REDD+ establishment of NFMS and FRL. Land Cover Mapping Process was guided by technical and process manuals which are available for further reading. Several trainings were undertaken by various institutions to ensure consistency in the methodology for the mapping process by coming up with a team of experts in GIS and remote sensing. The mapping process took step by step approach and begun by selection of a mapping methodology-random forest, the next step was selection of data source which led to Landsat being chosen due to data availability, it covers different seasons and cloud cover percentage, the data was then acquired and prepared for the required area. Cloud and shadow masking were employed to remove areas on the images that were covered by clouds. Spectral stratification was carried out as guided by ecological zones. Quality Check and Assessment was done to correct areas that might have been misclassified. A few points were noted after analysis of change; forest cover has been declining from 2002, with An average of 13,775 hectares of forest land lost per year where the major drivers of deforestation are agriculture and settlements.

COMMENTS

How and when was training data collected, local or international and what was the process for identification for forest and non-forest? Government institutions involved in the mapping collected the data at the onset of the mapping process also the technical manual outlines the auxiliary data used for mapping. Earth observations from various institutions that are in the forestry sector.

Terrain illumination correction, does it increase the area? Illumination correction makes the area balance the colors in the image removing areas that appear darker than others.

Accuracy assessment proportionate, why not use

Slow deforestation, why not include forest degradation which is significant. Forest degradation does not cause land use change within the minimum mapping unit.

After quality checking for the maps, the 76 % is an average for the overall classification accuracy, was there ways to try and improve or zero in on the areas that have low accuracy? The areas with low accuracy

are forest hence the individual stratum have not yet been considered however future improvement will be considered.

By 2013 forest cover included public forest, with improving human capacity and technological advancement, more work has been done.

The source of the data should be accompanied by evidence methodology. The forest cover should be considered not tree cover.

A new and advanced method has been used to come up with the new forest cover percentage hence the current value is the most correct one.

MIN 4/09/12/2019 DATA COLLECTION FOR PILOT INVENTORY

A pilot National Forest inventory was conducted for Emission Factor estimates, these estimates are also based on public plantations. The Finnish government and the Government of Japan through JICA assisted Kenya in Collecting the data. The points collected within various plots were selected according to stratification zones which are assigned in accordance with climate and altitude.

The pilot inventory was conducted for purposes of developing emission factors, these were used to calculate sequestration due to canopy enhancement. Tier 2 and 3 combined are used in the process.

Only state plantations are considered by the FRL process. There was a suggestion to rename 'plantation' to forest planation so as nit to confuse with other types of plantations.

MIN 5/09/12/2019 ASSIGNING ACTIVITY DATA TO LAND COVER CHANGES

Land Cover Change matrix, the four REDD+ activities were adequately defined and denoted by different colors, as deforestation-red, degradation-yellow, enhancement- green, non-forest- white. The four REDD+ activities considered for the case of Kenya were adequately defined. This was clearly explained using change matrix that depict how on land use changed or remained the same between the same 2002 and 2018. Forestland remaining forest land was computed based on two-year period to determine the changes within the various strata. A comparison of deforestation and afforestation was outlined whereby it was clear that the dryland stratum has undergone the highest deforestation. The same was done for annual transition from degradation and canopy cover improvements.

MIN 6/09/12/2019 EMISSION CALCULATIONS

Deforestation is conversion of forest to non-forest within the four strata considered, instantaneous oxidation was assumed for all deforestation, hence deforestation is difference between CO_2 of a higher value and CO_2

Degradation, all instantaneous sequestration was assumed for all degradation hence degradation was SFM considered as a value of the difference between a non-forest and the current plantation as guided following growth rates.

Comparisons were made for annual transitions between 2002 and 2018 for deforestation vs afforestation, forest degradation vs canopy improvement and transition rates for plantations.

Reactions

The changes in annual rates for plantation forests, 2006-2010 piloting of PELIS happened, but mismanagement might have occurred making the numbers changes, the data for the plantation is captured within the boundaries identified by KFS. The

Annual transition deforestation vs afforestation

National Strategy should capture what has caused the changes that occurred within the strata for the various REDD+ activities.

Forestland remaining forestland the areas were calculated based on the total forestland in Kenya which makes the percentage calculation adequate.

The change of two-year period to four-year interval was decided upon on during a TWG that was held in 16th and 17th July 2019.

Results

The emissions were calculated for the various activities and annual emissions from each REDD+ activity by strata then the activities were used to compute historical annual net emissions, which is Kenya's FRL the reference level is 52,204,059 tCO_2/year. However following uncertainty analysis for FRL; the submission uncertainty is ± 12,984,983. This implies that the FRL is 52,204,059 ± 12,984,983 t CO2/year:

It was agreed that land cover maps can be added to the final report.

DAY 2

MIN 7/10/12/2019 NATIONAL CIRCUMSTANCES

The following questions should be considered;

What is the future of forest cover in Kenya?

How can we Increase forest conservation?

Implementation of policies should concentrate on issues that increase

There is huge potential in the counties if the various issues for increasing forest cover are given more priority. Several policies can be prioritized at the national government level to ensure forest cover is improved eventually.

However, there are hinderances and barriers to increase forest cover including; increasing population which translates to increase in demand for more settlement area, developmental changes, conflict for resources and weak enforcements. The current issues that affect the future of increasing forest cover for Kenya from policies, laws and development goals.

What opportunities are there for the forest sector? What policies and circumstances can be improved to drive the forest sector in the right direction? Point out documents that are in place that help in improving

the forest cover, national forest programme and other documents should be linked to allow them to work towards the same goal-increasing forest cover.

If the country concentrates on increasing forest cover by 204,727 ha per year without reducing the current percentage then it would be possible to attain the Vision 2030 target.

FRL is baseline for getting results-based payments for reduction of emissions and FRL is not policy based. However, the national circumstance section in the FRL report captures the current situation of the forest in Kenya.

MIN 8/10/12/2019 RECAP OF DAY 1

Organized to review the country's progress in FRL development for REDD+ in Kenya

Main presentations made

- FRL and its components
- FRL road map

The key decisions that make up FRL were outlined, such as forest cover mapping, how emission factors were assigned to each activity data, emission factors, the estimates of emissions and the results for forest reference level.

There were informative reactions and comments from the discussions.

Areas to be clarified were pointed out and will be clearly outlined in the report including using footnotes for the complex issues.

MIN 9/10/12/2019 UNCERTAINTY OF AD, EF AND FRL

Ground data collection should be improved to ensure the numbers are more correct and more accurate. Comparability should be taken into consideration for FRL and other processes for Kenya hence the choosing of the years consistent for all processes to avoid conflicting numbers. Individual year accuracy assessment should be considered in the future.

Correctness of the data, figures and the final results should be considered and explanation should be outlined as to why errors are recorded.

Are there other countries that used the Olofsson method to calculate uncertainty? Are there comparable datasets like from other projects?

The FLINT data is currently being used though it has not been validated yet, in future it can be used to acquire a product for forest sector emissions. ICFRA data has been used in FRL and they care comparable with IPCC default values.

The numbers by the Kasigau project compare fairly with the uncertainty of FRL especially for dryland forest which they concentrate on.

Data precision, the current calculation of Uncertainty is fair and seems comfortable for Kenya but a comparison for the current data and IPCC default values should be outlined and reasons should be well articulated and package responses for questions that may come from GCF.

The methodology used checks out. The emission factors produce more errors than activity data but the submission should use numbers from literature and IPCC that have lower errors compared to the current data to reduce uncertainty. Using the collected data shows the country is more aware of the issues in the forest sector.

A methodology for doing inventories has been developed and it should be adopted even by project-based activities.

MIN 10/10/12/2019 PROJECTIONS OF EMISSIONS

The projections are based on historical average without adjustment for each REDD+ activity. It is projected that the net emission will remain at 52,204,059 tCO_2 into 2030.

MIN 11 / 10/12/2019 NEXT STEPS

- Submit FRL by 6th January 2020.
- Review process- select a review team
- Communication between the reviewers and Kenya starts mid-February
- A centralized review to be done in in 9th -21st March 2020.
- Finalization or review report after submission of comments/ confirmation/ agreements/ adjustments
- A final document to be submitted to the REDD+ portal against which Kenya can request for payment
- Kenya to continue reporting on REDD+ efforts in reduction of emissions as annex in BURs

Efforts by REDD+ and other processes will be illustrated in a reduction Emissions from the current historical average of 52,204,059 Tonnes of CO2 per year to a lesser value and justify Kenya's qualification for Results based payments

FRL transparency should be taken into consideration by including data sets that were left out earlier.

The FRL to be submitted to the CCF of Kenya Forest Service by Monday 16th December 2020 to ensure it is submitted to the MoEF and eventually UNFCCC by 6th January 2020.

A meeting will be organized in March after receiving the comments from UNFCCC.

GCF scorecard doesn't allow countries with low forest low deforestation country to use regression methods for estimation of projections hence the use of the average method for projecting emissions for Kenya.

National Strategy and Action plan. The Land cover map for 2010 needs to be prioritized to ensure they are in check. The Communities needs to be brought on board for cost benefit sharing at the end of the process because currently there are mechanisms on how to go about it.

Adjournment

The meeting was adjourned by 11:55am

ATTENDANCE LIST FOR REDD+ TWG AND STAKEHOLDERS WORKSHOP ON 10 TH DECEMBER IN NAIVASHA				
No.	**NAME**	**INSTITUTION**	**Tel No.**	**EMAIL ADDRESS**
1	Mwangi Kinyanjui	KARATINA		
2	Faith Mutwiri	KFS		
3	Alfred Gichu	ME&F		
4	Peter Nduati	KFS		
5	Jamleck Ndambiri	KFS		
6	Peter Sirayo	KFS		
7	George Tarus	KFS		
8	James Kmondo	KEFRI		
9	John Ngugi	KEFRI		
10	Anthony Macharia	S.O.K		
11	Merceline Ojwala	DRSRS		
12	Charles Ndegwa	DEKUT		
13	Mwangi Githiru	Wildlife Works		
14	Victor Esendi	Conservation International		
15	Thomas Keter	KFS		
16	Jeremy Freund	Wildlife Works		
17	Balozi Bekuta	University of Edoret		
18	Felix Mutua	JKUAT		
19	Peter Ndunda	WRI		
20	Jack Bambo	Transparency International		
21	Tecla Chumba	NACOFA		
22	Lily Murei	UNDP		
23	Gabriel Muturi	KEFRI		
24	Gordon Sigu	ME&F		
25	Ebby Chagalla	KEFRI		
26	Charles Kuria	KFS		
27	Florence Tuukuo	JOFCA		
28	Regina Miringu	KFS		
29	Keiichi Takahata	JICA		
30	Kazuhisa Kato	JOFCA		

Kenya's Forest Reference Level for REDD+ Implementation

REDD+ STAKEHOLDERS WORKSHOP

Date: 9th – 10th Dec, 2019 at Lake Naivasha Resort, *Naivasha*

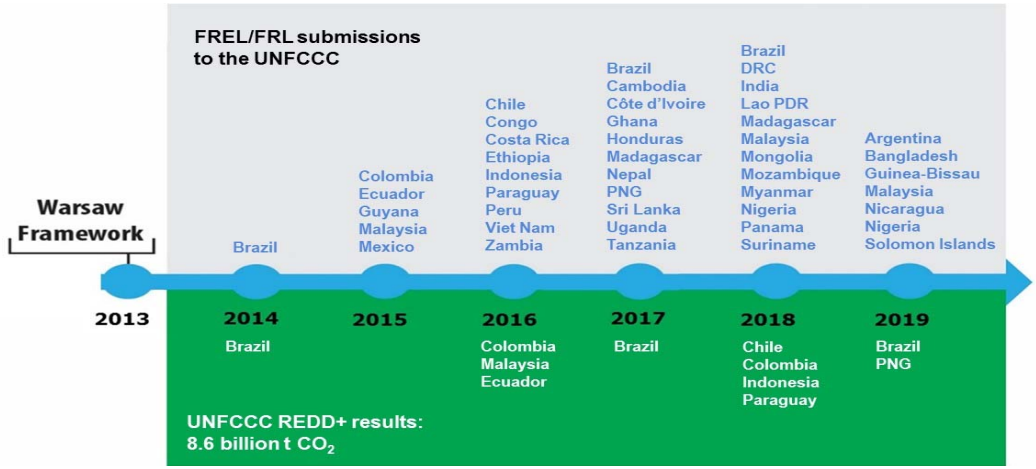
FRL SETTING
BY *ALFRED GICHU*

BACKGROUND

For a country to participate in REDD+

- National Forest Monitoring System (NFMS)
- National Strategy/ Action plan (NS/AP)
- Safeguard Information System (SIS)
- **Forest Reference Level (FRL)-**
  - **What is the historical trend of emissions so that it can be used as a reference point to judge whether the country is REDUCING EMISSIONS and therefore qualify for REDD+ PAYMENTS**
  - **Has to be submitted to UNFCCC for review**

Global progress



Some decisions that have guided development of the FRL

Discussion	Decision
Approach	National
FRL Activities	that reduce emissions and activities that increase removals thus adding the 'plus' to REDD to make it REDD+.
Pools	AGB and BGB only
Reference Period	2002- 2018 (monitored at 4 year intervals)
Gasses	CO2 only
Forest Definition	tree crown cover ≥ 15%, an area ≥ 0.5 ha and a tree height ≥ 2m.
Forest Strata	4 (Montane & Western Rain Forests, Coastal And Mangrove Forests, Dryland Forests, Public Plantations)
REDD+ Activities	Deforestation, forest degradation, Enhancement of carbon stocks (afforestation and canopy enhancement) and sustainable management of forests (Public plantation forests)
Projection	No Adjustment and based on the historical average

PROGRESS – Activity Data

- Activity data has been generated
  - 5 land cover maps (2002, 2006, 2010, 2014 and 2018) selected from the time series of 15 maps available for the period
  - Land cover change analysis done to generate change data – Activity data
  - Uncertainty assessment of change has been done
  - The activity data has been used together with EF to generate Emissions

THIS WILL BE PRESENTED BY FAITH MUTWIRI

PROGRESS – Emission factors

- Emission factors have been calculated
  - 4 forest strata were identified
  - Pilot NFI data was used to assign stocks to each forests strata
  - Changes in stocks were estimated from land cover change activities in the specific areas
  - These biomass stocks were converted into CO2 equivalents
  - The change in stock constitutes Emissions or Sequestration
  - The volumes of sequestration or Emissions per ha multiplied by Activity data comprises total national Emissions

THIS WILL BE PRESENTED BY PETER NDUATI, GEORGE TARUS, PETER SIRAYO AND MWANGI KINYANJUI

PROGRESS – Presentation of Results

- Results of the FRL have been presented to stakeholders for validation
  - 2017 stakeholder meeting and peer review
  - 2019 July stakeholder meeting and advise
  - REDD+ Academy Mombasa
  - Council of Governors (CEOs) – Simba Lodge

- This is the Final TWG meeting to decide on the way forward

PROGRESS – Intention to submit

Dated 29th October 2019

In response to decision 1/CP.16 paragraph 71 (b) and decision 12/CP.17 paragraph 8 and 10, Kenya wishes to voluntarily notify the United Nations Framework Convention on Climate Change (UNFCCC) of its decision to submit the proposed national forest reference level (FRL) for technical assessment in March 2020 in accordance with decision 13/CP.19,; decision 14/CP.19; and decision 12/CP.17.

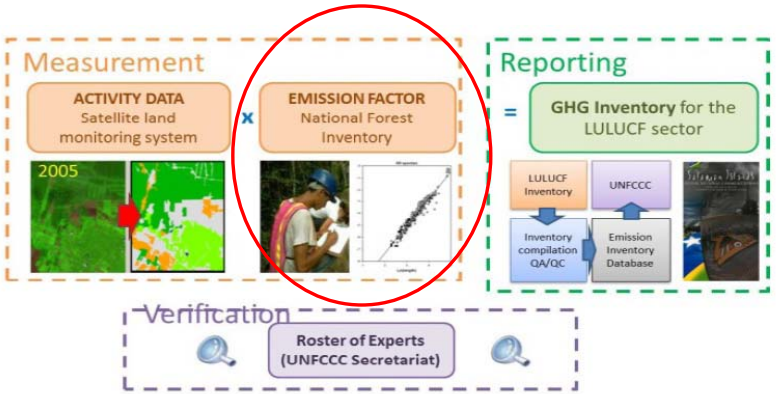
In preparing the Forest Reference Level, Kenya has used an approach consistent with decision 12/CP.19, including the right to make adjustments to the proposed FRL based on national circumstances".

Ground Data Collection (Pilot National Forest Inventory)

By

Peter Nduati

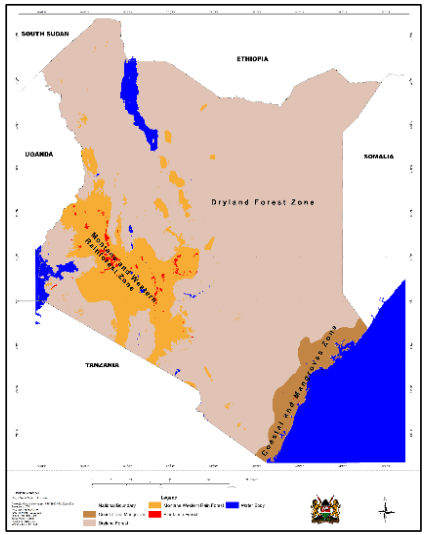
Monitoring Reporting and Verification



Introduction

- Kenya's current estimate are based on pilot inventory and Public plantations
- ICFRA (Improving Capacity in Forest Resources Assessment) a project funded by Finnish Government assisted Kenya in conducting a Pilot inventory and developing a proposal for National Forest Inventory (NFI)
- Government of Japan through JICA conducted additional plots for pilot inventory
- Note that for Transparency all the documents are available

Stratification of the Forests



Forests have been categorized into strata/ecozones based on climate and Altitude (Wass, 1995)

- Montane Kenya (Mt Kenya, Mau, cherangany, aberdares, Mt Elgon, Leroghi, Matthews range etc) and Western Rain forests – (Kakamega & Nandi forests)
- Coastal (Arabuko sokoke, Boni, Shimba hills etc) and Mangrove forests
- Dryland forests – found in the dry areas
- Plantation forests – Described as management zone set aside by KFs for Public plantation forestry

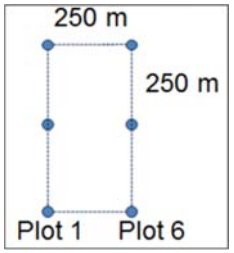
Step by Step Methodology

Sampling Design

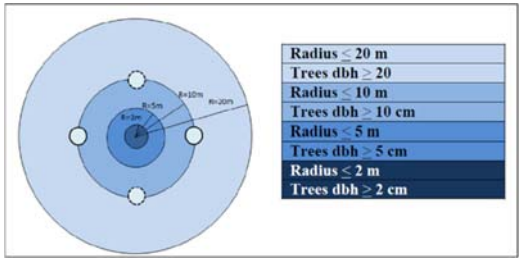
- Based on four strata
- A double stratified two-phase sampling method was used
- Design is systematic cluster sampling where 1st point is randomly selected in phase 1 while in phase 2 the generated points are stratified.
- Stratum for Sampling
  1. Grassland (Dryland Forest)
  2. Forested areas (Western and Rain Forest and Plantation Forest)
  3. Coastal Forests
  4. Mangrove Forests

Step by Step Methodology

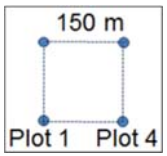
Cluster and Plot Design



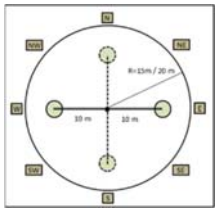
Cluster design for stratum 1 - 3



Plot design for stratum 1 - 3



Cluster design for stratum 4



Location of regeneration subplots (circle) and soil pits (rectangular).

Step by Step Methodology

Points Collected in Pilot inventory

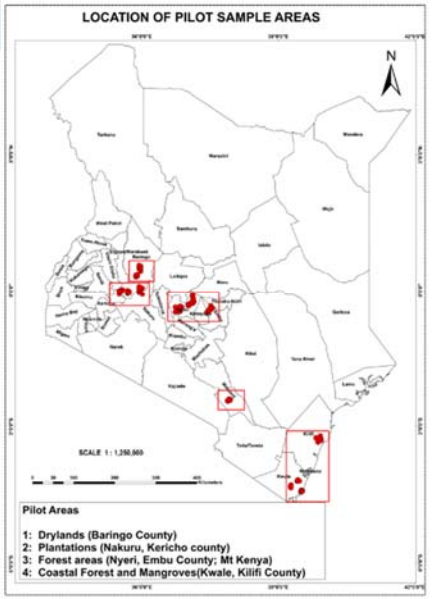
Pilot Areas

1: Dry lands/woodlands (Baringo County)

2: Plantations (Nakuru, Kericho county)

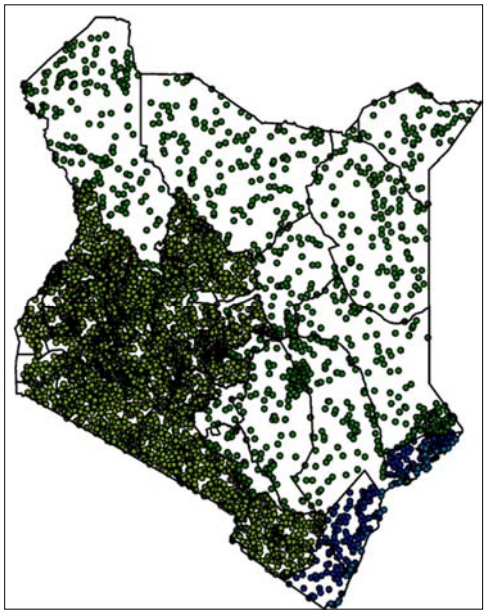
3: Natural Forest areas (Nyeri, Embu County; Mt Kenya)

4: Coastal Forests and Mangroves(Kwale, Kilifi County)



Proposed NFI

- Total proposed sample plots 30,978 (approximately 5,000 clusters)



Emission Factors by *George Tarus*

Example of Pilot NFI data

		Tree	bamboo	Climber	Total	Tree	bamboo	Total	Total	Tree	bamboo	Total	Total	Total	Total		
Vegetatio	D/M/O	m3ha	bm3ha	cm3ha	cm3ha	above_bic	bbiomass	AGB	AGB C sto	Below_bic	Below_bic	BGB	BGB C sto	Biomass	C stock to	county	district
Montane	Dense	263.89	1.61		265.49	208.38	0.98	217.24	102.10	77.10	0.36	80.38	37.78	297.62	139.88	Nyeri	Nyeri
Montane	Dense	1,513.97	-	-	1,513.97	1,146.39	-	1,146.39	538.80	424.16	-	424.16	199.36	1,570.56	738.16	Nyeri	Nyeri
Montane	Dense	105.90	-	-	105.90	87.87	-	87.87	41.30	32.51	-	32.51	15.28	120.38	56.58	Nyeri	Nyeri
Montane	Dense	195.91	-		195.91	160.50	-	163.67	76.92	59.39	-	60.56	28.46	224.22	105.38	Nyeri	Nyeri
Montane	Dense	246.38	-	-	246.38	200.15	-	200.15	94.07	74.05	-	74.05	34.81	274.20	128.88	Nyeri	Nyeri
Montane	Dense	361.74	-	-	361.74	288.13	-	288.13	135.42	106.61	-	106.61	50.11	394.74	185.53	Nyeri	Nyeri
Montane	Dense	646.28	-	-	646.28	511.25	-	511.25	240.29	189.16	-	189.16	88.91	700.41	329.19	Nyeri	Nyeri
Montane	Dense	532.79	-		532.79	427.02	-	429.13	201.69	158.00	-	158.78	74.63	587.91	276.32	Nyeri	Nyeri
Montane	Dense	72.25	-	-	72.25	60.93	-	60.93	28.63	22.54	-	22.54	10.59	83.47	39.23	Nyeri	Nyeri

Allometric equations were used to convert measured parameters to Biomass

Developing emission factors

Forest strata	Canopy Coverage	ABG	BGB	TOTAL		
		Biomass stock (Tonnes/ha)	Biomass stock (Tonnes/ha)	Biomass stock (Tonnes/ha)	Carbon Stock (Tonnes/ha)	CO_2 (Tonnes/ha)
Montane & Western Rain	Dense	244.80	90.57	335.37	157.62	577.95
	Moderate	58.43	21.62	80.05	37.62	137.96
	Open	18.31	6.77	25.08	11.79	43.23
Coastal & Mangrove	Dense	94.63	18.93	113.55	53.37	195.69
	Moderate	52.75	10.55	63.30	29.75	109.08
	Open	24.01	4.80	28.81	13.54	49.64
Dryland	Dense	42.43	11.88	54.31	25.53	93.60
	Moderate	34.52	9.67	44.19	20.77	76.15
	Open	14.26	3.99	18.26	8.58	31.47
Plantation	Plantation	324.79	87.69	412.48	193.87	710.84
Cropland		0	0	0	0	0
Grassland					8.7	14.99
Wetland		0	0	0	0	0
Settlements & Otherlands		0	0	0	0	0

Choice of stock change emission factors – Tier 2 and tier 3

1. Stock was obtained from Pilot NFI and allometric equations as simple average of plot data for each strata – tier 3
2. Shoot Root based on IPCC guidelines per forest biome
3. Carbon fraction for AGB and BGB is from IPCC = 0.47
4. CO_2 Calculated from molecular formula of 44/12 (IPCC guideline)
5. The Cropland Carbon Factor obtained from IPCC default values for tier 1 reporting: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4: Chapter 5 (Cropland) Table 5.8: Default Biomass Stocks Present On Cropland , After Conversion From Forestland
6. The Grassland Carbon Factor obtained from IPCC default values for Tropical Dry Grasslands: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4: Chapter 6 (Grassland) Table 6.4: Default Biomass Stocks Present On Grassland , After Conversion From Other Land Use
7. Default factors from Wetland, Settlement & Otherlands from IPCC tier 1 reporting

Choice of Root /shoot Ratios

Forest strata	Root shoot ratio	Source in IPCC 2006 guidelines
Montane	0.37	Table 4.4. for Tropical rainforest
Dryland	0.28	Table 4.4. above-ground biomass >20 tonnes ha^{-1}
Coastal and Mangrove	0.2	Table 4.4. above-ground biomass <125 tonnes ha^{-1} for Tropical moist deciduous forest
Plantation	0.27	Table 4.4. for Tropical Mountain systems

Emission Factors for Calculating sequestration due to afforestation (based on IPCC for forests Less than 20yrs)

Forest strata	Biomass gain (Tonnes)			Carbon from Biomass	CO_2 sequestered (Tonnes/	
	IPCC table 4.9 equivalent ABG value	BGB	Total		One year	4 years
Montane	10	3.70	13.70	6.44	23.61	94.44
Dryland	2.4	0.67	3.07	1.44	5.29	21.16
Coastal	5	1.00	6.00	2.82	10.34	41.36
Plantation	10	2.70	12.70	5.97	21.89	87.56

Emission Factors for calculation Sequestration due to Canopy enhancement (Based on IPCC for forests more than 20 yrs)

Forest strata	Biomass gain (Tonnes)			Carbon from Biomass	CO_2 sequestered (Tonnes/	
	IPCC table 4.9 equivalent ABG value	BGB	Total		One year	4years
Montane	3.1	1.15	4.25	2.00	7.32	29.28
Dryland	1.8	0.50	2.30	1.08	3.97	15.88
Coastal	1.3	0.26	1.56	0.73	2.69	10.76
Plantation	10	2.70	12.70	5.97	21.89	87.56

Assigning Activity Data to Land cover changes by *Peter Sirayo*

Land cover change Matrix

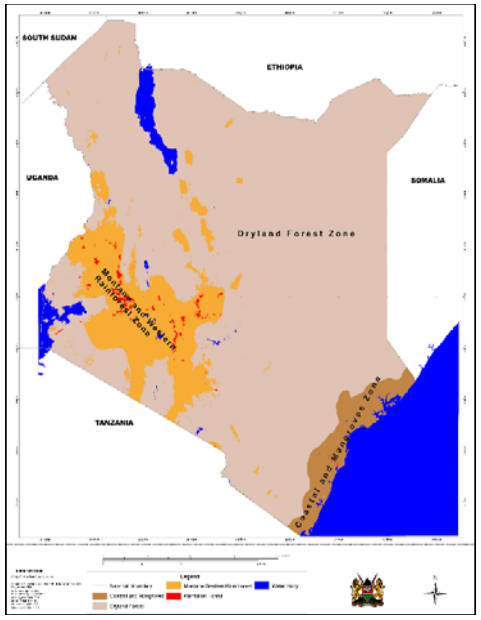
Area in 20XX			Area in 20XX+(X)													
			Forest										Non Forest			
			Montane Forest/ Western Rain Forest/ Bamboo			Costal Forest and Mangroves			Dryland Forest			Plantation Forest	Crop Land	Grass land	Wet land	Settlement and Other land
			D	M	O	D	M	O	D	M	O					
Forest	Montane Forest/ Western Rain Forest/ Bamboo	D	n	dg	dg								df	df	df	df
		M	e	n	dg								df	df	df	df
		O	e	e	n								df	df	df	df
	Costal Forest and Mangroves	D				n	dg	dg					df	df	df	df
		M				e	n	dg					df	df	df	df
		O				e	e	n					df	df	df	df
	Dryland Forest	D							n	dg	dg		df	df	df	df
		M							e	n	dg		df	df	df	df
		O							e	e	n		df	df	df	df
	Plantation Forest											n	s	s	s	s
Non Forest	Cropland		e	e	e	e	e	e	e	e	e	s	NA	NA	NA	NA
	Grass land		e	e	e	e	e	e	e	e	e	s	NA	NA	NA	NA
	Wetland		e	e	e	e	e	e	e	e	e	s	NA	NA	NA	NA
	Settlement and Other land		e	e	e	e	e	e	e	e	e	s	NA	NA	NA	NA

df Deforestation (F→NF) | dg Forest Degradation (F→F(Degraded)) | e Enhancement (F→F(Improved) ,NF→F)

n No Change (F→F) | s Sustainable Management of Forest (F→NF, NF→F) | NA Not Available

The Forest Strata

1. Montane & Western Rain Forests
2. Coastal And Mangrove Forests
3. Dryland Forests
4. Public Plantations



Assigning Activity Data to REDD+ Activities - Definitions

- Deforestation is conversion of Forests to Non forests in all canopy classes of Montane/Western Rain forest, Coastal and mangrove forests and Dryland forests and is indicated by Red colour
- Degradation is conversion of a forest from a higher canopy class to a lower canopy class for all forests in the strata/ecozones of Montane/Western Rain forests, Coastal and mangrove forests and Dryland forests and is indicated by yellow colour
- Enhancement of Carbon stocks is the conversion of Non forests into forests (afforestation and reforestation) and the improvement of forests from a lower canopy class to a higher canopy class in the strata/ecozones of Montane/Western Rain forests, Coastal and mangrove forests and Dryland forests and is indicated by green colour.
- Sustainable management of forests is the conversion of non-forests into forests and sustainable harvesting (forests into non forests) in public plantation forest areas managed by Kenya Forest Service (KFS) and is indicated by blue colour. This aims at reducing backlogs by replanting and increasing productivity of the public plantation forests.

Assigning Activity Data to REDD+ Activities - Definitions

- Forestlands remaining forestland in the strata/ecozones of Montane/Western Rain forests, Coastal and mangrove forests and Dryland forests which were mapped with a canopy remaining in the same canopy level in the two mapping years (2002 and 2018) do not imply any carbon stock changes and have not been assigned any colour. Similarly plantation forests that did not change in the two time instances (2002 and 2018) do not imply any carbon stock changes and have not been assigned any colour.
- Conversions among non-forests e.g. cropland converted to wetland do not imply any emissions and have not been assigned any colour

Land cover changes 2002-2018

			2018												
			Montane & Western Rain Forest			Costal and Mangroves Forest			Dryland Forest			Plantation	Cropland	Grassland	Wetland	Settlement & Otherland
			Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open					
2002	Montane & Western Rain Forest	Dense	772,025	46,912	16,427								167,916	111,437	457	1,039
		Moderate	60,757	59,277	12,190								30,410	53,521	389	87
		Open	23,898	17,630	21,139								13,581	77,873	36	131
	Costal and Mangrove Forest	Dense				84,317	32,686	739					3,747	46,315	712	301
		Moderate				80,975	85,893	3,609					14,242	155,399	1,256	984
		Open				6,195	12,707	367					3,056	15,696	72	126
	Dryland Forest	Dense							216,624	56,911	27,255		50,285	342,844	2,887	4,614
		Moderate							110,576	81,909	27,881		26,971	203,209	2,601	1,828
		Open							40,230	28,313	40,490		10,496	270,156	2,138	5,646
	Plantation											47,740	22,816	8,587	20	17
	Cropland		72,777	8,191	5,583	809	731	127	21,260	8,752	7,273	8,631				
	Grassland		119,848	67,872	50,280	93,653	82,323	12,861	432,319	219,841	202,697	8,652				
	Wetland		238	66	15	555	565	49	2,522	1,074	1,302	20				
	Settlement and Other land		550	143	497	201	284	11	2,921	1,992	9,180	13				

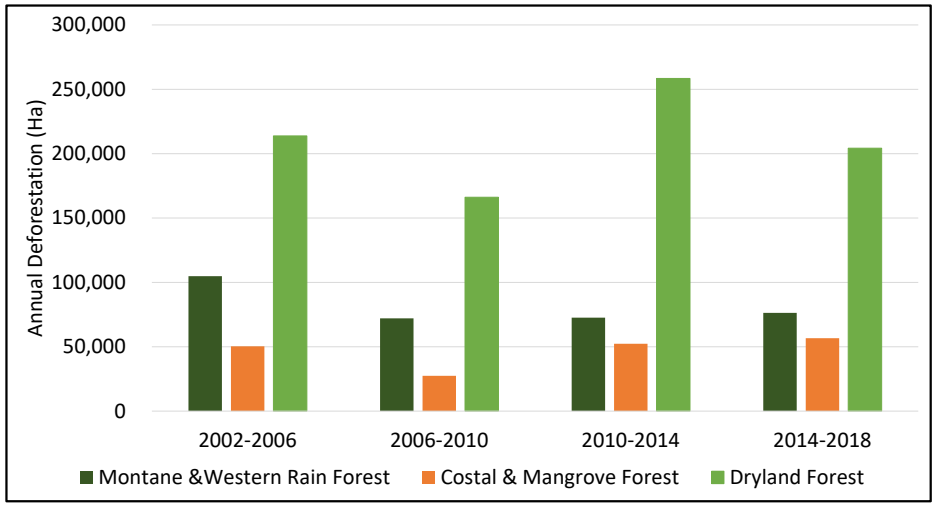
Area of Forestlands remaining Forestlands

Forest strata	Area (ha) of Forestland that remained forestland					Percentage of forestland (based on national land area) that remained forestland				
	2002-2006	2006-2010	2010-2014	2014-2018	Average	2002-2006	2006-2010	2010-2014	2014-2018	Average
Montane &Western Rain Forest	1,067,639	1,033,823	1,081,420	1,086,615	1,067,374	1.80	1.75	1.83	1.84	1.80
Costal & Mangrove Forest	347,841	375,728	365,710	320,549	352,457	0.59	0.63	0.62	0.54	0.60
Dryland Forest	698,714	774,168	820,364	744,965	759,553	1.18	1.31	1.39	1.26	1.28
Plantation	62,292	61,183	64,384	56,315	61,044	0.11	0.10	0.11	0.10	0.10
Total	**2,176,487**	**2,244,903**	**2,331,878**	**2,208,444**	**2,240,428**	**3.68**	**3.79**	**3.94**	**3.73**	**3.78**

Annual Transition Deforestation Vs Afforestation

Forest strata	Area (ha) of Deforestation					Area (ha) of Afforestation				
	2002-2006	2006-2010	2010-2014	2014-2018	Average	2002-2006	2006-2010	2010-2014	2014-2018	Average
Montane &Western Rain Forest	104,874	72,059	72,648	76,322	81,476	63,605	84,547	77,621	67,426	73,300
Costal & Mangrove Forest	50,388	27,463	52,359	56,664	46,719	34,435	49,855	45,374	44,777	43,610
Dryland Forest	213,787	166,164	258,443	204,279	210,668	185,027	269,992	185,429	199,089	209,884
Total	369,049	265,687	383,450	337,265	338,863	283,068	404,394	308,424	311,292	326,794

The Annual Deforestation Rates among strata



Annual Transition Forest Degradation vs Canopy improvement

Forest strata	Area (ha) of Forest Degradation					Area (ha) of Forest enhancement by Canopy improvement				
	2002-2006	2006-2010	2010-2014	2014-2018	Average	2002-2006	2006-2010	2010-2014	2014-2018	Average
Montane &Western Rain Forest	29,655	16,622	19,108	20,461	21,461	18,124	29,473	25,976	15,104	22,169
Costal & Mangrove Forest	9,168	7,634	5,874	22,830	11,377	29,287	12,714	15,138	6,032	15,793
Dryland Forest	18,689	21,016	24,572	43,316	26,898	43,220	29,955	29,353	24,878	31,852
Total	57,512	45,272	49,555	86,607	59,736	90,631	72,142	70,467	46,013	69,813

Annual Transition rates for Plantation forests

Forest strata	Area (ha) of Sustainable Management of forests				
	2002-2006	2006-2010	2010-2014	2014-2018	Average
Harvested area	4,222	3,039	3,155	6,298	4,178
Planted area	2,762	3,955	4,280	2,185	3,296
Net (Deficit/backlog)	-1,460	916	1,125	-4,113	-882

Emission Calculations - Deforestation

- Deforestation which is conversion of a forest to a non-forest in Montane/Western Rain forests, Coastal and mangrove forests and Dryland forests .
  - Instantaneous Oxidation was assumed for all deforestation. Therefore the EF is the difference between the CO_2 value of the initial forest strata/canopy class and the CO_2 value of the non-forest
  - All forest conversions into Croplands, Wetlands and Settlements & Otherlands attain a CO_2 value of Zero after conversion. The EF is the difference between the CO_2 of the former forest and zero
  - All forest conversions into Grasslands attain a CO_2 value of 14.99 Tonnes/ha after conversion. The EF is the difference between the CO_2 of the former forest and 14.99 Tonnes/ha

NB: No data on HWP - Most of the activities that convert forests to non-forests may result to instantaneous oxidation)

Emission Calculations – Forest Degradation

- Forest Degradation is the conversion of a forest from a higher canopy class to a lower canopy class in Montane/Western Rain forests, Coastal and mangrove forests and Dryland forests
  - Instantaneous Oxidation was assumed for all degradation. Therefore the EF is the difference between the CO_2 value of the initial forest canopy class and the CO_2 value of the new forest canopy class within a strata

NB: Data on drivers of degradation is not reliable enough to estimate emissions as shown in a preliminary study to this work - Options For Estimating GHG Emissions/Sinks From Forest Degradation, Forest Fires And Forest Revegetation. A Report To Support Establishment Of Kenya's Forest Reference Level

Emissions from sustainable management of forests

- In Sustainable management of forest which is the conversion of non-forests into forestlands in areas designated as Plantation zones, EF were calculated as follows
  - A stock change method was applied and the EF calculated as the difference between the CO_2 value of the pervious non-forest to the CO_2 value of a plantation based on growth rate.
  - A Conversion of a cropland, Wetland and Settlements & Otherlands into a forestland changes carbon stocks from a zero CO_2 value to a CO_2 value to 87.56 Tonnes/ha
  - A conversion of a grassland to a forestland changes carbon stocks from a CO_2 value of 14.99 Tonnes/ha

Enhancement of Carbon Stocks due to afforestation

- Enhancement of Carbon stocks due to conversion of non-forests into forests in Montane/Western Rain forests, Coastal and mangrove forests and Dryland forests was calculated as follows
  - A growth factor was adopted for each strata to give the amount of CO_2 gained in a planted/young forest (in this case a forest that is less than 20 years) in the 4 year period.
  - In case the calculation of growth results to a stock which is more than the stock factor of the specific canopy class, a capping was done to retain the stock of the specific canopy class.
  - The EF for conversion of Croplands, Wetlands and Settlements & Otherlands into forestlands was the difference between zero and the CO_2 value after growth of 4 years
  - The EF for conversion of grasslands into Forestlands was the difference between a CO_2 value of 14.99 Tonnes/ha and the CO_2 value of the forest after 4 years of growth

Enhancement of carbon stocks due to canopy improvement

- Enhancement of Carbon stocks due to improvement of Canopy in forests from a lower canopy class to a higher canopy class in Montane/Western Rain forests, Coastal and mangrove forests and Dryland forests was calculated as follows
  - A growth factor was adopted for each strata (Table 13) to give the amount of CO_2 gained in an existing forest (in this case a forest that is more than 20 years) in the 4 year period
  - The EF was calculated as the difference between the previous CO_2 value (for year 2002) and the new CO_2 value after forest enhancement (year 2018). In case the calculation of growth results to a stock which is more than the stock factor of the specific canopy class, a capping was done to retain the stock of the specific canopy class.

Emission factors for various REDD+ activities

			End Year												
			Montane &Western Rain Forest			Coastal & Mangroves Forest			Dryland Forest			Plantation	Cropland	Grassland	Wetland	Settlement & Other land
			Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open					
Start year	Montane &Western Rain Forest	Dense	0	440.00	534.72								577.95	562.96	577.95	577.95
		Moderate	-29.28	0	94.73								137.96	122.96	137.96	137.96
		Open	-29.28	-29.28	0								43.23	28.24	43.23	43.23
	Coastal & Mangroves Forest	Dense				0	86.61	146.04					195.69	180.69	195.69	195.69
		Moderate				-10.75	0	59.44					109.08	94.09	109.08	109.08
		Open				-10.75	-10.75	0					49.64	34.65	49.64	49.64
	Dryland Forest	Dense							0	17.44	62.13		93.60	78.60	93.60	93.60
		Moderate							-15.88	0	44.69		76.15	61.16	76.15	76.15
		Open							-15.88	-15.88	0		31.47	16.47	31.47	31.47
	Plantation											0	710.84	695.85	710.84	710.84
	Cropland		-94.44	-94.44	-43.23	-41.36	-41.36	-41.36	-21.18	-21.18	-21.18	-87.55				
	Grassland		-79.45	-79.45	-28.24	-26.37	-26.37	-26.37	-6.18	-6.18	-6.18	-72.55				
	Wetland		-94.44	-94.44	-43.23	-41.36	-41.36	-41.36	-21.18	-21.18	-21.18	-87.55				
	Settlement & Other land		-94.44	-94.44	-43.23	-41.36	-41.36	-41.36	-21.18	-21.18	-21.18	-87.55				

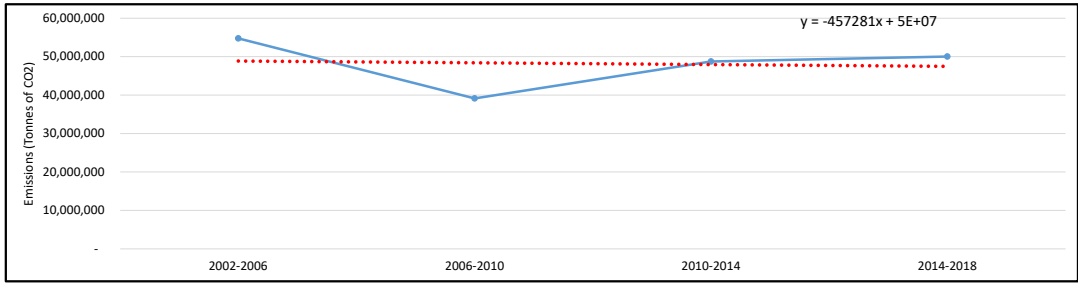
Results
by
Mwangi Kinyanjui

Calculated emissions (CO_2 Tonnes) for 2002-2006

			2006													
			Montane &Western Rain Forest			Coastal & Mangroves Forest			Dryland Forest			Plantation	Cropland	Grassland	Wetland	Settlement & Other land
			Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open	Dense				
2002	Montane &Western Rain Forest	Dense	0	33,402,790	14,952,439	0	0	0	0	0	0	0	63,970,436	71,655,345	144,916	256,958
		Moderate	-1,079,014	0	1,396,195	0	0	0	0	0	0	0	2,355,007	8,840,448	21,194	34,144
		Open	-734,972	-308,355	0	0	0	0	0	0	0	0	360,219	2,339,276	759	11,540
	Coastal & Mangroves Forest	Dense	0	0	0	0	957,251	465,807	0	0	0	0	480,910	6,577,554	95,791	121,980
		Moderate	0	0	0	-1,083,064	0	1,333,070	0	0	0	0	1,002,960	12,324,488	47,025	113,301
		Open	0	0	0	-129,630	-47,079	0	0	0	0	0	74,933	632,966	1,072	6,353
	Dryland Forest	Dense	0	0	0	0	0	0	0	560,352	1,329,447	0	3,606,220	23,672,823	180,967	230,717
		Moderate	0	0	0	0	0	0	-1,705,968	0	948,998	0	1,313,196	13,483,713	175,828	142,251
		Open	0	0	0	0	0	0	-683,703	-356,075	0	0	272,758	4,091,434	45,693	335,808
	Plantation			0	0	0	0	0	0	0	0	0	3,019,518	8,782,822	6,589	6,398
	Cropland		-3,500,587	-351,190	-114,753	-12,418	-24,117	-4,203	-343,535	-35,565	-115,221	-483,208			0	0
	Grassland		-8,255,667	-5,803,365	-936,099	-1,384,632	-1,090,906	-1,077,714	-2,121,493	-816,374	-1,414,338	-400,154			0	0
	Wetland		-19,387	-5,729	-1,004	-21,221	-23,838	-15,210	-47,195	-37,433	-38,861	-890			0	0
	Settlement & Other land		-43,653	-6,077	-2,081	-10,996	-6,455	-4,761	-36,156	-28,809	-84,815	-347			0	0

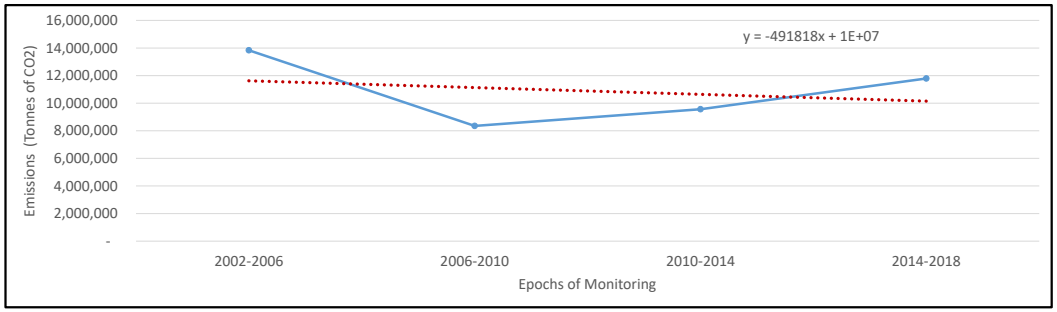
Historical annual emissions from Deforestation

Forest strata	Emissions (Tonnes of CO_2)				
	2002-2006	2006-2010	2010-2014	2014-2018	average
Montane &Western Rain Forest	37,497,560	26,953,329	27,609,168	28,425,689	30,121,437
Costal & Mangrove Forest	5,369,833	2,838,459	6,066,685	8,997,887	5,818,216
Dryland Forest	11,887,852	9,351,299	15,060,281	12,609,716	12,227,287
Total	**54,755,246**	**39,143,087**	**48,736,134**	**50,033,292**	**48,166,940**



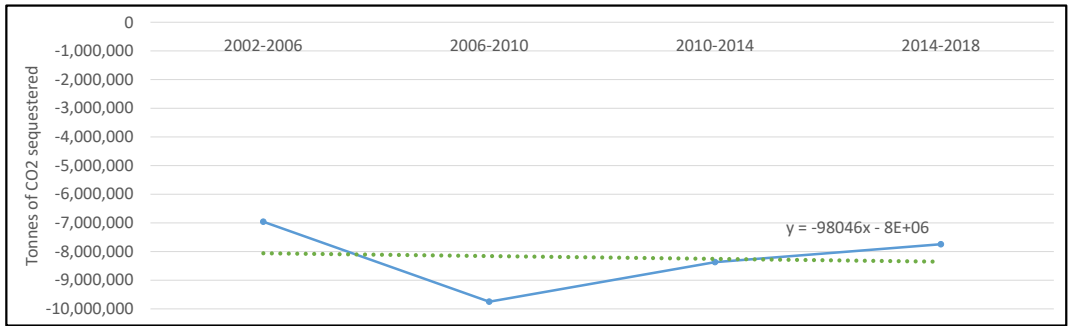
Historical annual emissions from Forest Degradation

Forest strata	Emissions (Tonnes of CO_2)				
	2002-2006	2006-2010	2010-2014	2014-2018	average
Montane &Western Rain Forest	12,437,856	6,904,687	8,171,469	8,356,545	8,967,639
Costal & Mangrove Forest	689,032	658,228	507,708	1,983,662	959,657
Dryland Forest	709,699	787,686	884,652	1,452,579	958,654
Total	**13,836,587**	**8,350,601**	**9,563,829**	**11,792,785**	**10,885,950**



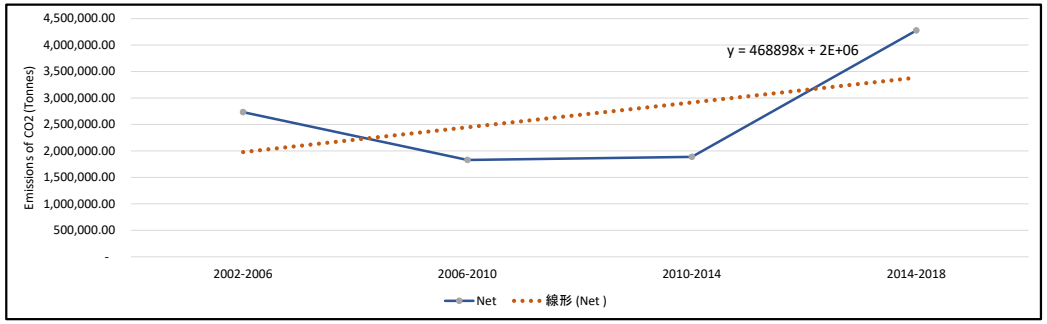
Historical annual sequestration from Afforestation

Forest strata	Emissions (Tonnes of CO_2)				
	2002-2006	2006-2010	2010-2014	2014-2018	average
Montane &Western Rain Forest	-4,759,898	-6,407,901	-5,807,682	-5,113,591	-5,522,268
Costal & Mangrove Forest	-919,118	-1,344,367	-1,215,551	-1,204,155	-1,170,798
Dryland Forest	-1,279,949	-1,996,239	-1,345,866	-1,427,843	-1,512,474
Total	**-6,958,965**	**-9,748,507**	**-8,369,099**	**-7,745,589**	**-8,205,540**



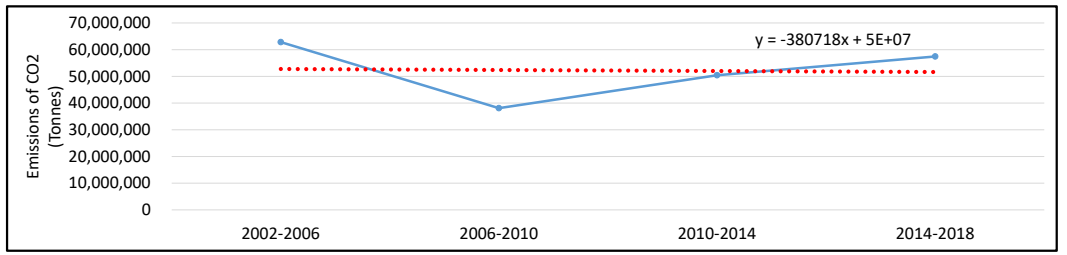
Historical annual emissions from Forest Plantations

Forest strata	Emissions (Tonnes of CO_2)				
	2002-2006	2006-2010	2010-2014	2014-2018	Average
Harvesting	2,953,832	2,130,667	2,217,234	4,449,483	2,937,804
Replanting	-221,150	-301,355	-329,799	-173,181	-256,371
Net	**2,732,682**	**1,829,312**	**1,887,435**	**4,276,302**	**2,681,433**



Historical annual NET emissions – Kenya's FRL

Forest Strata	Emissions (Tonnes of CO_2)				
	2002-2006	2006-2010	2010-2014	2014-2018	Average
Montane &Western Rain Forest	44,644,932	26,587,270	29,212,476	31,226,464	32,917,786
Costal & Mangrove Forest	4,824,805	2,015,603	5,196,054	9,712,528	5,437,247
Dryland Forest	10,631,166	7,666,989	14,132,878	12,239,340	11,167,593
Public Plantations	2,732,682	1,829,312	1,887,435	4,276,302	2,681,433
Total	**62,833,585**	**38,099,174**	**50,428,843**	**57,454,634**	**52,204,059**



Uncertainty of the FRL

By
Faith Mutwiri
and Mwangi Kinyanjui

Uncertainty of AD

- Land cover change analysis done to generate change data – Activity data
- Accuracy assessment was done using collect earth on the random points generated in the change

	V_ID_No	2006 LCLU CODE	2006 Reference	2006 Remark	2010 LCLU CODE	2010 Reference	2010 Remark	2006 - 2010 LCLU Chang	Result	Actual	Check
13	10	OTH	GL		FM	OTH		OTFM	FALSE	GLOT	OK
14	11	OTH	OTH		FM	OTH		OTFM	FALSE	OTOT	OK
15	12	OTH	FD		FM	FM		OTFM	FALSE	FDZM	OK
16	13	FD	FD		FD	FD		FD2D	TRUE	FD2D	OK
17	14	FD	OTH		FD	OTH		FD2D	FALSE	OTOT	OK
18	15	FD	GL		FD	GL		FD2D	FALSE	GLGL	OK
19	16	FD	FD		FD	FD		FD2D	TRUE	FD2D	OK
20	17	FD	FD		FD	FD		FD2D	TRUE	FD2D	OK
21	18	FD	GL		FD	GL		FD2D	FALSE	GLGL	OK
22	19	FD	FD		FD	FD		FD2D	TRUE	FD2D	OK
23	20	FD	FD		FD	FD		FD2D	TRUE	FD2D	OK

Using Olofsson, et al, (2013) formula shown below, the table show here was generated

$$S(\hat{p}_{\cdot j}) = \sqrt{\sum_{i=1}^{q} W_i^2 \frac{\frac{n_{ij}}{n_i}\left(1-\frac{n_{ij}}{n_i}\right)}{n_{i\cdot}-1}}.$$

Summary

Uncertainty (%) of Change map 2002-2006	
Overall Accuracy	41.05
Overall Uncertainty	4.94
Limits	41.05%±4.94%
Uncertainty (%) of Change map 2006-2010	
Overall Accuracy	51.9
Overall Uncertainty	4.03
Limits	51.9%±4.03%
Uncertainty (%) of Change map 2010-2014	
Overall Accuracy	35.75
Overall Uncertainty	2.17
Limits	35.75%±2.17%
Uncertainty (%) of Change map 2014-2018	
Overall Accuracy	30.01
Overall Uncertainty	2.15
Limits	30.01%±2.15%

$$\frac{4.94^2}{41.05^2}+\frac{4.03^2}{51.9^2}+\frac{2.17^2}{35.75^2}+\frac{2.15^2}{30.01^2}$$

Average uncertainty of Ad = 0.029 equivalent to 2.9%

Uncertainty of EF

Strata	Canopy Class	Mean (AGB)	Std Dev	No Samples	Uncertainty	Uncertainty of mean
Montane & Western Rain Forest	Dense	244.80	157.94	8	126.46	44.71
	Moderate	58.43	34.64	7	116.20	43.92
	Open	23.26	13.64	6	114.94	46.92
Coastal & Mangrove forest	Dense	94.63	45.03	18	93.27	21.98
	Moderate	60.45	31.90	12	103.43	29.86
	Open	35.47	34.03	16	188.04	47.01
Dryland Forest	Dense	42.43	32.11	8	148.33	52.44
	Moderate	34.52	15.01	8	85.22	30.13
	Open	14.26	6.89	7	94.70	35.79
Plantation	Plantation	324.79	249.38	36	150.49	25.08

This data does not conform to a minimum sampling size for Uncertainty analysis. A bootstrap simulation was done and Uncertainty calculated as 24.7%

Uncertainty of FRL

The Error propagation formula used

$$SD\,CO_2 = \sqrt{\overline{Total_{carbon}}^{2}_{1\to2}\left[\left(\frac{SD^2_{Emissions_{factor}}}{\overline{Emissions_{factor}}^{2}_{1\to2}}\right)+\left(\frac{SD^2_{Activity_{data}}}{\overline{Activity_{data}}^{2}_{1\to2}}\right)\right]}$$

Filling in numbers

$$Uncertainty\ of\ the\ FRL = \sqrt{52{,}204{,}059^2 * [(0.247^2 + (0.029^2)]}$$

Results

The Uncertainty of this Submission is ± 12,984,983. This implies that the FRL is 52,204,059 ± 12,984,983 t CO2/year:

External validation using the FLINT

Description	Average CO2 tonnes	% change
FREL Assumptions with Kenyan Forest Strata, V2 (2002 & 2018) - 16yr Interval	**22,068,707**	54%
FREL Assumptions with Kenyan Forest Strata, V2 (2002, 2006, 2010, 2014 & 2018) - 4yr Interval	**47,460,285**	**0%**
FREL Assumptions with Kenyan Forest Strata, V2(2002, 2004, 2006, 2008, 2010, 2012, 2014 & 2018) - 2yr Interval	**70,393,449**	-48%
FREL Assumptions with Kenyan Forest Strata, V2 (all years 2002-2018) - 1yr Interval	**104,044,728**	-119%
Tier 2 Time Series with all Kenya Forest Strata, V2 (all years 1990-2018) - Full	**39,390,373**	17%

National Circumstances

By

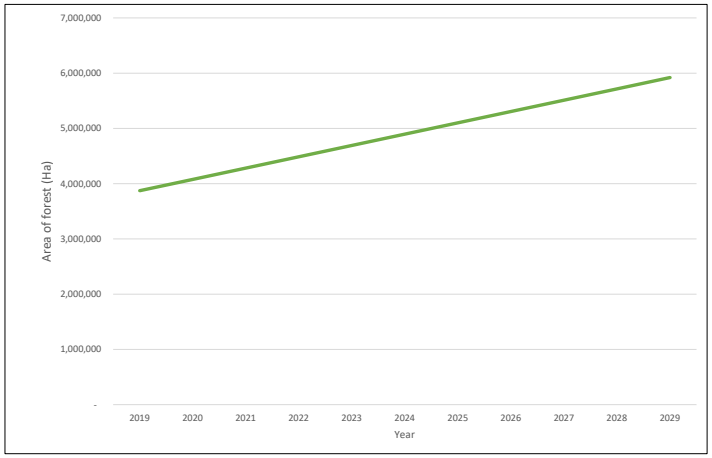
Jamleck Ndambiri

What is the future of Forest Cover in Kenya?

Increase with forest conservation?

- Implementation of forest Policies
- Conservation policies
- Climate change policies
- Land conservation policies
- More tree planting in farms
- More trees in dryland areas
- Devolved management systems

Illustration of Vision 2030 targets based on current forest maps

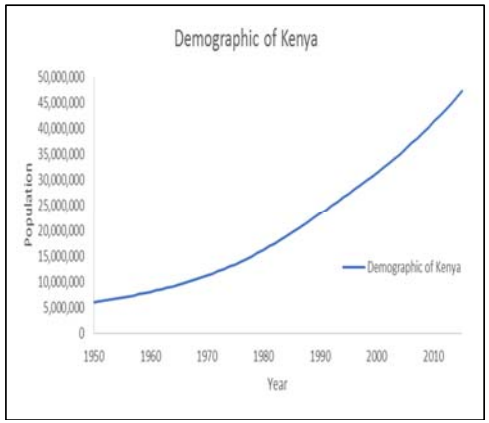


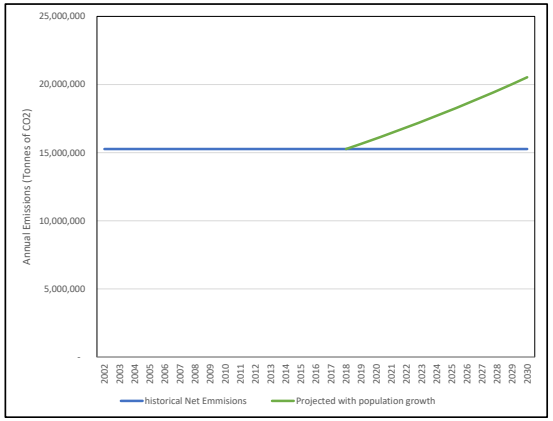
If we increase forest cover today by 204,727 ha without losing any forest to other non forest uses, we will attain the vision 2030 goal of 10% forest

Hindrances/Barriers to forest increase

- Increasing population and their associated developmental needs
- Agricultural expansion
- Urban expansion including infrastructure
- Improved access to formerly pristine forests
- Conflicts of natural resource use
- Weak Enforcement

An illustration of Kenya's population growth and how it may increase forest related emissions

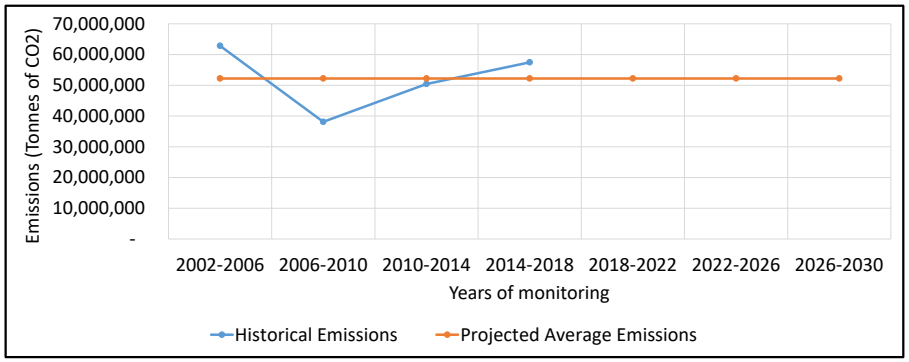




What will be the emissions in future?

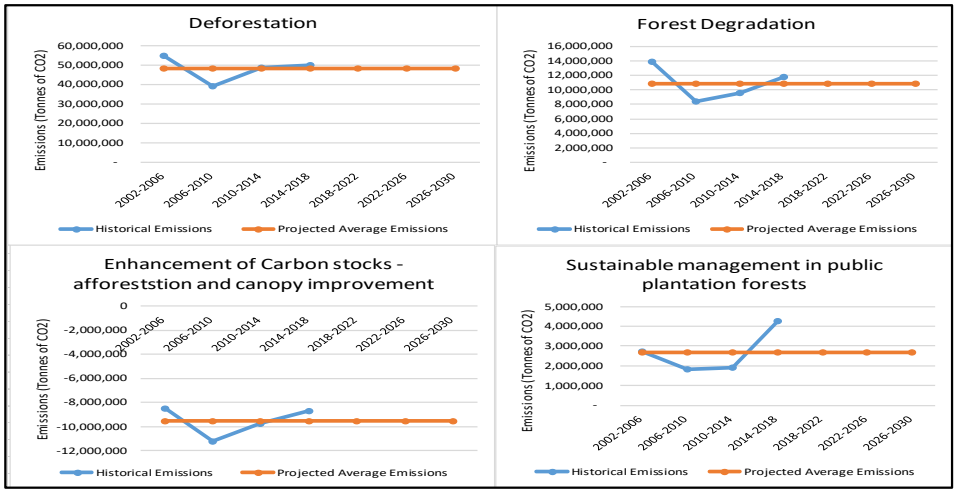
Projected Emissions
(based on historical average without adjustment)

Projection of Net emissions



2002-2006	2006-2010	2010-2014	2014-2018	2018-2022	2022-2026	2026-2030
54,755,246	39,143,087	48,736,134	50,033,292	47,713,595	47,256,314	46,799,033

Projections of emissions by REDD+ Activity



Projections of emissions by REDD+ Activity

REDD+ Activity	2002-2006	2006-2010	2010-2014	2014-2018	2018-2022	2022-2026	2026-2030
Deforestation	48,166,940	48,166,940	48,166,940	48,166,940	48,166,940	48,166,940	48,166,940
Degradation	10,885,950	10,885,950	10,885,950	10,885,950	10,885,950	10,885,950	10,885,950
Sustainable management of forest	2,681,433	2,681,433	2,681,433	2,681,433	2,681,433	2,681,433	2,681,433
Enhancement	-9,530,264	-9,530,264	-9,530,264	-9,530,264	-9,530,264	-9,530,264	-9,530,264
Total (Emission estimates (Net))	52,204,059	52,204,059	52,204,059	52,204,059	52,204,059	52,204,059	52,204,059

Summary

The Forest Reference Level is the

Benchmark against which the success of Reducing Emissions from our forests will be measured

Mizani ambayo itatumika kupima ufanisi wetu katika kupunguza gasi mkaa inayoingia angani tunapoharibu misitu yetu

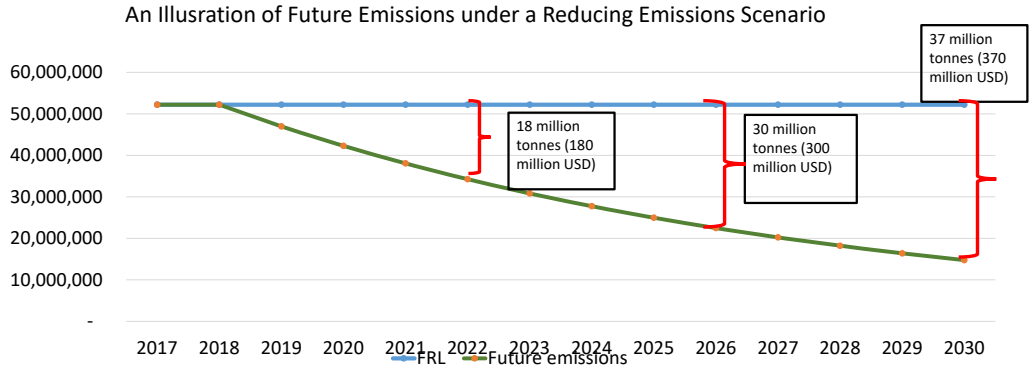
Next steps by *Alfred Gichu*

NEXT steps….

- Submit FRL by January 6th 2020
- UNFCCC selects review team
- Review team analyses the document to understand, critique, identify applicability etc.
- Communication between review team and Kenya team starts mid February – questions, clarification etc.
- A centralised review takes place in Germany where the reviewers meet to consolidate their comments and engage Kenya on one to one – for one week in the period 9th – 21st March 2020
- A review report is finalised and submitted to us for comments/confirmation/agreement/adjustments of our methods/revision…
- A finally agreed document is submitted to the REDD+ portal as a public document against which Kenya's request for REDD+ payment will be gauged
- Kenya will continue reporting on REDD+ - efforts in reduction of emissions as an annex in the Biennial Update Reports

NEXT steps….

- The efforts will be illustrated in a reduction Emissions from the current historical average of 52,204,059 Tonnes of CO2 per year to a lesser value and justify Kenya's qualification for Results based payments



Asante

REPUBLIC OF KENYA

NATIONAL LAND AND FOREST COVER MAPPING

REDD+ STAKEHOLDERS WORKSHOP

Date: 9th Dec, 2019 at Lake Naivasha Resort, Naivasha

*by: **Faith** Mutwiri*

Introduction

- **Globally, Kenya is categorized as a low forest cover –low deforestation country with less than 10 per cent forest cover.**
- **Forest cover is variously reported as 7.2 % (4.22 million ha) ,6.9%, 3% or 2.7%;**
- **Deforestation rate is estimated at 12,600 hectares per year (WB, 2017)**
- **Government has committed to increase forest cover to 10 per cent by 2022.**
- **First comprehensive forest cover mapping done in 2013 for year 2010 which established a forest cover of 6.9%.**

Forest definition

Organizations (Main Contributors)	A single minimum tree crown cover value	A single minimum land area value	A single minimum tree height value
KFS, DRSRS, KEFRI, REDD+, SLEEK, NGHG Inventory	15%	0.5 ha	2 m

–Kenya's definition is informed by global reporting standards and is informed by FAO limits within which countries define their forests;

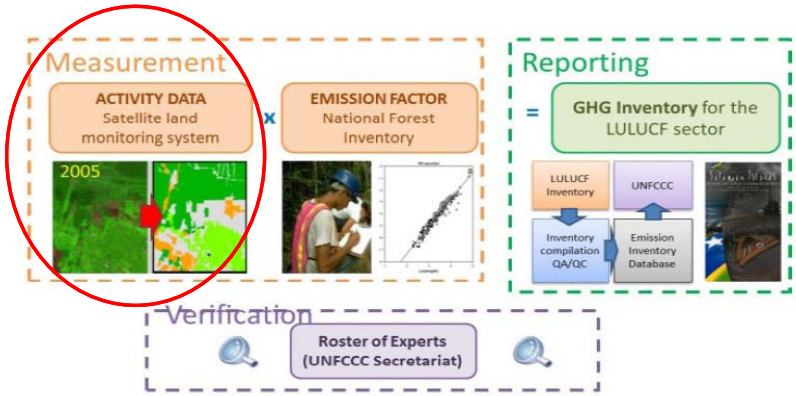
▪*Forestlands are areas occupied by forests and characterised by tree crown cover ≥ 15%, an area ≥ 0.5 ha and a tree height ≥ 2m. It also includes areas managed for forestry where trees have not attained 2m height but with potential to do so, and areas that are temporarily destocked.(KFS, 2013)*

Objectives

1. **Policy requirement**
   - **reporting on status of forest to Parliament;**
   - **performance contracting**
   - **performance on NDC and AFR 100 implementation**
2. **Global commitments- Reporting to UNFCCC, FAO, UNFF, CBD and others on performance of our commitments;**
3. **Support to decision-making and strategic planning;**
4. **SLEEK – Estimating GHG emissions from land-based sectors;**
5. **REDD+ -Establishment of REDD+ FRL and the NFMS**

LAND USE AND FOREST COVER MAPPING

Monitoring Reporting and Verification



Institutions Involved in Forest Cover Mapping

- A multi-institutional process with members from;
  - Kenya Forest Service (KFS)
  - Directorate of Resource Survey and Remote Sensing (DRSRS)
  - Survey of Kenya (SoK)
  - Kenya Forestry Research Institute (KEFRI)
  - National Environment Management Authority (NEMA)
  - Kenya Wildlife Service (KWS)
  - Regional Centre for Mapping of Resources and Development (RCMRD)
  - African Wildlife Foundation (AWF)
  - Environmental Research Mapping and Information Systems in Africa (ERMIS Africa)
  - Jomo Kenyatta University of Agriculture and Technology (JKUAT)
  - Dedan Kimathi University
  - Karatina University
- Work strongly guided by a Technical and process manual.

Capacity Building

- Several trainings have been undertaken
  1. **SLEEK and Australian Government- CSIRO (*Commonwealth Scientific and Industrial Research*) -**
     - Random Forest classification and scripts used in the classification
     - Terrain illumination correction
     - Conditional Probability Network
  2. **REDD+ - FAO Trainings**
     - Accuracy Assessment
     - Land Cover Classification System (LCCS)
     - Data collection using collect earth
  3. **RCMRD -** RECAREDD Project
  4. **GHGI and Reporting for Report-based REDD+ (RRR+) Project**
     - Generation of Activity Data (AD)
     - Calculation of Uncertainty

Step by Step mapping method

1. Testing of mapping methods

- **Four mapping methods for** developing an optimal method for land cover and forest cover mapping and change detection tested;
  - **•Decision tree classifier,**
  - **•Random Forest Classification,**
  - **• Supervised Classification – Maximum Likelihood;**
  - **•Disaggregation and aggregation of land covers**
- **Random forest was selected as it is open source, has higher accuracy, stores uncertainty .**

Step by Step mapping method

2. Data acquisition

- **Land Sat data from the USGS website was selected following the technical manual guidance**
  - **Availability at the USGS archive**
  - **Date of acquisition (Season)**
  - **Cloud cover percentage**

Landsat was selected because it is freely available, historical images are available, has medium resolution and it is already pre- processed.

Image Quality Assessment Report_2018.docx

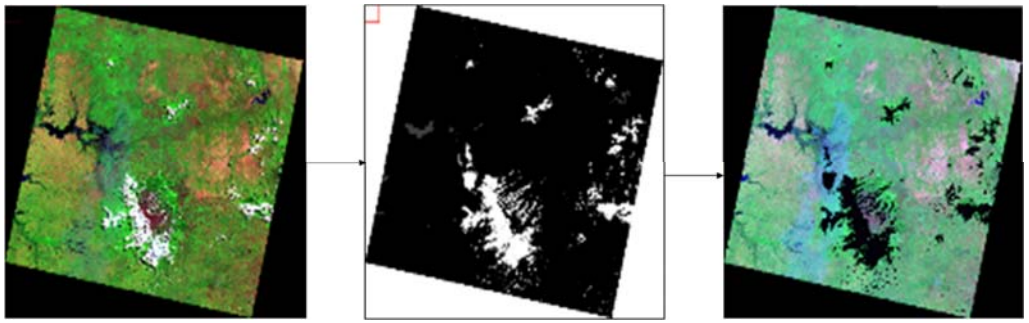
Step by Step mapping method

3. Data preparation

a) Cloud and Shadow masking

Masking (Removing) all clouds and their shadow

- **Used "cfmask" band from USGS**



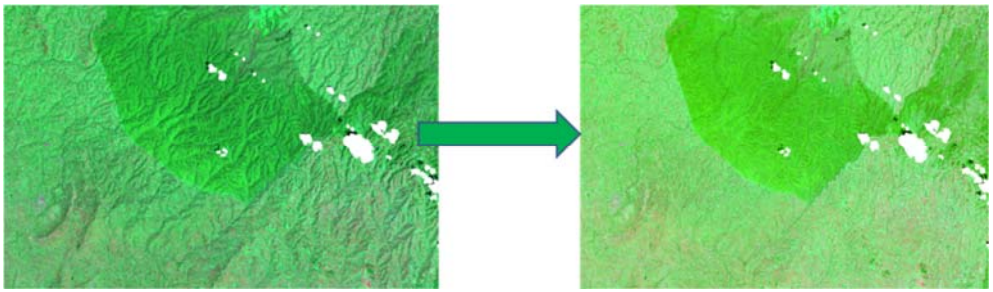
Raw Image | cfmask Band | Masked (Removed)Cloud

Step by Step mapping method

3. Data preparation

b) Terrain illumination Correction

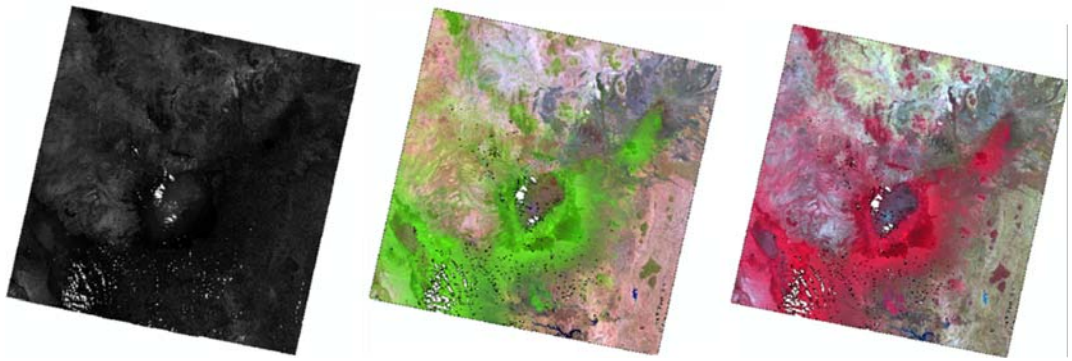
- **Affected by variations in slope and aspect**
- **The process corrects terrain illumination effects so that the same land cover will have a consistent digital signal**



Before TIC | After TIC

Step by Step mapping method

3. Data preparation
   - **Data processing followed Standard procedure from Survey of Kenya e.g. Layer stacking, Projection systems etc**
   - **Reprojection from UTM WGS 84 to UTM Arc1960 37 South**



Single band | After layer staking (True colour) | Processed (False colour)

3. Land Use Land Cover Classification

❖ **Land cover classes for LCC Mapping guided by the IPCC classification**

I. Forest
1. Dense Forest > 65% canopy cover
2. Moderate Forest 40 – 65% canopy cover
3. Open Forest 15 – 40% canopy cover

II. Cropland
1. Annual Cropland
2. Perennial cropland

III. Grassland
1. Open Grassland
2. Wooded grassland

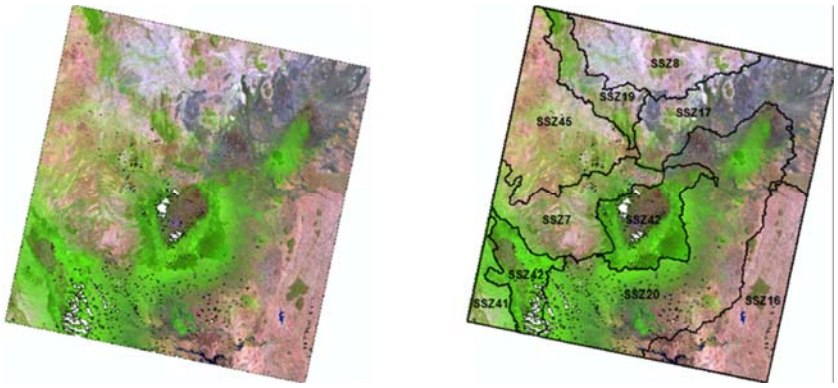
IV. Wetland
1. Open Water
2. Vegetated wetland

V. Settlement *(use of Auxiliary Data)*

VI. Other lands

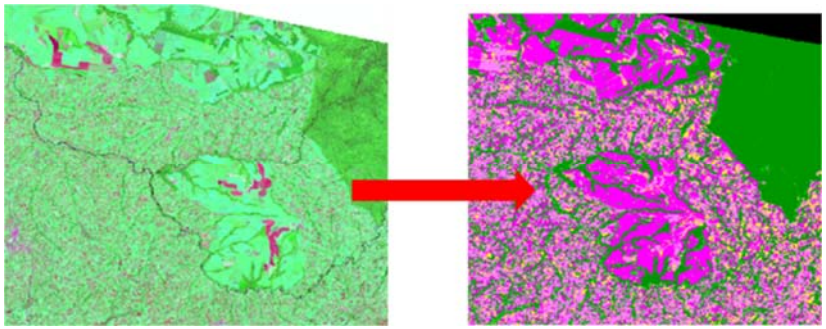
Stratification – spectral stratification zones

- **Land use land cover variations in Kenya**
- **Spectral Stratification Zones (SSZ) were initially based on Kenya's Agro-Ecological Zones later modified**



4. Classification using Random Forests

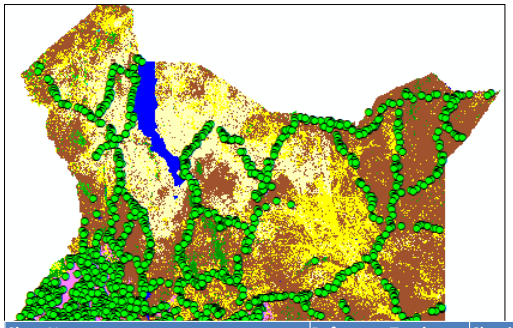
- **Running R-Scripts**



Landsat Image | *Output: Classified Image*

❖ QAQC – Both internal and External

❖ 2018_P168R062_QA_CORRECTIONS_20112018_V1.xlsx



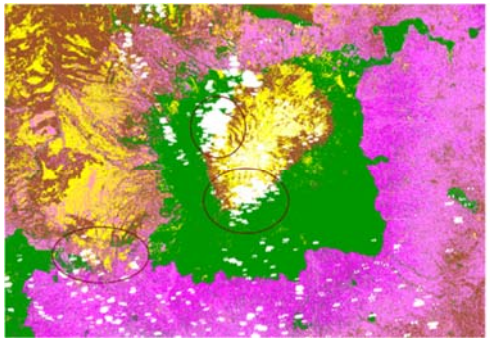
5. Accuracy Assessment

- **Checking the correctness of the map**
- **Sampling Procedure - *Proportionate stratified random***
- ***Use of High resolution images and Aerial photography***

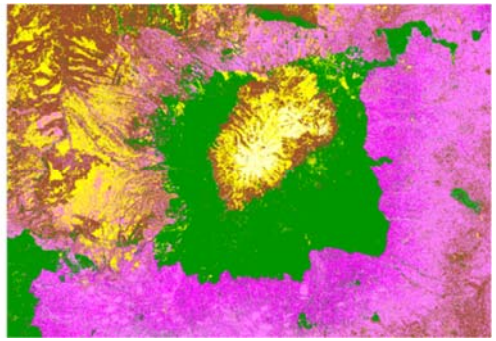
Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy
Dense Forest	270	232	171	63.33%	73.71%
Moderate Forest	213	174	87	40.85%	50.00%
Open Forest	152	118	51	33.55%	43.22%
Wooded Grassland	1084	1157	945	87.18%	81.68%
Open Grassland	499	599	413	82.77%	68.95%
Perennial Cropland	216	230	169	78.24%	73.48%
Annual Cropland	875	846	696	79.54%	82.27%
Vegetated Wetland	86	61	50	58.14%	81.97%
Open Water	41	36	30	73.17%	83.33%
Otherland	212	195	162	76.42%	83.08%
Totals	3648	3648	2774		
Overall Classification Accuracy =		76.04%			

5. CPN (Conditional Probability Network)

- **Due to data gaps a mathematical model known as a conditional probability network (CPN) is used to fill.**
- **It uses the time series maps and the probability bands developed during classification**



Before gap filling

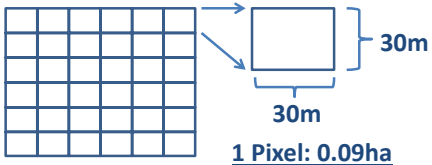


After filling with CPN

6. Image filtering

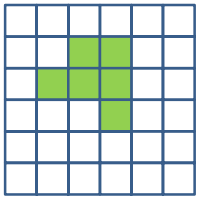
Image filtering is done to correspond with a country's forest definition.

In Kenya, a forest is defined with a minimum 0.5ha ,2m height and 15% canopy



1 Pixel: 0.09ha

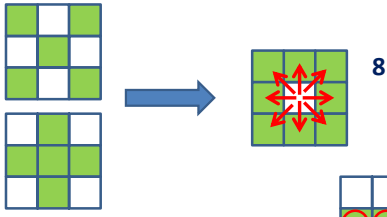
LANDSAT Imagery



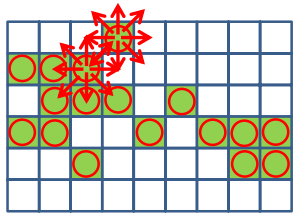
Forest area size: 0.54ha

Cluster Method

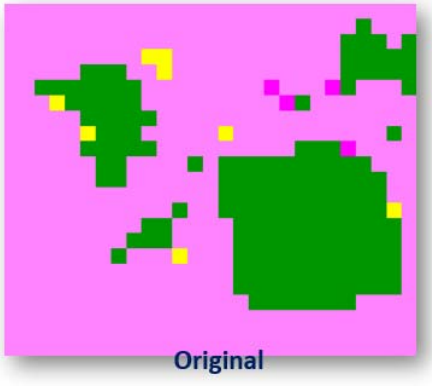
Searching for the forest cluster as same group

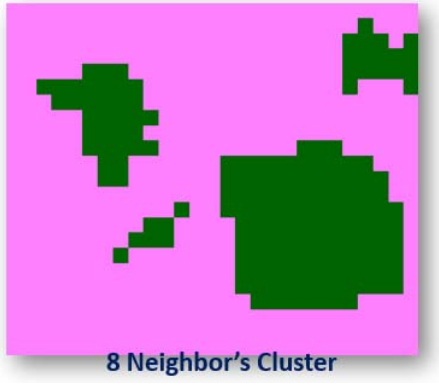


8 neighbor searching method

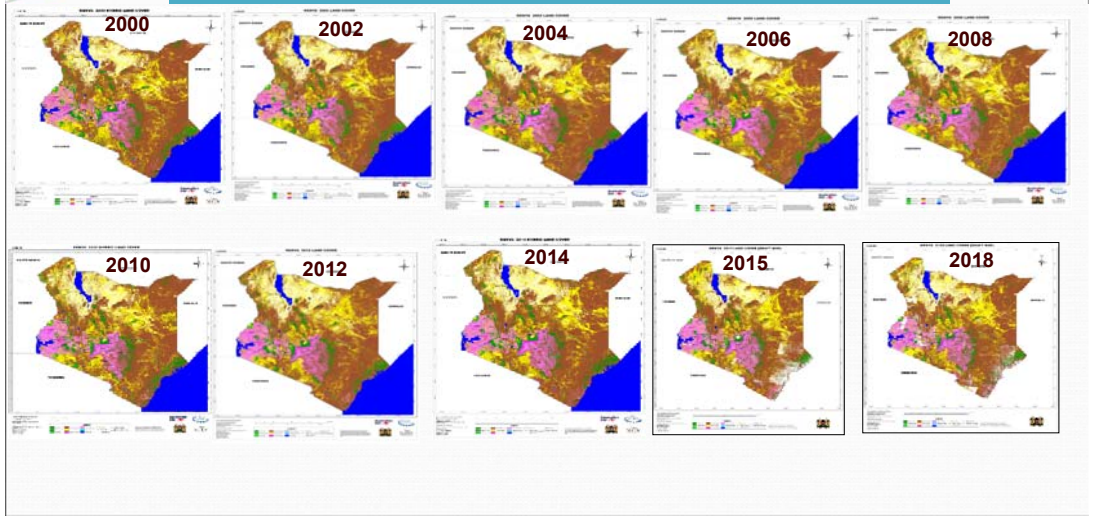


Example of Elimination





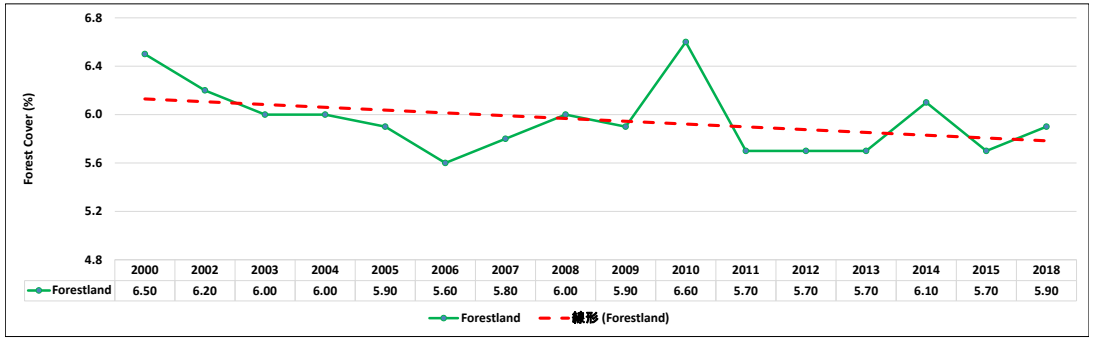
Land cover Time Series (2000 – 2018)



Proportion Land Cover 2000 - 2018

Land Cover	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2018
Forestland	6.50	6.20	6.00	6.00	5.90	5.60	5.80	6.00	5.90	6.60	5.70	5.70	5.70	6.10	5.70	5.90
Grassland	72.70	71.70	72.90	71.20	72.10	70.20	69.60	70.10	70.90	69.40	70.10	70.70	68.70	69.60	71.00	69.70
Cropland	7.50	8.90	7.60	8.90	8.40	10.30	10.90	10.00	10.10	10.20	11.20	9.60	11.10	10.50	11.40	11.40
Wetland	2.00	2.10	2.10	2.10	2.10	2.10	2.20	2.00	2.10	2.10	2.10	2.20	2.00	2.10	2.10	2.00
Otherland	11.30	11.10	11.40	11.80	11.50	11.80	11.50	11.90	11.00	11.70	10.90	11.80	12.50	11.70	9.80	11.00
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Trends in Forest cover 2000 - 2018



FRL ACTIVITY DATA

- 5 land cover maps (2002, 2006, 2010, 2014 and 2018) selected from the time series of 15 maps available for the period

Land Use Strata	2002		2006		2010		2014		2018	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Dense Forest	2,057,649	3.5	2,139,703	3.6	2,463,674	4.2	2,558,363	4.3	2,205,189	3.7
Moderate Forest	1,021,083	1.7	657,767	1.1	889,327	1.5	609,436	1.0	816,174	1.4
Open Forest	591,035	1.0	522,508	0.9	525,469	0.9	415,061	0.7	441,173	0.7
Sum Forests	**3,669,768**	**6.2**	**3,319,978**	**5.6**	**3,878,470**	**6.6**	**3,582,861**	**6.1**	**3,462,536**	**5.8**
Wooded Grassland	33,447,438	56.5	32,286,628	54.5	31,742,295	53.6	32,388,566	54.7	32,271,452	54.5
Open Grassland	8,985,269	15.2	9,299,024	15.7	9,331,841	15.8	8,821,893	14.9	8,980,656	15.2
Sum grassland	**42,432,707**	**71.7**	**41,585,652**	**70.2**	**41,074,136**	**69.4**	**41,210,459**	**69.6**	**41,252,109**	**69.7**
Perennial Cropland	281,755	0.5	299,776	0.5	261,821	0.4	299,727	0.5	284,357	0.5
Annual Cropland	4,995,761	8.4	5,798,968	9.8	5,800,963	9.8	5,901,652	10.0	6,455,816	10.9
Sum cropland	**5,277,516**	**8.9**	**6,098,743**	**10.3**	**6,062,784**	**10.2**	**6,201,378**	**10.5**	**6,740,173**	**11.4**
Vegetated Wetland	29,327	0.0	40,541	0.1	45,956	0.1	38,868	0.1	40,212	0.1
Open Water	1,212,707	2.0	1,177,785	2.0	1,215,342	2.1	1,223,689	2.1	1,227,320	2.1
Sum Wetland	**1,242,034**	**2.1**	**1,218,326**	**2.1**	**1,261,298**	**2.1**	**1,262,557**	**2.1**	**1,267,532**	**2.1**
Settlements & Otherland	**6,581,764**	**11.1**	**6,981,089**	**11.8**	**6,927,099**	**11.7**	**6,946,533**	**11.7**	**6,481,438**	**10.9**
Grand Total	**59,203,788**	**100**	**59,203,788**	**100**	**59,203,788**	**100**	**59,203,788**	**100**	**59,203,788**	**100**

FRL ACTIVITY DATA

- Land cover change analysis done to generate change data – Activity data

			2006												
			Montane & Western Rain Forest			Costal & Mangrove Forest			Dryland Forest			Plantation	Cropland	Grassland	Wetland	Settlement & Otherland
			Dense	Moderate	Open	Dense	Moderate	Open	Dense	Moderate	Open					
2002	Montane Forest & Western Rain Forest /	Dense	773,672	75,916	27,963								110,685	127,283	251	445
		Moderate	36,857	75,670	14,739								17,071	71,895	154	248
		Open	25,105	10,533	27,186								8,333	82,848	18	267
	Costal & Mangrove Forests	Dense				114,602	11,053	3,190					2,458	36,401	490	623
		Moderate				100,716	77,558	22,429					9,195	130,990	431	1,039
		Open				12,055	4,378	1,861					1,509	18,267	22	128
	Dryland Forest	Dense							303,805	32,124	21,397		38,529	301,166	1,933	2,465
		Moderate							107,414	84,438	21,236		17,244	220,465	2,309	1,868
		Open							43,048	22,420	62,831		8,668	248,377	1,452	10,672
	Plantation											62,292	4,248	12,622	9	9
	Cropland		37,067	3,719	2,655	300	583	102	16,223	1,679	5,441	5,520				
	Grassland		103,916	73,048	33,153	52,514	41,374	40,874	343,099	132,028	228,734	5,515				
	Wetland		205	61	23	513	576	368	2,229	1,768	1,835	10				
	Settlement & Other land		462	64	48	266	156	115	1,707	1,360	4,005	4				

Key Observations in Forest Cover Changes 2000-2018

- Forest cover has continually decreased over time;
- An average of 13,775 hectares of forest land lost per year between 2002 and 2018. Findings in line with other global observations;
- Kenya still on a slow deforestation path and requires a strategy to halt and reverse deforestation and forest degradation;
- Current trajectory suggests the need to propose additional and transformative measures to meet Constitutional obligations and implement global commitments on Climate change;
- Agriculture and settlements major drivers of deforestation in the country.

Memo of the proceedings of REDD+ Technical Working Group on development of FRL and NFMS for REDD+ held on 24th and 25th September 2016 at Blue Post Hotel.

In attendance;

1. Eunice Maina- KFS
2. Ali Mwanzei- PMU, SLEEK
3. Tom Kemboi- AWF
4. Maurice Otieno- NEMA
5. Faith Mutwiri- KFS
6. George Tarus- KFS
7. Florence Tuukuo- KFS
8. Serah Kahuri- KFS
9. Mary Kariuki- KFS
10. Kenichi Takano- CADEP-SFM
11. Kei Sato- Japan Consultant
12. Alfred Gichu- KFS
13. Jamleck Ndambiri- KFS
14. Peter Sirayo- JOFCA
15. Mercyline Ojwala- DRSRS
16. Nancy Mwangi- JKUAT
17. John Ngugi- KEFRI
18. Peter Ndunda- WRI
19. Phoebe Oduor- RCMRD
20. Mwangi Kinyanjui- Karatina University
21. James Kimondo- KEFRI
22. Peter Nduati- KFS

Day One- 24/11/2016.

The chair called the meeting to order at 10 a.m.

Eunice Maina offered to pray.

An introduction session followed.

Why the meeting for Redd+ Technical Working Group?

- See the products developed
- Make decisions on the products so as to aid in FRL and NFMS development.

Peter Ndunda, from World Resource Institute, joined and asked to introduce himself.

Agenda

Agenda 1: Presentation and discussion of work plan for FRL and NFMS

Presented by Peter Nduati, Component 3 Manager.

Objectives

-Develop NFMS and FIP using outputs produced in the past.

-Support capacity development of counterparts through the implementation of REDD+

-Develop system for periodical forest monitoring.

Indicators

-NFMS is established.

-FRL is established.

-Land cover- Land use map 2020 is created.

-Annual monitoring of forest cover done.

Discussion.

Mr. Gichu further explained on the component. He reiterated the importance of NFMS in tracking changes in forest degradation, deforestation, sustainable forest management and enhancement of forest carbon stocks- which he called restoration activities.

Phoebe from the Regional Centre for Mapping of Resources for Development arrived and was asked to introduce herself.

Mr. Kimondo sought an explanation on what OJT (On-Job-Training) meant. Mr. Gichu responded by informing him that experts from Japan would train counterparts (KFS, KEFRI, MENR and others) while on job so as to ensure monitoring of REDD+ activities is done from within, not outside.

Mr.Peter Ngugi then sought to know if ICFRA data was adequate to be used. Mr. Nduati then responded saying that ICFRA data was not adequate as there was no data on other forest types especially the coastal forests and western rain forests and so there would be a need to carry out inventory to enhance the data that is available. Mr. Gichu, further, added that data not available would be sought from other sources- studies carried out in the said areas and other projects carried out in the past.

Tea break- 10.35-10.55 a.m.

Agenda 2: Land cover change mapping.

Presented by Serah Kahuri.

Took the members through what SLEEK meant. It was a program implemented by the government of Kenya with support from Australian Aid to track land based emissions.

Key stakeholders involved were; KFS, SoK, DRSRS, African Wildlife Fund, KEFRI, RCMRD, JKUAT, Dedan Kimathi University, Karatina University.

ISO mapping standards; Mapping scale of 1: 100,000 and UTM projection.

Methodology applied;

-Data acquisition

-Testing

-Classification using Random Forest pixel based method

-Field validation

-CPN usage to fill data gaps.

Products;

-Country land use maps

-Land use change maps

-Canopy cover and canopy cover change maps

-County statistics

Accuracy assessment of the maps was 75-80%.

Discussion

Mr. Ndambiri proposed that the government of Kenya logo to be left alone so as the technical manual can be owned by the country. Phoebe reacted that the logos of the Australian Aid and Clinton Climate Initiative need to be maintained so as they can be recognised in the funding they provided.

Mr. Gichu then asked if there has been consistency in referencing following the IPCC guidelines in which case Phoebe answered that yes it has been continuous following the IPCC guidelines.

Mercyline also added that the document (SLEEK Technical Manual) is in the process of being published by DRSRS for, the process, for public use.

Nancy Mwangi from JKUAT asked the reason as to why the settlements were not captured in the maps since to her settlements might affect reporting on GHG. Mr, Ndunda responded that data from Ministry of Housing is not available and that as long as changes from land based cover, agriculture and forestry are included, there is no problem. Phoebe's reaction on the same was that forests in urban areas and other settlements are accounted for and that all settlements cannot be accounted for.

"Settlement" is classified as "Other" on the Land cover/Land use map. This "Other" includes artificial land such as Bare land and Settlement.

Mr. Gichu sought to know the meaning of CPN. Phoebe reacted by informing him that it is a prediction tool used to fill gaps where data is not available. The tool has been used in other countries like Indonesia and Australia and has worked well but since Kenya has got many categories of land cover, it posed a challenge in its usage.

The CPN that is used by Indonesia and Australia is working well because it has only 2 items (Forest or Non-Forest). In case of Kenya, it has 10 items. That is why the Kenyan result isn't very good as Indonesia.

Gichu then sought to be explained if FAO had issues with the maps created. Faith responded that they had been trained by FAO and had borrowed some accuracy assessment tools from

them. Mr. Ndunda further mentioned that FAO was involved in the process and that they looked at the maps and commented them to be good.

Mr. Ndunda then advised the members and proposed that the government of Kenya should not go for softwares that are supported by sponsors/ Institutions and when the project is done sustainability of the software would be a problem to the country as obtaining a license for the software would be a problem.

Nr. Gichu asked whether CPN had a copyright. Phoebe responded that there was but the licence will expire in five years after which they have to be bought, though expensive. She further reiterated that technology changes and UNFCC has not mentioned on the tool to be used and so as long as the process is explained, documentation and the steps are the ones checked by IPCC, and so there would be no problem in using any software.

Mr. Gichu then said that CPN can be used, for purposes of 1st FRL reporting, but when another tool would be in place in future it can be used.

Mr. Tarus then asked if there was any other tool that was used before CPN (Continuous Probability Network). Phoebe responded by saying that where data gaps were, for example for 1990, 1989 data was used manually to fill the gaps available.

Mr. Sato asked if the CPN was tuned for the Kenyan situation since there were many categories. Phoebe responded that the CPN was customized to fit the Kenyan situation adding that for other countries it was easy using it since categories are either forest or non-forest. Based on the same data filling by use of CPN, 16 maps were developed; 1990, 1995, 2000, 2002-2014.

Also he mentioned that not only the strata and the trend of the secular change but also the trend of the period is important for tuning.

Gichu pointed out that in PELIS areas, forestland would remain as forestland since clear felling does not imply deforestation, an area remains for more than 20 years without trees being planted again, and it is not to be changed to cropland as it is a temporary change due to co-managing of forests between KFS and the forest adjacent communities.

Agenda 3: Land use Land cover maps.

Presented by Faith Mutwiri.

No settlement map generated.

The original maps had no data due to clouds and stripping (use of Landsat 7 images caused it).

During the presentation, Mr. Gichu sought to know where cities were included in the categories listed. Faith responded that cities were distributed to other categories, except forestland, and that the highest percentage would fall under other lands' category.

Areas with no data would fit in any of the categories.

Lunch break 1-2p.m.

Use of CPN to fill the gaps posed a challenge as there was too much generalization.

Hybrid maps, a combination of original map and CPN map, created.

Cropland/ Agriculture data had a small percentage and Mr. Ndambiri asked what might be the reason. Faith responded that data from landsat may not capture cropland less than 0.2 ha and so that might be the reason for the small percentage in area.

Since there was an issue on the figures of the statistics data especially between 2008-2014, way forward on whether to use the hybrid maps needed to be obtained and as such; a committee was selected to look critically at the issues (key areas where problems were) especially the ASAL areas, which were the ones which had problems of no data in the original maps. The team would then validate the data. The team members selected comprised of; Phoebe Oduor, Faith Mutwiri, Mercyline Ojwala and Tom Kemboi.

Mr. Nduati then asked if an independent body can be sourced to verify the maps. Mr. Gichu responded that there was no need as all institutions have been involved in the Process.

Day one meeting adjourned at 1620hrs after a word of Prayer by Mr. Ndambiri.

Day Two- 25/11/2016.

9.30 a.m. meeting called to order by Mr. Gichu and Serah Kahuri offered to pray.

Followed by a recap of what was discussed the day before, by Mr. Tarus.

After the recap, Dr. Kinyanjui asked on the decision on the use of CPN since it was not put in black and white. Phoebe responded that there was no problem in using the tool since later on when another tool comes in place, it can be adopted as well.

Kinyanjui further explained that the tool would not be available in future and thus if used now and licence expires, using another tool would mean changing the maps and that would affect reporting since data would differ. It was, however, agreed and put on record that the CPN tool would be used now to fill the gaps but moving further when a new technology arrives, it would be adopted for use.

Mr. Maurice Otieno, from NEMA, sought to know how much it would cost a license for the next years as MENR Conservation Secretary had told him that he was keen on budgeting for the same. Mr. Gichu responded to him that the licence is there now for the next five years, and so if the ministry would cater for the period after the five years have elapsed, it would be fine. Mr. Nduati asked to know if CPN maps or Hybrid maps are the ones to be used for FRL. Mr. Gichu responded that Hybrid maps are the ones to be used but CPN ones would only be used to fill the gaps. Serah further added that CPN data and expert knowledge from the indigenous people would be both used in filling the gaps.

Tea break 10-10.20a.m.

Agenda 4: Land Cover Change Mapping: County Statistics.

Presented by Faith Mutwiri.

National forest gains and loss data between forestland and other categories (between 2010 and 2014).

From the data, forest loss was more than the gains. This was attributed to the unstable land use in Kenya.

2010 data had issues and Mr. Ndambiri sought to know if FPP data was used and so brought an increase in forest cover, of one percent compared to the following year. Eunice Maina responded that 2010 data represents reality on the ground as accuracy was done by FAO and found out to be 95%. Mr. Ndunda, however, said that the method that was used by FAO, to assess the data, was global and that it cannot represent the Kenyan situation.

Since 2010 data had issues and the presentation was not to be continued, the committee that was selected the previous day, was tasked with another responsibility of checking at the 2010 statistics to see the probable problem.

Agenda 5: Policy discussion on how to establish FRL (Jurisdictional versus national) and the pools to be assessed.

Presented by Mr. Tarus.

Stratification of forest types in Kenya into;

- Plantations
- Coastal and mangroves
- Dryland forests
- Western rain forests, montane and bamboo.

Figures on tonnes of CO2 equivalent per ha given on biomass (above and below ground), dead organic matter (dead and litter) and soil organic matter carbon pools were given. Asked if the data can be used as they are to create FRL.

Discussion.

Mr. Kinyanjui reacted to the presentation saying that the data presented only represents western rain forest and cannot be used to represent montane and bamboo as western rainforest is better stocked than the other two.

Mr. Gichu and Dr. Kimondo advised that more data should be sought to include Mt. Kenya and Aberdare as well as Mt. Elgon to complement the already available data from Kakamega forest and Mau forest.

Mr. Gichu then informed members that the figures to be used as they are or else default values (e.g. 310 for montane) can be used. However, he said that if the default values are used yet other pools had been left out, the values need to be reported. He further stated that Mr. Nduati to share ICFRA data in full and coupled with the ones available, the data will keep the process of developing carbon maps would be there.

Mr. Gichu informed the meeting that most countries have avoided soil carbon as they report their reference levels. In Kenya, soil carbon data is not adequate as forest land soil carbon data is only available. Inventory on other land categories need to be done.

Mr. Nduati then asked how changes on soil carbon can be reported in years to come as Mr. Kato seemed not comfortable with soil pools. Mr. Gichu answered by saying that where Japan

expertise has worked in, only 2 pools have been prioritised and stated that Kenya needs to include soil carbon as a pool. Mr. Kinyanjui further said that in UNFCCC guidelines, change in land use does not necessarily mean change in soil carbon pool. It takes 20 years for soil carbon pool to change.

Mr. Ndambiri asked how forest degradation assessment can be done. Mr. Gichu answered by saying that for forest degradation assessment, values for the forest classes (O/M/D) are there and can be used for the same.

Mr. Gichu commented that jurisdictional reference levels can be done first before national reference levels so as the benefits can be distributed based on performance of the regions. Mr. Ndunda, however, said that jurisdictional reference levels have implications with costs and resources but at the same time, it brings equity and allows communities to benefit from their actions.

Mr. Gichu summed it all by saying that further research and comments can be sought from experts (UNDP) on whether to first do sub national reference levels before national reference levels.

Any Other Business.

Mr. Ndunda pointed out that WRI and KFS are carrying out landscape restoration programme (5.1 mil ha for Kenya) and wanted to know if Kenya can have a monitoring system to assess the programme as well as REDD+ Readiness. Mr. Takano responded by saying that Mr. Kato will come January 2017 and a forum on the same can be organized.

Mr. Tarus sought to know the timeline on the deliberation by the small committee selected. Mr. Gichu reacted that Faith would convene the meeting and share on deadline after the meeting.

Mr. Kinyanjui asked if it is possible to start creating 2015 and/or 2016 carbon maps. Mr. Gichu responded that the facilitation might be a problem.

Mr. Ngugi asked if Emission Factor meeting can be convened to discuss on the same. Mr. Gichu answered that already that is already in the plan.

Closing remarks

The chair thanked all for availing themselves for the meeting and asked that the proceedings of the meeting to be shared latest Tuesday so as members can give comments for final minutes' preparation.

The meeting came to a close at 12.58 p.m. by a word of prayer from Eunice Maina.

REPUBLIC OF KENYA

Ministry of Environment and Natural Resources

Kenya Forest Service

Programme for REDD+ Technical Working Goupe Meeting

Date: 28th June 2017

Venue: Kenya forest service Boardroom

Purpose: Making decision of various requirements to develop FRL in Kenya.

Participants: Members of the Technical Working Group for REDD+, JICA Kenya Office, JICA Project Members, Other stakeholders.

Time	Topic	Contents	Presentation
9:00-9:10	Opening remarks		Mr. Gichu
9:10-9:30	Review of last TWG meeting	・Confirming of minutes	Mr. Gichu
9:30-9:45	Outline of FRL	・Requirements for FRL ・Progress of Kenya's FRL ・Timeline of Kenya's FRL	Ms. Fujimura
9:45-10:00	Tea Break		
10:00-10:20	Setting of AD	・Result of data screening ・Reference Time and Period ・Data points	Mr. Sato and Ms. Faith
10:20-10:40	Discussion		
10:40-11:10	Setting of EF	・Carbon pools included ・Tier level (country data(tier2) or default value(tier1)) ・Scope of gases	Mr. Yamashita
11:10-11:40	Discussion		
11:40-12:20	Setting of other requirements	・REDD+ Activity ・National Circumstance ・Construction method	Mr. Yamashita
12:20-13:00	Discussion		
13:00-14:00	Lunch Break		
14:00-14:15	FRL Documentation	・Process of documentation ・Draft contents	Mr. Yamashita
14:15-14:30	Discussion		
14:30-14:50	System for Forest Information Platform	・Conceptual design of system	Mr. Yamamoto
14:50-15:10	Discussion		
15:10-15:30	Way forward and closing remarks		Mr. Gichu
15:30-16:00	Tea Break		

PARTICIPANTS LIST OF TECHNICAL WORKING GROUP MEETING ON FRL SETTING		
DATE: 28TH JUNE 2017		
VENUE: KENYA FOREST SERVICE HEADQUARTERS, KARURA		
	Name	Organization
1	Alfred Gichu	KFS
2	Peter Nduati	KFS
3	Edward Juma	DRSRS
4	Mwangi Githiru	Wildlife Works
5	Mino Rand Rianarison	FAO
6	Dr.Eng. Benson Kenduiywo	JKUAT
7	Faith Mutwiri	KFS
8	Stephen Kiama	KEFRI
9	John Ngugi	KEFRI
10	Julius Muchemi	ERMIS
11	Felix Mutua	JKUAT
12	Eunice Maina	KFS
13	Okeyo Wilberforce	KFS
14	Tom Kemboi	AWF
15	Kenichi TAKANO	CADEP-SFM
16	Peter Ndunda	WRI
17	James Kimondo	KEFRI
18	Fredrick Mokua	GEOENVI
19	Florence Tuukuo	JICA REDD+ TEAM
20	Kazuhisa KATO	JICA REDD+ TEAM
21	Kei SATO	JICA REDD+ TEAM
22	Kohei YAMAMOTO	JICA REDD+ TEAM
23	Shintaro ISHIZUKA	JICA REDD+ TEAM
24	Sahori Fujimura	JICA REDD+ TEAM
25	Yoshihiko SATO	JICA REDD+ TEAM
26	Kazuhiro YAMASHITA	JICA REDD+ TEAM
27	Naomi MATSUE	CADEP-SFM
28	Abednego Osindi	CADEP-SFM

MINUTES OF REDD+ TECHNICAL WORKING GROUP (TWG)MEETING HELD AT KENYA FOREST SERVICE HEADQUARTERS ON 28TH JUNE 2017

MIN 1/28/06/2017 INTRODUCTORY REMARKS

The meeting was called to order at 9.35 am by National REDD+ Coordinator Mr. Gichu who requested Mr. Stephen Kiama to start off with a word of prayer. He then went ahead to ask participants to introduce themselves. After introduction, Mr. Gichu gave a brief introduction of the day's Agenda stating that the purpose of the meeting was to make decisions on various requirements to develop FRL in Kenya which would inform JICA team on the way forward on construction of FRL and NFMS.

MIN 2/28/06/2017 REVIEW OF PREVIOUS TWG MINUTES

Mr. Gichu called on Mr. Nduati to take the participants through minutes of last TWG meeting which was held in Naivasha on 28th and 29th March 2017. Mr. Nduati consequently, read through the minutes in assistance with Mr. Gichu who in addition to explaining issues discussed previously and the conclusions reached at; stated that FRL needs to be developed with engagement of relevant stakeholders adding that FRL Report it will be assessed in March 2018 thus should be submitted by January 2018 with a notification through National Focal Point having being made by Oct 2017.

From the minutes, it was specified that Stakeholders Consultations Workshop turned into a TWG and Mr. Gichu on TWG members to develop NFMS that will cater for wider stakeholder's engagement where he proposed that more space needs to be created so as to bring relevant stakeholders on board.

Reactions

Contents of the minute were accepted but it was noted that the list of participants was missing from the minutes and members agreed that participants list should be included in all minutes because it informs on what stakeholders attend a meeting.

A concern was raised on the status of NFMS roadmap where Mr. Gichu answered that development of the roadmap was done with support from FAO and it aims to help the country in establishing FRL, he said that the document is available in soft copy and that he would share it with the participants.

MIN 3/28/06/2017 OUTLINE OF FRL

Ms. Fujimura enumerated the outline of setting FRL in Kenya highlighting:

i. REQUIREMENTS OF FRL

In this section, requirements for setting FRL in Kenya were outlined which formed basis for TWG discussions these are;

- Scale
- Forest Definition
- Forest stratification

- Scope REDD+ Activities
- Scope Carbon pools
- Reference Time Period
- Historical data
- GHGs Gas
- Construction Method
- National circumstance

ii. PROGRESS OF KENYA'S FRL

Ms. Fujimura then gave a summary of the requirements that have already been decided upon i.e. ***scale, Forest definition and Forest stratification***. All the other requirements needed decisions to be made at the TWG meeting.

iii. TIMELINE OF KENYA'S FRL

An outline for schedule on development and submission of FRL to UNFCCC was given which made it clear that by mid- Sep calculation of Activity Data should be done, this will be possible if data analysis is efficiently carried out by both Japanese side and Kenyan side to develop FRL on time.

iv. FRL SETTING PROCEDURE

As presented by Ms. Fujimura, setting FRL involves three steps;

Step 1) Decision making on various requirements of FRL

Step 2) Analysis of historical data (AD and EF)

Step 3) Combining AD and EF

Reactions

Mr. Gichu emphasized that decisions on each requirement of FRL should be made with an understanding of problems in forestry and what the requirements are to meet i.e. the purpose to be served by each requirement.

MIN 4/28/06/2017 SETTNG AD

MIN 4.1 /28/06/2017 RESULTS OF DATA SCREENING,

Ms. Faith from Forest Information System section gave a presentation on results of data screening, from the previous meeting, all images had been identified to have used the best images but a recommendation was made for screening the data to determine cloud cover and stripping effect and hence give opinions based on the results obtained about appropriate reference period.

Ms. Faith stated that all the images for the period of 1990-2014 were checked and striping was examined for each Landsat image used to identify how good the image used in developing the maps was. This was based on the fact that the quality of Land Cover/ Land Use Map by image classification

is affected by the quality of source data which is satellite imagery. Landsat 8 and Landsat 5 are not affected by stripping while Landsat 7 is affected hence the stripping identified was from Landsat 7. Landsat 4 scene is not affected by stripping effect but its affected by cloud cover.

Stripping of images started in 2004 after failure of Landsat 7 in end of May, 2003. From analysis carried out, after combining 'No Data' with 'stripping effect', the years with best images were identified which are coloured in green these are; 1990, 2000, 2002, 2003 and 2014. Second in rank were marked in yellow i.e. 1995, 2010 and 2013 the rest didn't have very good images.

From examination, the recommended years as reference years are 1990, 2000, 2010 and 2014. This was illustrated in Forest Cover Ratio Graph based on Recommendable Reference Years.

Reactions

Mr. Felix sought to know whether the maps were borrowed from those developed for SLEEK or if they had been selected from a different project. Where Ms. Faith clarified that all the maps including methodology were borrowed from SLEEK.

He also noted that from the graph, there was a very big drop from 2000 to 2010 and a discussion ensued with Mr. Sato stating that the difference is 0.3% but the scale that was used on the map caused a big difference to be depicted.

Mr. Kiama inquired if using a period of 24years (1990-2014) is acceptable making reference to requirements of time period and whether it should be limited to 15 years. Mr. Gichu responded stating that it was acceptable. Mr. Kiama was also concerned about the interval between epochs where Mr. Gichu opined that it is up to the TWG to make decision whether it was suitable.

Mr. Benson inquired if beyond stripping there was harmonization of problems that emerge due to seasonality encountered during analysis. Ms. Faith retorted that the analysis was limited to dry season (Jan-Mar) and (Aug- Sep) which allowed images to be harmonized without much cloud cover effect. Also, CPN was used to deal with 'No data' areas.

Mr. Mwangi asked if it is possible to capture what happened between 1990 and 2000 that led to rise in the graph and what is on the ground that is causing the changes in forest percentage, so that it can be easy to identify where forest change occurred stating that it could be used to project into what will happen in future. Ms. Faith responded that after setting Activity Data, next task will be to generate changes to depict what changes within forest area to what and percentage of change.

Mr. Kato inquired whether to use average method for projection into the future in case there was no trend in making regression projection. Mr. Mwangi stated that the choice between linear method and other methods depend on understanding of what causes changes at the ground.

Mr. Jamleck opined that between 1990-2000 in forestry sector there was so much deforestation caused by government regime that was in place at that time while since 2001 forest area has been increasing. Mr Gichu interjected that the activity at hand was aimed at determining whether the images were accurate stating that reasons for changes will be discussed at a different forum. He also added that KFS manages all forests on wall to wall basis not public forests only.

A question was raised whether there is consistency in years within which images that were acquired by Forest Preservation Programme and JICA REDD+ analysis. Ms. Faith stated that resolution and methodology are different. Ms. Mino from FAO suggested that data available should be compared with available global data to be sure about consistency since internationally available data will be

used to check for consistency at Technical Assessment. In addition, Mr. Ndunda said that foot note could capture reference to international data pointing out Global Forest Watch.

MIN 4.2 /28/06/2017 Image Filtering

Mr. SATO gave a presentation on how images can be filtered by stating how images are captured versus forest definition.

Forest definition: A Forest is a minimum area of land of 0.5 hectare with a Canopy cover ratio not less than 15 percent and trees with the potential to reach a minimum height of 2 metres at maturity.

In this definition, area of more than 0.5 hectare which meets forest definition has to be composed of at the least 6 pixels where 1 forest pixel equal to 0.09 hectare. Mr. Sato gave a presentation on the methods that can be used to gather forest class of pixels as cluster for filtering of unsatisfied forest definition. He explained cluster searching methods

i. 8 neighbor searching method
ii. 4 neighbor searching method

These methods eliminate pixels which are less than 6 pixels.

Reactions

Mr. Benson said that by using post classification method results to inconsistency generated by algorithm used and propagated by the errors of classification. Adding that whichever method is chosen propagation of errors will occur leading to missing of details, random forest classification was used and filtering was applied to take out the errors and thus recommended for use of contextual classification but this method brings about algorithm complications. Hence, he opined that 8 searching method could be chosen.

Mr. Felix sought whether it is possible to approximate uncertainties so as to know amount of loss that occurred on forest and the response was that initial classification could be used to understand what has occurred on forests then filter to get changes that have happened in forestry.

Mr. Ndunda stated that random forest assessment has a large ability to capture changes in forests. But he was concerned about pixels and forest definition in terms of distribution of those pixels within 15% and 0.5ha of forest land. After a detailed discussion, it was agreed that forest definition relates to pixels that are contiguous and fit into definition of a forest.

In conclusion, 8- neighbor searching method was settled at in the light that it does not matter where the pixels are as long as they are within 0.5 ha and 15%.

MIN 5/28/06/2017 SETTING EF

MIN 5.1 /28/06/2017 Scope Carbon pools

Mr. Yamashita stated that AGB and BGB had already been decided upon then gave a brief description on soil organic carbon pool, stressing that IPCC guidelines 2006, recommend use of default values for setting Soil Organic Carbon pool in Tier 1 level which requires estimation of annual change in carbon stocks in soil requires to set Stock change factors. The Stock change factors consist of a land-use factor (FLU), a management factor (FMG), an input factor (FI). The factors need input from several other information. Therefore, further research needs to be carried out to set Soil Organic Carbon pool for Kenya. He also mentioned that SOC would be determined by taking into

consideration climate region and Soil classification. These two should be set prior two acquiring reference carbon stocks.

He stated that decisions needed to be made on Stock Change Factors. From Second National Communication, there isn't enough data about soil carbon where and it has description but there are no details on Soil Carbon Pool. He added that Soil Organic Carbon pool need to be decided upon by 7th July for it to be included in FRL keeping in mind requirements from IPCC on submission of FRL. Due to the tight timeline, stating that he would like to have all the data that is needed for FRL setting.

Mr. Gichu opined that Soil Organic Carbon Pool was captured in National Greenhouse Gas Inventory while saying that even if REDD+ doesn't include this pool for now, another organization may have to research deeply on the same. He therefore invited Mr. Fredrick from GEOENVI who is doing consultation work for NGHGI to do a brief presentation on information available hence assist in decision making on the issue at hand.

In his presentation, he gave an introduction on IPCC guidelines in regards to SOC in Tier 1, which assumes that mineral soil carbon stock density on land that has been forest for at least 20 years will be equal to the mineral soil carbon stock density under native vegetation for the relevant climate and ecosystem type also assumes that where there are transitions to or from another land use, the mineral soil carbon stock density on the other land use in question will be that value times a relative carbon stock change factor depending on the land use, the level of management and the climate.

Where soil-related emissions are key, countries should aim to apply higher Tier methods. He stated that Kenya falls under this category and said that NGHGI is using Tier 2 method which requires soil maps but the spatial resolution should be enhanced with consideration of management practices. Soil data, Land cover and maps are available and the challenge remaining is that multipliers for management practices are not explicit. Inventory software (IPCC 2006) is applied in GHGI. he suggested that a pilot inventory on soil needs to be done (similar to pilot forest inventory on Forests) so as to ascertain climate regions and soil categories.

Reactions

Mr. Gichu inquired about level fluxes expected in changes occurring for example converting forest to non-forest, Fredrick responded that equations provided in the previous presentation by Mr. Yamashita are applicable in calculation on SOC.

There was a suggestion that Kenya could buy time by providing the available background information on current status of Soil Organic Carbon pool which he said could lead to acquiring support to collect data required for its inclusion in future FRL. He added that work on Soil carbon needs to be spearheaded by a government organization with the Mandate to deal with soil related matters e.g. Kenya Agricultural and Livestock Research Organization (KALRO) or Ministry of Agriculture which could convene a meeting to decide on the way forward where data provided by Fredrick could be used to form basis on what is to be focused on.

Mr. Ngugi suggested that a sub-committee to work on SOC pool be composed where information can be acquired from Fredrick and in agreement Mr. Ndunda added that the sub-committee should consult with the group that worked on Soil in SLEEK program.

Mr. Ngugi from KEFRI stated that timeline was squeezed and that development of SOC may not be achieved because data available is only from ICFRA programme. Also, the complexity of setting SOC was not left out stating that it could lead to it being left out for REDD+ but it could be captured in GHGI.

Mr. Kato suggested that KEFRI can carry out investigation as to whether soil is important or not and this was agreed upon.

In conclusion, TWG decided that soil carbon pool would be removed from the development of first FRL to be submitted in January 2018.

MIN 5.2 /28/06/2017 GHGs Gas

CH_4 is emitted from biomass burning and inclusion of CH_4 in FRL reporting depends on whether forest fires are drivers of deforestation, it is also emitted from Mangroves soil and it should be identified through attribution. The data of area information and mass of fuel available for combustion (Biomass(tonnes/ha)) are needed to calculate for CH_4.

As discussed, CH_4 should be included only when forest fires are identified as significant driver of deforestation. Mr. Yamashita stated that data on forest fires is not available which makes it difficult to include CH_4 in FRL. CH_4 released from soil is not to be considered for the initial FRL following the decision made on SOC. Looking at forest fires, data for areas that are not managed by KFS is not available and considering National Scale, For mangroves, there is no default data to capture CH_4 in the forest land from 2006 IPCC Guideline, thus CH_4 from this stratification cannot be included.

After wide discussions, it was concluded that CO_2 gas only will be captured in the FRL for Kenya.

MIN 5.3 /28/06/2017 EF

Emission factor values will be calculated for changes from forest land to non-forest land. It will be calculated as;

Emission Factor (Forest land to non-forest land) = CO_2 amount (Forest land) - CO_2 amount (Non-Forest land).

Mr. Yamashita then gave an outline on Biomass stock, Carbon stock and CO_2 on forestland for country data based on the pilot inventory by ICFRA and JICA so as to set EF, then also gave a description of two suggestions which can be applied in calculation of EF in case of using default value as Tier 1. i.e.

- **Suggestion1**: EF (CO_2 amount calculated by averaging **Default data** using each researched place information)
- **Suggestion2**: EF (CO_2 amount calculated by selecting **Default data** from among default values)

He also gave an explanation on how averaging default data is done using both suggestions and recommended for Kenya to use suggestion 2 adding that Suggestion 1 shows using different default data by researched area information. Default data should be used as it is. Further, he explained that

advantages and disadvantages of country data are Consistency of forest stratification and Reliability of the DATA, while those of Tier 1 are Reliability of the Data and Consistency of forest stratification, respectivley.

Reactions

Mr. Gichu inquired about experts involved in calculation where Mr. Yamashita said they worked closely with forest inventory experts during the pilot inventory and calculation process.

Mr. Mwangi asked if the country data available was based on 137 plots that were covered in pilot inventory and whether it is able to capture national level information. Mr. Yamashita responded that number of plots (137) is not enough for setting reliable EF adding that Kenya has decided to use the available country data. However, there were a decision to use the country data for setting FRL without enough reliability of the number to have researched and a decision to use the Default data in the last TWG meeting on March 2017.

Some members suggested that inventory data from various projects should be combined and used as country data but this should be done if the inventories were based on same method of ICFRA and SLEEK classification.

A decision was reached at to focus on country data based on the pilot inventory by ICFRA and JICA hence doing away with comparison with default data but if Technical Assessment rejects use of Country Data then default data can be applied.

MIN 6/28/06/2017 SETTING OTHER REQUIREMENTS

AGENDAS for other requirements of FRL setting

MIN 6.1/28/06/2017 AD Definition

Mr. Yamashita gave an outline of stratification that had been decided upon for Non- forest as follows;

- Wooded grassland＋Open grassland→Grassland
- Vegetated Wetland＋Open Water→Wetland
- Other land→Other land, Settlement
- Annual cropland＋Perennial cropland→Cropland

Mr. Gichu agreed that these was the reclassification adopted.

MIN 6.2/28/06/2017 Scope REDD+ Activities

Decision needed to be made as to whether REDD+ Activities would be defined by use of a matrix, these activities include;

- Deforestation
- Degradation
- Sustainable management of forest
- Enhancement

The change matrix would be used to determine the changes that occur with forest areas and how the activities will be assigned to areas of change.

Reactions

Mr. Gichu gave an explanation on how the matrix will be applied in detecting conversions of forest between different stratification types and also stated that REDD+ aims at suggesting that sustainable forest management can be used to cover all the transition from Plantation to Non forest in the Public forest and from Non forest in the Public forest to Plantation.

The participants agreed to use the matrix in determining REDD+ Activities.

MIN 6.3/28/06/2017 Construction method

Mr. Yamashita gave a description of two construction methods; i.e. average method and regression method, the method should be chosen taking into consideration forest area change and the rate of change. From his presentation, it was clear that forest area change and rate of change of forest are fluctuating hence he proposed that average method to be used.

After Mr. Yamashita explained how average emission calculation is done to get 3 values by consideration of reference period of 1990- 2014, in this method; 1990-2000, 2000-2010, 2010-2014 form the three values to be averaged.

Average method was proposed as method for FRL construction as. Given the following reasons:

a) The values of forest area change and forest change area rate show fluctuation.
b) The values of forest change area rate for each year cannot be found.
c) The conditions of the data show that there is no trend for regression.
d) Analysis of drivers of deforestation is required for the regression method.
e) Time line until FRL report submission due date is very tight.

Reactions

Mr. Gichu opined that average method is easy but doesn't seem very useful for Kenya. Here, Mr. Kato explained that even if National Circumstance are used the regression method is difficult because there is no tendency in historical trend. Mr. Kiama opined that with the four points only, the average method can be used and improved using current circumstances.

After conclusive discussions, it was decided that the average method be used because it will give average emission rate for forestry sector.

MIN 6.4/28/06/2017 National circumstance

Mr. Yamashita gave a discussion on national circumstance with two examples to be considered in the case of Kenya, saying that analysing of the data need to be correlated with forest change e.g. how population change has affected change in forest area. Further, he added that there was no correlation between the two and that it is difficult to find National Circumstance. Given the timeline is very tight. The team will not be possible to revisit calculation of FRL where analysing the whole process again in September due to taking a lot of time for it.

Reactions

Mr. Julius suggested that direct national circumstances should be looked into given the fact that National circumstance issue is complex, he stated that the team could look into submissions that have been done by Madagascar hence Kenya could borrow from them in setting National Circumstances for small areas.

Mr. Mwangi opined that National development plan captures plans like Standard Gauge Railway and thus information on what has been done on forestry by the project and how enhancement will be done.

Mr. Kato reminded participants that FRL setting has a timeline and that inclusion of National Circumstances require huge analysis also adding that small area calculations cannot be used to represent National Circumstances. In addition, he suggested that Japanese side should support the consideration of national circumstance which Kenya side initiatively consider.

Mr. Gichu said that FRL document is required to project what is likely to occur in future and it is aimed at REDD+ implementation thus it should be developed in the knowledge that it should not be sub-standard document, he also went ahead to propose that JICA team and Kenya team need to consult further on projection of economic modules into the future.

He asked Mr. Kato to find out whether it is possible to get more support to FRL construction to avoid development of sub-standard FRL which can be discussed broadly in September's TWG. This was agreed upon for further deliberations in September.

MIN 7/28/06/2017 FRL DOCUMENTATION

AGENDAS for FRL Documentation

MIN 7.1 /28/06/2017 Process of Documentation

The process takes three steps;

i. Draft making

As requested by the Kenyan Side, JICA team will assist in documentation process until it is complete. JICA team suggests that after the TWG meeting /Workshop of FRL setting in the middle of September, it will make the first draft of FRL report in collaboration with KFS by the end of September.

ii. Finalizing FRL document

After making the first draft, a Workshop will be held in the middle of October with participants being drawn from FAO and other relevant Stakeholders to discuss on the need for revision of the first draft after which the draft will be improved by JICA team in collaboration with KFS.

iii. Notification to UNFCCC

Notification for submission of FRL to UNFCCC must be done by 31st October for assurance of submission of the report. However, revision of the document will be continued until November.

MIN 7.2 /28/06/2017 Table of Contents of Draft FRL Report

Mr. Yamashita gave an outline of the contents to be captured in FRL Report as below;

1. Introduction

2. Definition
3. Scope
    3.1 Activities
    3.2 Carbon pools
4. Reference period
5. Scale
6. GHGs Gas
7. Historical data (Activity Data)
8. Emission Factor
9. Construction Approach Method
10. National circumstances
11. Forest Reference Level

Reactions

Mr. Gichu asked if this was consistent with what other countries have done, where Mr. Yamashita said that he had looked into reports from Uganda, Papua Guinea, Zambia and Vietnam then Mr. Gichu suggested for him to look into Ghana's report.

About the annexes required in the report; documents on minutes, calculations, technical manuals used in data construction could be included in the report. Also, in Decision 13 CP.19 contains description on contents to be included in FRL report.

An agreement was reached at the first draft can be shared with participants if it will be ready by middle of September after which a TWG can be convened to discuss the document at a date that will be set later.

MIN 8/28/06/2017 SYSTEM FOR FOREST INFORMATION PLATFORM

Mr. Yamamoto gave a presentation on outline of System of forest management, he stated that his presentation was seeking advice on challenges that have been encountered in developing System for Monitoring Forests. The challenges are;

I. Open Folis Collect program was developed by ICFRA project which ended in 2015 and operation lacks uniformity hence there are operational problems.
II. There arise difficulties in trying to link the System with current Forest Management Information System.

He also gave two options that could solve the challenges i.e. modification of the existing tool or develop a new too stating in addition their advantages and disadvantages;

Modification of existing tool

Merit

- To reduce preparation of system operation environment and training

Demerit

- Necessary additional development that is unified inventory data management tool (which includes exclusive control)
- Increasing of operational work such as generation of survey point of geo-spatial information, submission of survey result data to the server, etc. it will be accompanied by risks such as human error, change of responsible people, etc.

Development of new tool

Merit

- Checking the field with maps and automatic acquisition of ground data with GPS
- To reduce system development cost and to manage data including high quality exclusive control, using the existing function for data registration of ArcGIS Server

Demerit

- Necessary new system development (including GUI) although database definition is similar to the one on current system
- Necessary preparation of system operation environment and training newly

Reactions

Mr. Gichu inquired from the expert what was more appropriate for Kenya who suggested for use of the Relational Database Management Software which is less expensive. However, Mr. Felix opined that an understanding of the processes is required prior to deciding on what option to take up.

After detailed discussions, participants agreed that a sub-committee would be set up to work on the discussions whereby stakeholders to bring in technical advice on the issues will be involved.

MIN 9/28/06/2017 CLOSING REMARKS

The chairman (Mr. Gichu) thanked participants for their contribution in the TWG and requested Ms. Faith to end the meeting with a word of prayer.

Meeting was adjourned at 4.45pm.

Table of contents

- Requirement of FRL
- Progress of Kenya's FRL
- Timeline of Kenya's FRL
- FRL setting procedure

Table of contents

- Requirement of FRL
- Progress of Kenya's FRL
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Requirements of FRL

- **Scale**
- **Forest Definition**
- **Forest stratification**
- **Scope REDD+ Activities**
- **Scope Carbon pools**
- **Reference Time Period**
- **Historical data**
- **GHGs Gas**
- **Construction Method**
- **National circumstance**

Table of contents

- Requirement of FRL
- Progress of Kenya's FRL
- Timeline of Kenya's FRL
- FRL setting procedure

➢ Progress of Kenya's FRL

Decided requirements of FRL

- **Scale**: National
- **Forest Definition**: Forest is a minimum area of land 0.5 ha with tree crown cover (or equivalent stocking level) of more than 15 percent with trees with the potential to reach a minimum height of 2 meters at maturity in situ.
- **Forest stratification for Kenya**:
- a. Stratification on the basis of canopy cover percentage of: Open(15-40 %),Moderate(40-65 %), and Dense(above 65 %)

  * In the case of EF as Tier 1 data, Canopy cover percentage is not considered.
- b. Natural forest with sub-stratification into;
  - i. Coastal forest and Mangroves
  - ii. Montane forest/Western forest/Bamboo
  - iii. Dryland forest
- c. Plantation (KFS plantation boundary);

➢ Progress of Kenya's FRL

Requirements of FRL to decide

- **Scope REDD+ Activities**
- **Scope Carbon pools**
- **Reference Time Period**
- **Historical data**
- **GHGs Gas**
- **Construction Method**
- **National circumstance**

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- Requirement of FRL
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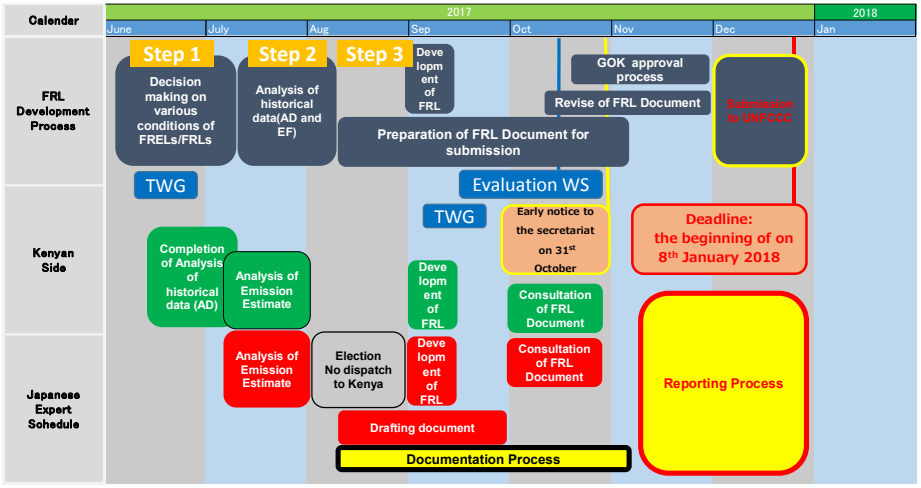
- Timeline of Kenya's FRL
- FRL setting procedure

➢ Timeline of Kenya's FRL Plan for TOR

Outline of schedule for development and submission of FRL to UNFCCC



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- ➢Requirement of FRL
- ➢Progress of Kenya's FRL
- ➢Timeline of Kenya's FRL
- ➢FRL setting procedure

➢ FRL setting procedure

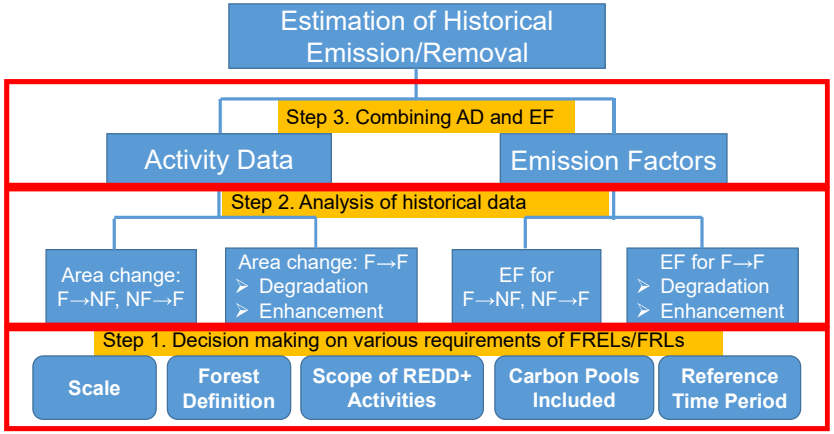
Three steps for FRL setting

Step 1) Decision making on various requirements of FRL

Step 2) Analysis of historical data (AD and EF)

Step 3) Combining AD and EF

Historical Emission Estimate for REDD+



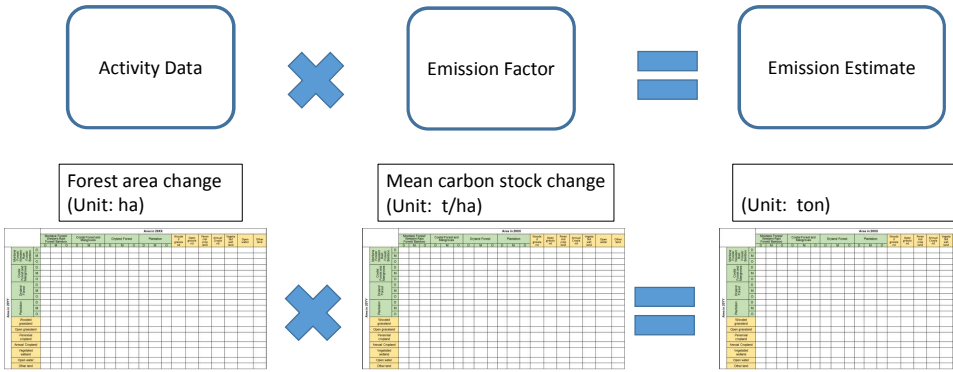
F: forest
NF: non forest
EF: emission factor

Source: Meridian Institute, 2011 (modified)

➢ FRL setting procedure

Combining AD and EF

Forest Reference Level （FRL)



Thank you for your attention.

REPUBLIC OF KENYA
Ministry of Environment and Natural Resources
Kenya Forest Service
REDD+ Technical Working Group Meeting

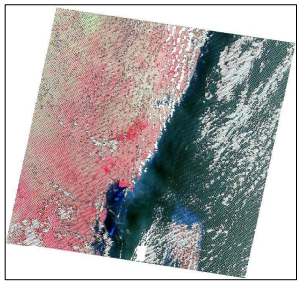
Date: 28th June 2017

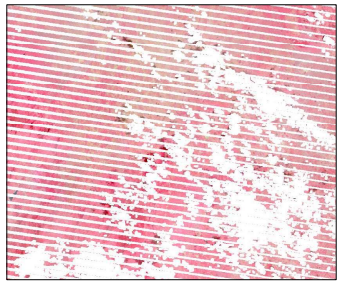
By Faith MUTWIRI and Kei SATO

Result of Data Screening for SLEEK Time Series Land Cover / Land Use Map

Why do we need the data screening?

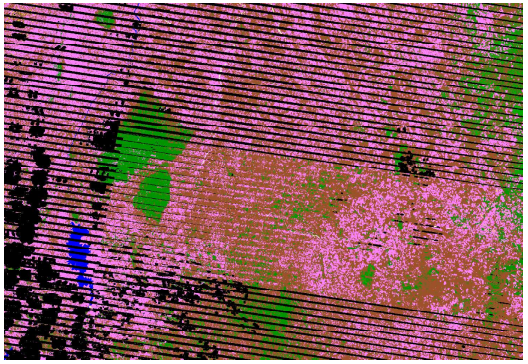
- **The quality of Land Cover/ Land Use Map by image classification is affected by the quality of source data which is satellite imagery.**
- **So the good quality satellite imagery shall be utilized**
- **Stripping is from end of May 2003**



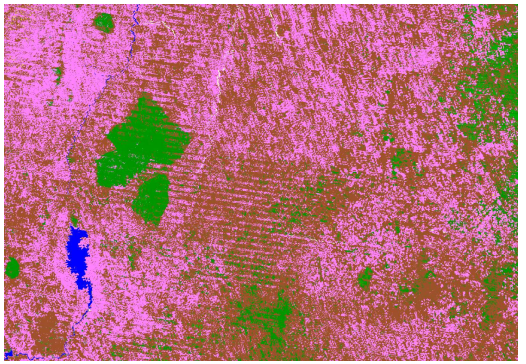


Stripping effect on classification

2006 Land cover Land use map



Before CPN



After CPN

Result of data screening and Recommendable Year

	1990	1995	2000	2002	2003	2004	2005	2006
No DATA (%)	10.59%	14.35%	6.50%	6.53%	8.56%	23.77%	20.86%	23.13%
LANDSAT4 (scene)	26	0	0	0	0	0	0	0
LANDSAT5 (scene)	8	34	0	0	0	0	0	0
LANDSAT7 (scene)	0	0	34	34	34	34	34	34
Missing scenes	0	0	0	0	0	0	0	0
LANDSAT8 (scene)	0	0	0	0	0	0	0	0
Stripping Effect (scene)	0	0	0	0	0	34	34	34
Ratio of Stripping Effect (%)	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**100.00%**	**100.00%**	**100.00%**

	2007	2008	2009	2010	2011	2012	2013	2014
No DATA (%)	26.14%	28.00%	15.85%	6.81%	12.51%	20.85%	16.98%	3.75%
LANDSAT4 (scene)	0	0	0	0	0	0	0	0
LANDSAT5 (scene)	0	0	11	24	15	0	0	0
LANDSAT7 (scene)	34	34	23	9	19	34	13	0
Missing scenes	0	0	0	1	0	0	0	0
LANDSAT8 (scene)	0	0	0	0	0	0	21	34
Stripping Effect (scene)	34	34	23	9	19	34	13	0
Ratio of Stripping Effect (%)	**100.00%**	**100.00%**	**64.60%**	**26.50%**	**55.90%**	**100.00%**	**38.20%**	**0.00%**

10 Year's epoch shall be utilized and 2014 as recent Activity Data

Forest Cover Ratio Graph based on Recommendable Reference Years

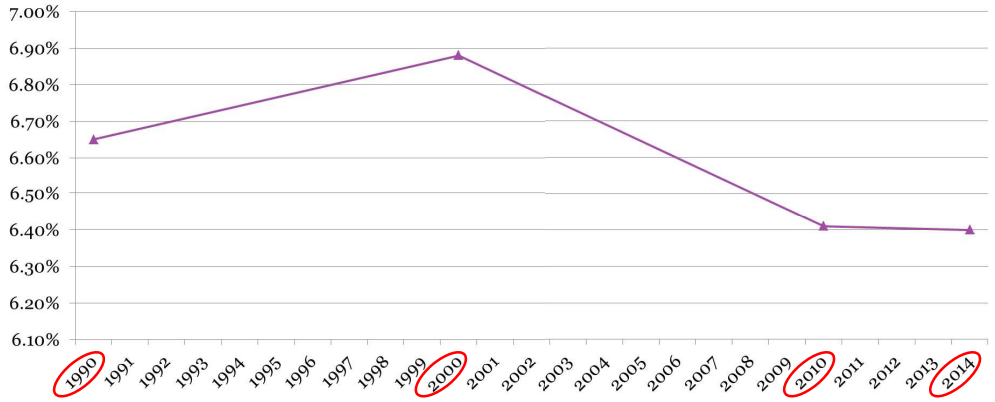
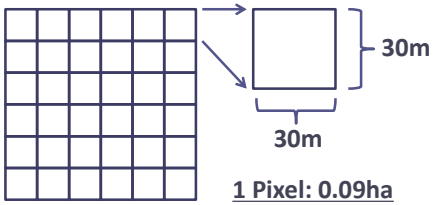


Image Filtering for Satisfied of Forest Definition

Image vs. Forest Definition

0.5ha as minimum mapping unit was considered as concept of SLEEK Map

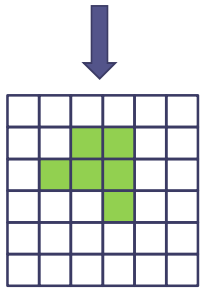


LANDSAT Imagery

1 Pixel: 0.09ha

Forest Definition

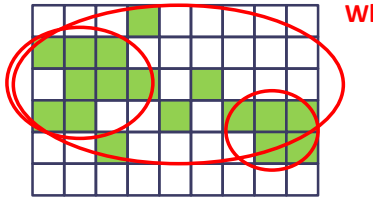
- Canopy Cover Ratio: ≥ 15%
- Area size: 0.5ha



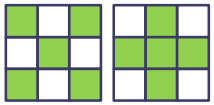
Forest area size: 0.54ha

Definition of Pixel Cluster

How to gather the forest class of pixels as one cluster for the filtering of unsatisfied forest definition?
What is forest cluster?



Which area do you think as one forest class of pixel cluster?



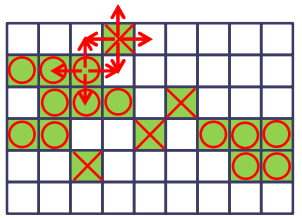
Recognized it as connected

Recognized it as connected

Cluster Searching Method 1

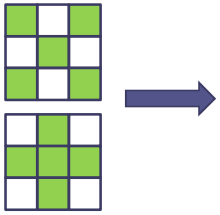
How to searching the forest cluster as same group?

4 neighbor searching method

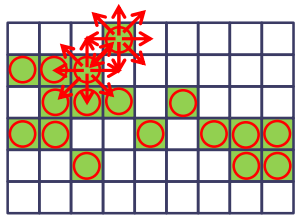


Cluster Searching Method 2

How to searching the forest cluster as same group?

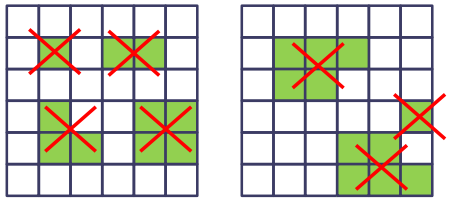


8 neighbor searching method

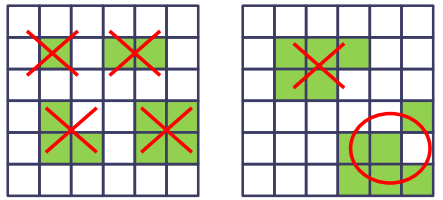


Elimination of Cluster

Eliminate the pixels which are less than 6 pixels



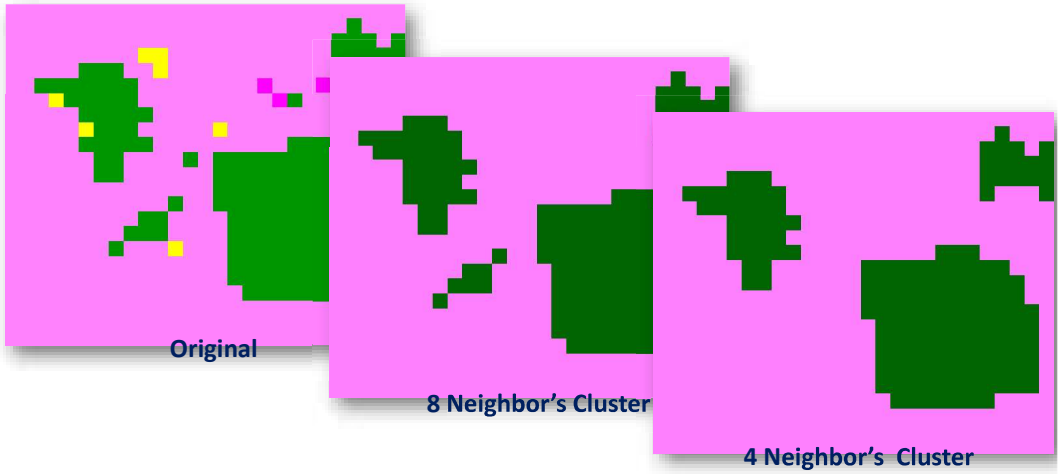
4 neighbor searching method



8 neighbor searching method

Eliminated less than 6 pixels will be replace neighbor bigger cluster of class Type

Example of Elimination which is less than 6 pixels



Thank you very much!

Contact address: f.mukabi@gmail.com
koetia2696@pasco.co.jp

Capacity Development Project for Sustainable Forest Management in the Republic of Kenya
(REDD+ Readiness Component)

Setting of Emission Factor (EF)

FRL
Kazuhiro YAMASHITA
Japan Overseas Forestry Consultants Association
28th June, 2017

AGENDAS for Setting of EF for Development of FRL

- Scope Carbon pools
- GHGs Gas
- EF

AGENDAS for Setting of EF for Development of FRL

- Scope Carbon pools
- GHGs Gas
- EF

➢ Scope Carbon pools:

◆**To consider final decision for analyzing of Soil carbon pool**

◆Requirement to set soil carbon pool by Tier 1

- In the IPCC Guideline 2006, the estimating total change in soil carbon stocks is shown as annual change in carbons stocks. The annual change of organic carbon stocks in mineral soils and annual loss of carbon from drained organic soils are the elements to calculate annual change in carbons stocks. For using the default value of IPCC Guideline 2006 as Tier 1 level, estimation of annual change in carbon stocks in soil requires to set Stock change factors.

➢ Scope Carbon pools:

Setting Soil carbon methodology (for Tier 1)

- The equation for estimating total change in soil carbon stocks

EQUATION 2.24
ANNUAL CHANGE IN CARBON STOCKS IN SOILS

$$\Delta C_{Soils} = \Delta C_{Mineral} + L_{Organic} + \Delta C_{Inorganic}$$

To set the $\Delta C_{mineral}$, some factors have to be set

Where:

ΔC_{Soils} = annual change in carbon stocks in soils, tonnes C yr^{-1}

$\Delta C_{Mineral}$ = annual change in organic carbon stocks in mineral soils, tonnes C yr^{-1}

$L_{Organic}$ = annual loss of carbon from drained organic soils, tonnes C yr^{-1}

$\Delta C_{Inorganic}$ = annual change in inorganic carbon stocks from soils, tonnes C yr^{-1} (assumed to be 0 unless using a Tier 3 approach)

(IPCC 2006)

➢ Scope Carbon pools:

$\Delta C_{Mineral}$ = annual change in organic carbon stocks in mineral soils, tonnes C yr^{-1}

EQUATION 2.25
ANNUAL CHANGE IN ORGANIC CARBON STOCKS IN MINERAL SOILS

$$\Delta C_{Mineral} = \frac{(SOC_0 - SOC_{(0-T)})}{D}$$

$$SOC = \sum_{c,s,i} \left(SOC_{REF_{c,s,i}} \bullet F_{LU_{c,s,i}} \bullet F_{MG_{c,s,i}} \bullet F_{I_{c,s,i}} \bullet A_{c,s,i} \right)$$

(Note: T is used in place of D in this equation if T is ≥ 20 years, see note below)

Reference soil organic carbon which have to be set

(IPCC 2006)

Setting of SOC_{REF} (Reference carbon stocks)

To select Climate region and Soil classification for setting SOC, each **digital mapping data** are required.

Climate region \ Soil classification	HAC soils	LAC soils	Sandy soils	Spodic soils	Volcanic soils	Wetland soils
Boreal	68	NA	10	117	20	146
Cold temperate, dry	50	33	34	NA	20	87
Cold temperate, moist	95	85	71	115	130	
Warm temperate, dry	38	24	19	NA	70	88
Warm temperate, moist	88	63	34	NA	80	
Tropical, dry	38	35	31	NA	50	86
Tropical, moist	65	47	39	NA	70	
Tropical, wet	44	60	66	NA	130	
Tropical montane	88	63	34	NA	80	

(IPCC 2006)

➢ Scope Carbon pools:

$\Delta C_{Mineral}$ = annual change in organic carbon stocks in mineral soils, tonnes C yr^{-1}

EQUATION 2.25
ANNUAL CHANGE IN ORGANIC CARBON STOCKS IN MINERAL SOILS

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(Note: T is used in place of D in this equation if T is ≥ 20 years, see note below)

Stock change factors to be set

(IPCC 2006)

Setting of F_{LU}(Land use factor), F_{MG}(Management factor), F_I (Input factor)

Forest converted to…	Conversion term	Factors to be set up	Level which Kenya have to select for setting the factor
Crop land	Continuous conversion?	Land use level (F_{LU}) — Land converted to…	Long term cultivated ??
			Paddy rice ??
			Perennial Tree crop ??
			Set aside (< 20yrs) ??
		Tillage (F_{MG}) — The tillage level of the clop land is	Full ??
			Reduced ??
			No-tillage ??
		Input (F_I) — The input for the clop land is	Low ??
			Medium ??
			High without manure ??
			High without manure ??
	Transient land use conversion?	Land use level (F_{LU}) — Land converted to…	Native forest of grassland ??
			Shifting cultivation-shortened fallow ??
			Shifting cultivation-Mature fallow ??
		Input : applied only to improved grassland (F_I)	Managed forest ??
			Managed grassland ??
			Cropland ??

After setting level of each factor, the default values can be set

⚠ In case that Kenya select more than two levels for one factor, the digital mapping data of the levels will be required.

⚠ The reason how to select the each level must be clarified with evidence, which is recommendable.

Setting of F_{LU}(Land use factor), F_{MG}(Management factor), F_I (Input factor)

Forest converted to…	Factors to be set up	Level what Kenya have to decide for setting the factor
Glass land	The level of the Glass land management is… — Management (FMG)	Nominally managed(non-degraded) ??
		Moderately degraded grassland ??
		Severely degraded ??
		Improved grassland ??
	Input : applied only to improved grassland (FI) — The input for the Glass land is…	Medium ??
		High ??

After setting level of each factors, the default values can be set

⚠ Each level of Management factor and Input factor for grass land have definition by IPCC

⚠ In case that Kenya select more than two levels for one factor, the digital mapping data of the levels will be required.

⚠ The reason how to select the each level must be clarified with evidence, which is recommendable.

➢ Scope Carbon pools:

◆Answer to the question on the Second National Communication

The Second National Communication

As for the Second National Communication final version (SNC), there is description including soil in the carbon pools. However, there is not enough research for the soil organic carbon in Kenya for setting EF in the soil carbon pool. In addition, it is explained in the SNC that the further research of the soil including the method is expected. For estimation, the accurate value of annual carbon stock change are requisite to submit to UNFCCC. Meanwhile, in this communication, it was also written that the details of method was explained in "the Kenya's 2010 Greenhouse Gas Inventory Report".

➢ Scope Carbon pools:

◆**Suggestion**

◆Kenya side must prepare the data, analysis and the description for the first draft of report until the 7th of July. If Kenyan side does not prepare for them until the 7th of July, we cannot calculate the value of Soil carbon pool to FRL setting.

✓ Temperature regime and Moisture regime for decision of the Stock change factor must follow Climate region of IPCC Chapter 3 Guide. Also Level of land has to be decided.

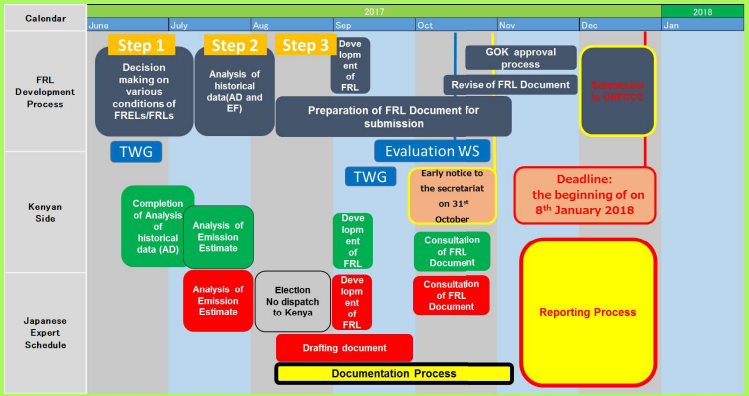
✓Climate region for the Default reference soil organic C stocks (SOC_{REF}) must follow IPCC Chapter 3 Guide. It is required Climate region's digital data for setting SOC_{REF}. Also, it is required that soil stratification must be classified by digital data for setting SOC_{REF}.

✓The classification shown above must be fitted with SLEEK stratification by digital data for using Area data.

➢ Scope Carbon pools:

◆**Suggestion**

- The timeline is very tight. If Kenyan side will not finished calculation until the due date to the 7th July. Soil carbon poll should be omitted. However, the team will advise as long as possible.



➢Scope Carbon pools:

◆**To consider final decision for analyzing of Soil organic carbon pool**

- Other carbon pools covered are:
  - Above-ground biomass
  - Below-ground biomass

- The carbon pools not covered are:
  - Dead wood
  - Litter

AGENDAS for Setting of EF for Development of FRL

➢ Scope Carbon pools

➢GHGs Gas

➢EF

➢GHGs Gas:

- **CH_4** is related to Biomass burning. If the forest fire is not significant matter, it is not considerable (e.g. Uganda's FRL report). The data of area information and mass of fuel available for combustion (Biomass (tonnes/ha)) are needed to calculate for CH_4.

✓**Kenyan side must clarify whether the forest fire in Kenya is significant or not.**

- **Another CH_4** is releasing from Soil. However, even if Soil carbon poll is included, since there is no default data of the CH_4 from the soil. CH_4 from soil must not be considered.

AGENDAS for Setting of EF for Development of FRL

➢ Scope Carbon pools

➢GHGs Gas

➢EF

➢EF

- The values of Emission factor changed from forestland to non-forestland (deforestation) will be calculated by the equation as shown below:

  Emission factors (Forestland change to Non-forestland)

  = CO_2 amount (Forestland) - CO_2 amount (Non-forestland)

➢EF

Biomass stock and Carbon stock of forestland (Using Country data)

Table 1. Volume (m^3/ha), Biomass stock (ton/ha) and Carbon stock (ton/ha) of each forest type class

Class	Canopy coverage	Volume**	AGB		BGB		TOTAL	
			Biomass stock	Carbon stock	Biomass stock	Carbon stock	Biomass stock	Carbon stock
Montane Forest & Western Rain Forest	Dense	437.86	344.75	162.03	93.08	46.54	437.83	208.57
	Moderate	69.59	58.36	27.43	15.76	7.88	74.12	35.31
	Open	26.23	23.02	10.82	6.22	3.11	29.23	13.93
Coastal forest & Mangrove forest	Dense	97.35	92.82	43.62	27.39	13.70	120.21	57.32
	Moderate	64.53	60.45	28.41	13.64	6.82	74.09	35.23
	Open	41.92	35.24	16.57	7.48	3.74	42.72	20.30
Dryland Forest	Dense	98.55	79.27	37.26	31.29	15.64	110.56	52.90
	Moderate	38.74	33.83	15.90	12.72	6.36	46.55	22.26
	Open	16.00	14.26	6.70	3.85	1.93	18.12	8.63
Plantation	Dense	539.23	436.68	205.24	117.90	58.95	554.58	264.19
	Moderate	137.79	113.54	53.36	30.66	15.33	144.20	68.69
	Open	174.54	138.22	64.96	37.32	18.66	175.54	83.62
*(Agro-forestry)		106.98	74.23	34.89	20.04	10.02	94.27	44.91

* The class of Agro-forestry has been considered to apply for setting FRL. **Volume does not include volume of Climber.

➢EF

CO_2 amount of forestland (Using Country data)

Table 2. CO_2 amount (ton/ha) of each forest type class in the Country data

Class	Canopy coverage	AGB	BGB	TOTAL
		CO_2 amount	CO_2 amount	CO_2 amount
Montane Forest & Western Rain Forest	Dense	594.11	170.65	764.76
	Moderate	100.57	28.89	129.46
	Open	39.67	11.39	51.06
Coastal forest & Mangrove forest	Dense	159.95	50.22	210.17
	Moderate	104.17	25.01	129.18
	Open	60.74	13.71	74.45
Dryland Forest	Dense	136.62	57.36	193.98
	Moderate	58.31	23.32	81.63
	Open	24.58	7.06	31.64
Plantation	Dense	752.54	216.15	968.69
	Moderate	195.67	56.20	251.87
	Open	238.20	68.42	306.62

* The class of Agro-forestry has been considered to apply for setting FRL.

➢ EF

CO_2 amount of forestland (Using Default data of Tier 1)

✓**Reference for Country data**

- **Suggestion1**: EF (CO_2 amount calculated by averaging **Default data** using each researched place information)
- **Suggestion2**: EF (CO_2 amount calculated by selecting **Default data** from among default values)

➢EF

CO_2 amount of forestland (Default data of Tier 1)

- **Suggestion1**: EF (CO_2 amount calculated by averaging **Default data** using each researched place information)

Appendix Table 1. Above-Ground Biomass data in forests from 2006 IPCC and 2003 IPCC Guideline

Class	Canopy coverage	IPCC Ecological zone	Biomass stock (ton/ha)	Carbon stock (ton/ha)	CO_2 amount (ton/ha)	Remarks
Montane Forest	Dense Moderate Open	Tropical mountain systems	40–190	18.8–89.3		Nyeri
Coastal forest	Dense Moderate Open	Tropical moist deciduous forest	260 (160–430)	122.2 (75.2–202.1)		Kilifi, Kwale
Mangrove Forest	Dense Moderate Open	Tropical rain forest Tropical moist deciduous forest	310 (130–510) 260 (160–430)	145.7 (61.1–239.7) 122.2 (75.2–202.1)		Gazi Kwale
Dryland Forest	Dense Moderate Open	Tropical shrubland	70 (20–200)	32.9 (9.4–94)		Kibwezi
Plantation A	Dense Moderate Open	Tropical mountain systems Values from AGB in Forests	40–190	18.8–89.3		Nyeri
Plantation B	Dense Moderate Open	Tropical mountain systems Values from AGB in Forest Plantations Africa broad leaf > 20 y Africa broad leaf ≤ 20 y Africa Pinus sp. > 20 y Africa Pinus sp. ≤ 20 y	60–150 40–100 30–100 10–40	28.2–70.5 18.8–47 14.1–47 4.7–18.8		Nyeri

Averaging the values

Averaging the values

or

➢EF

CO_2 amount of forestland (Default data of Tier 1)

- **Suggestion1**: EF (CO_2 amount calculated by averaging **Default data** using each researched place information

Table 2. CO_2 amount (ton/ha) of each forest type class in the Country data

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	Moderate	195.67	56.20	251.87
	Open	238.20	68.42	306.62

* The class of Agro-forestry has been considered to apply for setting FRL.

Table 3. CO_2 amount (ton/ha) of each forest type class in IPCC Default data

Class	AGB	BGB	TOTAL
	CO_2 amount	CO_2 amount	CO_2 amount
Montane Forest & Western Rain Forest	198.2	53.5	251.7
Coastal forest & Mangrove forest	469.65	120.9	590.6
Dryland Forest	120.6	40.4	161.0
Plantation	114.16	30.8	145.0
Plantation (*Pinus sp*)	77.53	20.93	98.46

or

✓The Canopy cover class cannot be classified in the default values.

➢EF

CO_2 amount of forestland (Default data of Tier 1)

- **Suggestion2**: EF (CO_2 amount calculated by selecting **Default data** from among default values)

Appendix Table 1. Above-Ground Biomass data in forests from 2006 IPCC and 2003 IPCC Guideline

Class	Canopy coverage	IPCC Ecological zone	Biomass stock (ton/ha)	Carbon stock (ton/ha)	CO_2 amount (ton/ha)	Remarks
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How select the value?

How select the value?

➢EF

CO_2 amount of forestland (Default data of Tier 1)

- **Suggestion2**: EF (CO_2 amount calculated by selecting **Default data** from among default values)

Table. Ratio of BGB to AGB

Class	R/S ratio
Montane Forest	0.27
Coastal forest	0.2 (Kilifi &Kwale)
Mangrove Forest	0.37 (Gazi) or 0.20 (Kwale)
Dryland Forest	0.40 (Kibwezi) or 0.27 (Baringo)
Plantation	0.27 (Tropical mountain system)

How select the value?

How select the value?

Table. CO_2 amount (ton/ha) of each forest type class in the IPCC Default data

Class	AGB	BGB	TOTAL
	CO_2 amount	CO_2 amount	CO_2 amount
Montane Forest & Western Rain Forest			
Coastal forest & Mangrove forest			
Dryland Forest			
Plantation			

Setting value and Calculation

* The class of Agro-forestry has been considered to apply for setting FRL.

➢ EF

CO_2 amount of forestland (Using Default data of Tier 1)

✓**Reference for Country data**

- **Suggestion2**: EF (CO_2 amount calculated by selecting **Default data** from among default values)

◆**Recommendation to use Suggestion 2**

●**Reasons**

Suggestion 1 shows using different default data by researched area information. Default data should be used as it is.

➢EF

CO_2 amount of forestland (Default data of Tier 1)

- **Suggestion2**: EF (CO_2 amount calculated by selecting **Default data** from among default values)

Appendix Table 1. Above-Ground Biomass data in forests from 2006 IPCC and 2003 IPCC Guideline

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How select the value?

How select the value?

Recommendation

Recommendation

➢EF

CO_2 amount of non-forestland (Default data of Tier 1)

Table 4. Default values of Biomass stock and Carbon stock of land cover classes without forest type (Tier1)

Class	Biomass stock (ton/ha)	Carbon stock (ton/ha)	CO_2 amount (ton/ha)	References
Cropland Annual L* to C		5	18.3	IPCC Guideline2006 Ch5.T5.9
Grassland L to G	0	0	0	IPCC Guideline2006 Ch6.3.1.2
Wetland	-	–	–	IPCC Guideline2006
Settlement L to S	0	0	0	IPCC Guideline2006 Ch8.8.3.1
Other land L to O	0	0	0	IPCC Guideline2006 Ch.9.9.3.1.

* L shows the former land classification

- Only cropland has CO_2 amount.
- Therefore, Non-forestland is divided into cropland and other non-forestlands for EF calculation.

➢EF

advantages and disadvantages of the Country data and Tier1 default data

Point	Country data	Tier1 default data
Reliability of the Data	△ Country data is not set with scientifically enough number of sample	○ The data is given by IPCC guideline to apply in case the country has not enough information to develop country data.
Consistency of forest stratification	○ Country data is set according to Kenya forest stratification.	× There are some difference between IPCC forest classification and Kenya's forest stratification. There are no forest stratification by canopy coverage in IPCC default value.
Conservative or more beneficial value	It cannot be judged without calculation. Not yet calculated so far.	

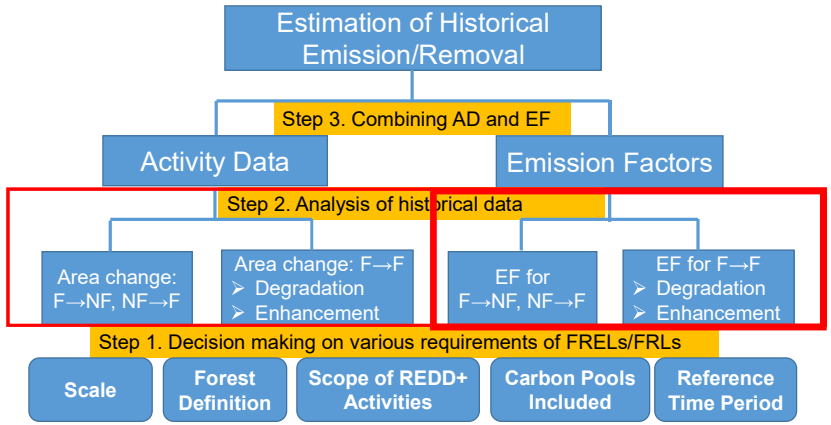
Three steps for FRL setting

Step 1) Decision making on various requirements of FRL

Step 2) Analysis of historical data (AD and EF)

Step 3) Combining AD and EF

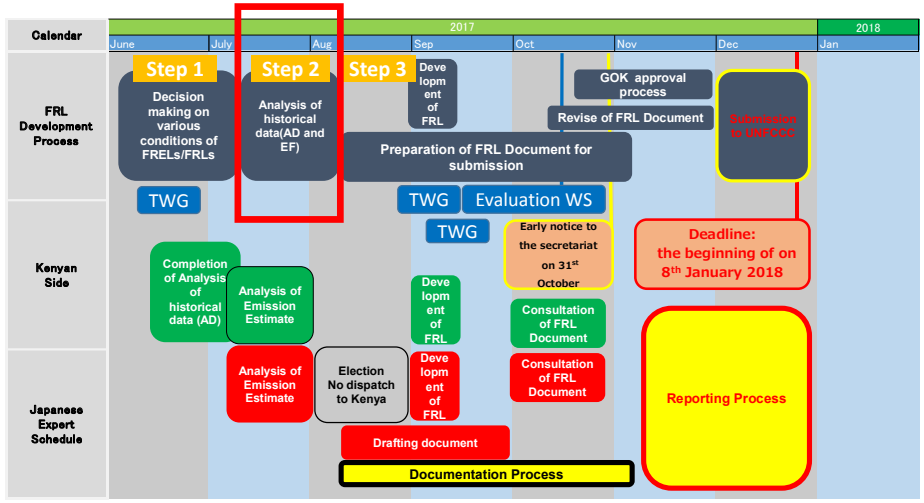
Historical Emission Estimate for REDD+



F: forest
NF: non forest
EF: emission factor

Source: Meridian Institute, 2011 (modified)

Plan by TOR Outline of schedule for development and submission of FRL to UNFCCC



Monitoring Land Cover/Land Use Changes (IPCC Approach 3)

				Area in 20XX+(X)															
				Forest												Non Forest			
				Montane Forest/ Western Rain Forest/ Bamboo			Costal Forest and Mangroves			Dryland Forest			Plantation			Crop land		Other Non Forest	
				D	M	O	D	M	O	D	M	O	D	M	O	Public Forest land	Non Public Forest land	Public Forest land	Non public Forest land
Area in 20XX	Forest	Montane Forest/ Western Rain Forest/ Bamboo	D																
			M																
			O																
		Costal Forest and Mangroves	D																
			M																
			O																
		Dryland Forest	D																
			M																
			O																
		Plantation	D																
			M																
			O																
	Non Forest	Crop land	*Public Forest land																
			Non Public Forest land																
		Other Non Forest	Public Forest land																
			Non Public Forest land																

*Public Forest ：National parks, Nature reserves, Community forest, County forest and Gazetted forest by KFS

Thank you for your attention.

GREENHOUSE GAS (GHG) INVENTORY FOR THIRD NATIONAL COMMUNICATION AND BIENNIAL UPDATE REPORT AND A WEB BASED GHG INVENTORY MANAGEMENT SYSTEM

SOIL CARBON DISCUSION

Introduction

- Soil Organic Carbon.
- IPCC provides Tier 1 methods for estimating CO2 emissions and removals on mineral soils associated
  - with the transitions from forest to non-forest land uses that sum to deforestation,
  - other land uses to forest.

Introduction

- The Tier 1
  - assumes that mineral soil carbon stock density on land that has been forest for at least 20 years will be equal to the mineral soil carbon stock density under native vegetation for the relevant climate and ecosystem type
  - assumes that where there are transitions to or from another land use, the mineral soil carbon stock density on the other land use in question will be that value times a relative carbon stock change factor depending on the land use, the level of management and the climate.

Introduction

- The Tier 1
  - Following transition between land uses carbon is emitted or removed over a 20 year transition period at which time the new carbon value is assumed to be achieved.
  - assumes that mineral soil carbon stocks do not change for land remaining in forest land use.
  - For drained organic soils IPCC provides emission/removal factors which depend on climate and ecosystem and will produce emissions so long as the land is drained and organic carbon remains.
  - The relevant tables in the IPCC guidance are summarized in Table below.

Introduction

Parameter	2003 Good Practice Guidance	2006 Guidelines	2013 Wetlands Supplement
Mineral Soil Organic Carbon reference carbon stocks	Table 3.2.4 Table 3.3.3 Table 3.4.4	Table 2.3	Table 5.2
Relative carbon stock change factors	Tables 3.3.3 Table 3.4.5	Table 5.5 Table 5.10 Table 6.2	Table 5.3
Drained and rewetted organic soil emission/removal factors	Table 3.3.5 Table 3.4.6	Table 4.6, Table 5.6 Table 6.3	Table 2.1 Table 2.2(a) Table 3.1 (b) Table 3.2(a)
Change due to fires	--	--	Table 2.6 Table 2.7
Soil carbon stocks in mangroves	--	--	Table 4.11 (c)

Notes: a) emission/removal factors in Table 2.2 of the wetlands supplement are for estimating emissions of CO_2 from waterborne carbon arising from drained and rewetted organic soils. b) Removals and emissions factors in Table 3.1 of the wetlands supplement are for rewetted organic soils. c) This table provides undisturbed soil carbon densities. Carbon in extracted soil is assumed by default to be oxidized in the year of extraction.

Introduction

- Where soil-related emissions are key (Chapter 2, Section 2.2.3) countries should aim to apply higher Tier methods.
- Developing estimates of temporal change in soil carbon stocks using repeated field sampling is challenging. This is because soil carbon stocks are large and spatially variable and almost impossible to detect changes which are usually small (generally only a few % of the total stock) unless intensive and expensive sampling is undertaken.
- Instead, for Tier 1 default reference carbon stocks (i.e. carbon stocks under native vegetation and default soil C change factors (multipliers capturing the effect of management practices and land uses) are applied.
- At Tier 2, the method is the same, but default values are replaced by country-specific values.
- Tier 3 methods employ detailed modelling of soil C dynamics, requiring detailed calibration and validation data and large and long-term investment for their development.

Introduction

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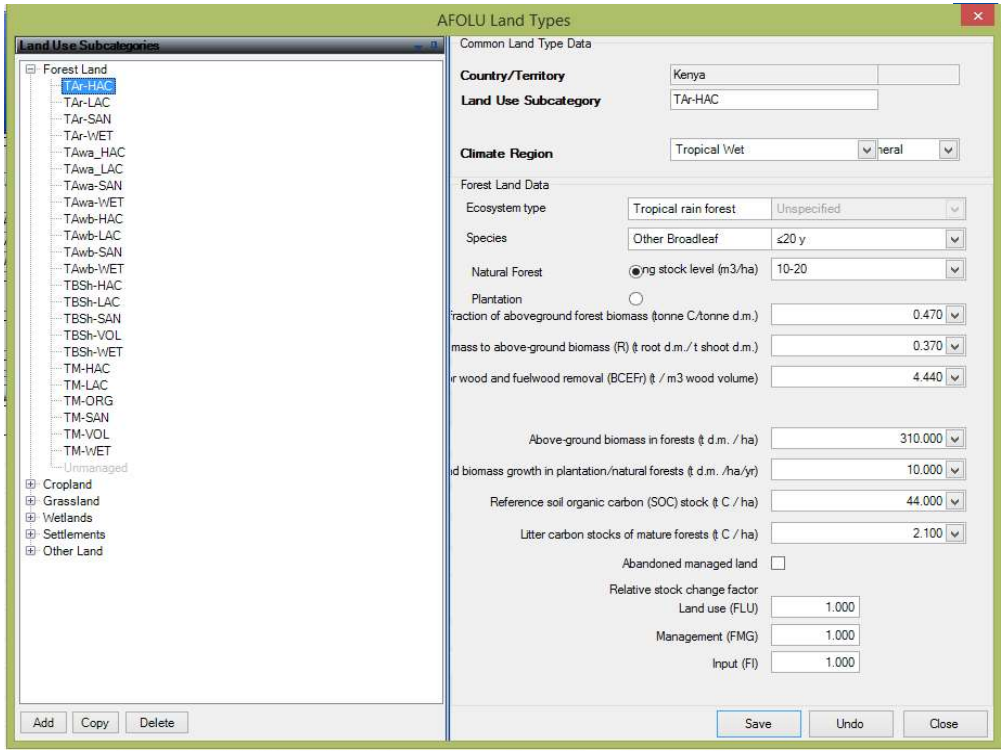
- Tier 3 methods employ detailed modelling of soil C dynamics, requiring detailed calibration and validation data and large and long-term investment for their development.

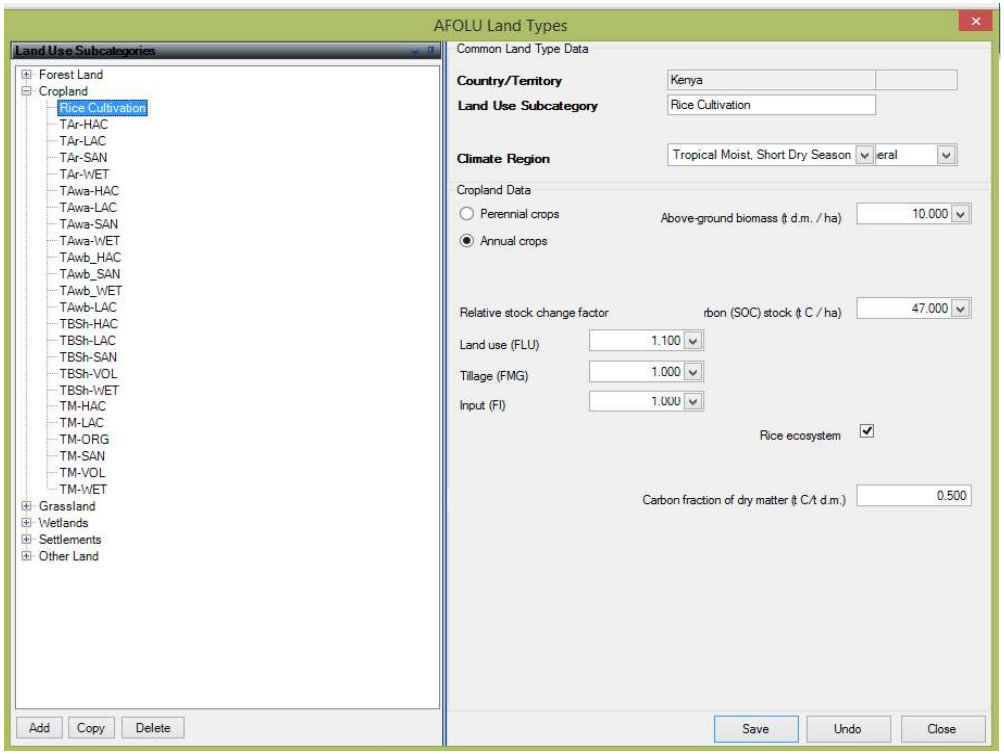
Introduction

- Whatever approach is used, soil maps are required in combination with soil carbon change factors or more complex models.
- Some maps already be held by Agriculture and Forestry agencies, but their spatial resolution may need to be enhanced based on further soil survey *before they can be applied to REDD+ activities*.
- For many inaccessible tropical forest areas soil maps may not exist, or have poor spatial resolution. Kenya has a soil map that is quite representative
- But the maps may limit carbon-rich soils, which are important sources of carbon emissions due to biological oxidation or fire following forest disturbance.
- Barthelmes et al., (2015) provide valuable advice on how existing maps combined with remote sensing which can provide useful vegetation and topographic surrogates for soils, and new ground surveys can be effectively integrated to map organic soils under tropical forests at scales useful for management decision making.

Introduction

- Under some conditions nitrous oxide (N2O) can be released from soils. Emissions can be either direct (derived from local soil management processes) or indirect (resulting either from atmospheric deposition of N or inputs of N from leaching or run-off from elsewhere).
- Emissions of N2O are increased following the addition of N fertilizers, or by any forest management practices that increase the availability of inorganic N in soils. IPCC(1) provides guidance on how to estimate emissions of N2O from managed soils which is cross-referenced in the guidance in GPG2003.
- N2O emissions would not usually represent a key category for forests unless lands have had heavy application of N fertilizer; this combined with the complexity of estimating emissions of N2O means most countries will use Tier 1 approaches unless they have undertaken replicated field studies to demonstrate that the IPCC default factors are inappropriate for their circumstances.





UNEP

Thanks For Your Attention!

Capacity Development Project for Sustainable Forest Management in the Republic of Kenya
(REDD+ Readiness Component)

Setting of other requirements

FRL
Kazuhiro YAMASHITA
Japan Overseas Forestry Consultants Association
28th June, 2017

AGENDAS for other requirements of FRL setting

- AD Definition
- Scope REDD+ Activities
- Construction method
- National circumstance

AGENDAS for other requirements of FRL setting

- AD Definition
- Scope REDD+ Activities
- Construction method
- National circumstance

➢ AD Definition

To consider Stratification of Non forest of SLEEK map to be reclassified as shown below:

* Wooded grassland＋Open grassland→Grassland
* Vegetated Wetland＋Open Water→Wetland
* Other land→Other land, Settlement
* Annual cropland＋Perennial cropland→Cropland

- Agro-forestry data cannot be classified from Perennial cropland. And also, Agro-forestry data is not be analyzed. It will be considered for future FRL submission.

AGENDAS for other requirements of FRL setting

➢ AD Definition
➢Scope REDD+ Activities
➢Construction method
➢National circumstance

➢Scope REDD+ Activities

- To decide that the REDD+ activities required to decision making of each definition (Using Matrix):
  - Deforestation
  - Degradation
  - Sustainable management of forest
  - Enhancement

Classification of land-use/land-cover in Kenya

Forest	Montane Forest/ Western Rain Forest/ Bamboo		Open
			Moderate
			Dense
	Costal Forest and Mangroves		Open
			Moderate
			Dense
	Dryland Forest		Open
			Moderate
			Dense
	Plantation		Open
			Moderate
			Dense
Non Forest	Cropland (Perennial Cropland + Annual Cropland)		
	Other Non forest	Grassland (Open Grassland + Wooded grassland)	
		Wetland (Vegetated Wetland + Open Water)	
		Other land	
		Settlement	

Monitoring Land Cover/Land Use Changes (IPCC Approach 3)

Area in 20XX				Area in 20XX+(X)															
				Forest										Non Forest					
				Montane Forest/ Western Rain Forest/ Bamboo			Costal Forest and Mangroves			Dryland Forest			Plantation			Crop land		Other Non Forest	
				D	M	O	D	M	O	D	M	O	D	M	O	Public Forest land	Non Public Forest land	Public Forest land	Non public Forest land
Forest	Montane Forest/ Western Rain Forest/ Bamboo	D																	
		M																	
		O																	
	Costal Forest and Mangroves	D																	
		M																	
		O																	
	Dryland Forest	D																	
		M																	
		O																	
	Plantation	D																	
		M																	
		O																	
Non Forest	Crop land	*Public Forest land																	
		Non Public Forest land																	
	Other Non Forest	Public Forest land																	
		Non Public Forest land																	

*Public Forest : National parks, Nature reserves, Community forest, County forest and Gazetted forest by KFS

Monitoring Land Cover/Land Use Changes (IPCC Approach 3)

Area in 20XX				Area in 20XX+(X)															
				Forest												Non Forest			
				Montane Forest/ Western Rain Forest/ Bamboo			Costal Forest and Mangroves			Dryland Forest			Plantation			Crop land		Other Non Forest	
				D	M	O	D	M	O	D	M	O	D	M	O	Public Forest land	Non Public Forest land	Public Forest land	Non public Forest land
Forest	Montane Forest/ Western Rain Forest/ Bamboo	D		f	b	b										a	a	a	a
		M		e	f	b										a	a	a	a
		O		e	e	f										a	a	a	a
	Costal Forest and Mangroves	D					f	b	b							a	a	a	a
		M					e	f	b							a	a	a	a
		O					e	e	f							a	a	a	a
	Dryland Forest	D								f	b	b				a	a	a	a
		M								e	f	b				a	a	a	a
		O								e	e	f				a	a	a	a
	Plantation	D											f	d	d	d		d	
		M											d	f	d	d		d	
		O											d	d	f	d		d	
Non Forest	Crop land	Public Forest land		e	e	e	e	e	e	e	e	e	d	d	d	f			
		Non Public Forest land															f		
	Other Non Forest	Public Forest land		e	e	e	e	e	e	e	e	e	d	d	d			f	
		Non Public Forest land																	f

a Deforestation(F→NF)
b Forest Degradation(F→F(Degraded))
c Forest Conservation(F→F)
d Sustainable Management of F(F→F)
e Enhancement(F→F(Improved) ,NF→F)
f No Change(F→F, NF→NF)

➢Scope REDD+ Activities

- Natural forest enhanced by the Rehabilitation programme (Enrichment planting) in Gazetted forest cannot be detected on the SLEEK map.
  - ✓ The Rehabilitation programme's areas are included in the areas of all enhancement activities in the natural forest not only by the Rehabilitation programme.

➢Scope REDD+ Activities

- Canopy cover percentage affect to EF of Plantation. The value of Moderate and Open is oppositely because of the research method. It needs solution to set FRL using EF of Plantation.
  - ✓For Plantation, the survey areas for open cover were selected by the canopy cover percentage as the same as other forest cover. However, early stage of open cover after planting could not be found. Thus, the areas shows the old stand with thinning.
  - ✓The change from Open to Moderate cannot be defined as enhancement.
- Due to the reason above, to consider Idea for definition: to define 40,000 ha of KFS's plantation areas as Sustainable management of forest.

Plantation areas should be defined as Sustainable management of forest.

AGENDAS for other requirements of FRL setting

- AD Definition
- Scope REDD+ Activities
- Construction method
- National circumstance

➢Construction method

• Average method and Regression method

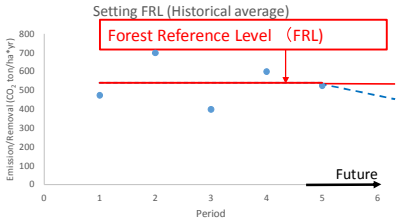


Figure. Average method

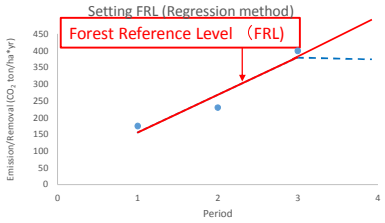
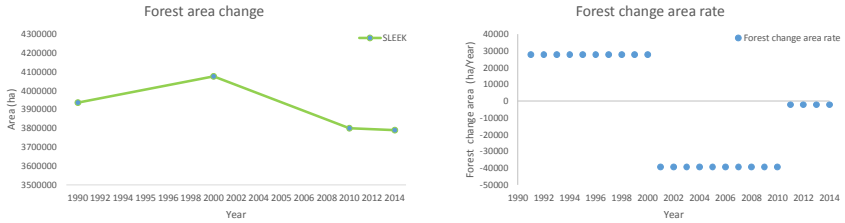


Figure. Regression method

➢ Construction method

◆Considering of change of forest area and Forest change area rate



✓The values of change of forest area shows fluctuating. And also, the values of forest change area rate shows same trends.

✓The value of Forest change area rate cannot be found in each year. The conditions of the data show that it is impossible to use Regression method, because of no trend for regression.

AGENDAS for FRL setting

➢ Construction method

◆Other requirements for using Regression method

✓ Both of past and future driver analysis is required for the method. Latest TA to Peru's FRL submission report shows that it is necessary to analyze past deforestation factors and to show data that the factors can cause deforestation continuously in the future in case of using Regression method.

✓Time line is very tight until FRL report submission due date.

AGENDAS for FRL setting

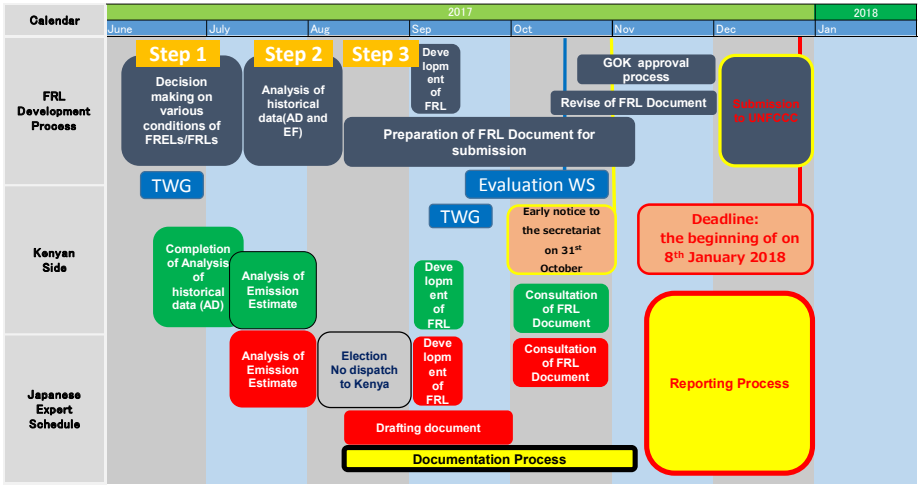
➢ Construction method

◆The team suggests Average methods for FRL setting as Construction method. The summary of reasons are shown as following:

- ✓ The values of change of forest area and forest change area rate shows fluctuating.
- ✓ The value of forest change area rate cannot be found in each year.
- ✓ The conditions of the data show that there is no trend for regression.
- ✓ Driver analysis is required for the regression method.
- ✓ Time line is very tight until FRL report submission due date.

Plan by TOR Outline of schedule for development and submission of FRL to UNFCCC

Option1: Timeline for Average method



AGENDAS for other requirements of FRL setting

- ➢ AD Definition
- ➢Scope REDD+ Activities
- ➢Construction method
- ➢National circumstance

AGENDAS for FRL setting

➢ National circumstance

◆Submission on 8th January 2018

◆There are 2 Options.

1. For the first submission, Kenyan side does not consider the National circumstance.
2. For the first submission, Kenyan side consider simple analysis for national circumstance by themselves. The result of analysis is not be available to set FRL if there is no correlation between forest change and the factor of National circumstance. Kenya side must complete the analysis with the result of CO_2 Emission estimate until the end of August. The team can advise for them. On September, The team combine the National circumstance data with FRL.

➢ National circumstance

Collection and Completion of Analysis of National circumstance data

◆Examples of requirements of data (e.g. Standard Gauge railway as development plan)

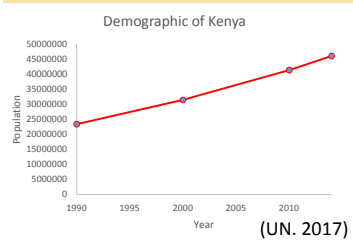
- Railway construction data per year as amount of change (Quantity data required)
- Evidence of that plan is feasible with presence of that same kind past development plans were implemented (Quantity data)
- Presence of clear evidence related with forest deforestation data by railway construction
- Confirmation of correlation between railway construction data and forest stock data in Kenya.

◆If confirmed every requirement above, the data of railway construction can be analyzed with emission estimate data as national circumstance.

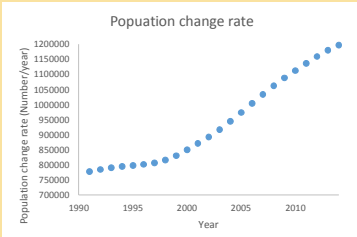
➢ National circumstance

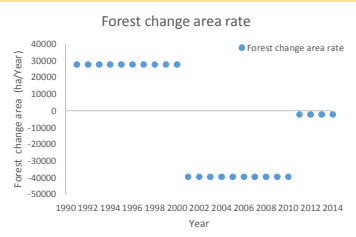
Collection and Completion of Analysis of National circumstance data

◆ Examples of requirements of data (e.g. Demographic of Kenya)



(UN. 2017)



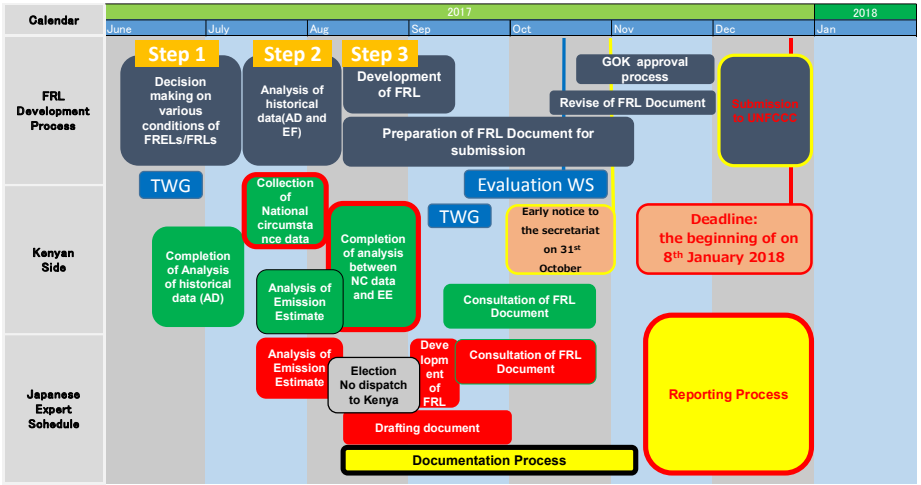


✓Suggestion

- There is no correlation between Forest change rate and population change rate. Two figures show the different trend.
- In the figures, population change rate was increased, while Forest change rate was fluctuating from 1991 to 2014.
- It is difficult tasks to find the relation between Forest change rate and Population change rate.

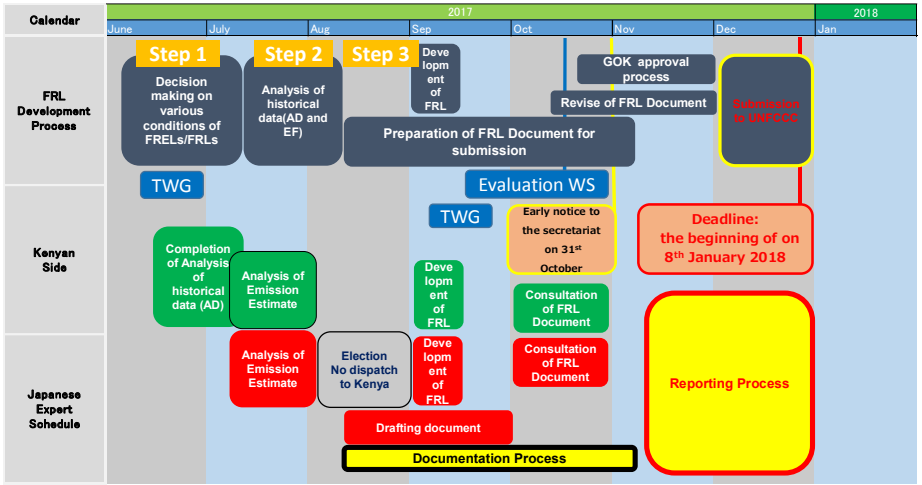
Plan with National circumstance Outline of schedule for development and submission of FRL to UNFCCC

Option 2: Average method with National circumstance data



Plan by TOR Outline of schedule for development and submission of FRL to UNFCCC

Option1: Timeline for Average method

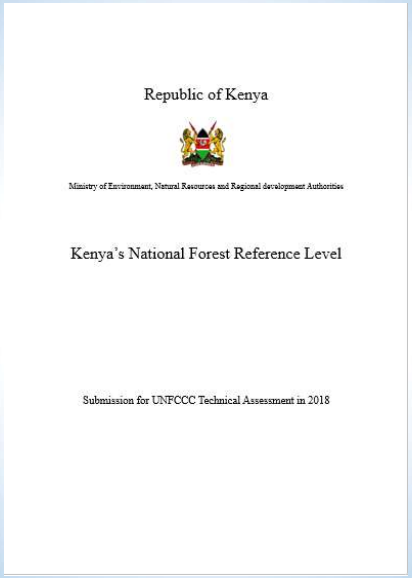


Thank you for your attention.

Capacity Development Project for Sustainable Forest Management in the Republic of Kenya
(REDD+ Readiness Component)

FRL Documentation

FRL
Kazuhiro YAMASHITA
Japan Overseas Forestry Consultants Association
28th June, 2017


Republic of Kenya

Ministry of Environment, Natural Resources and Regional development Authorities

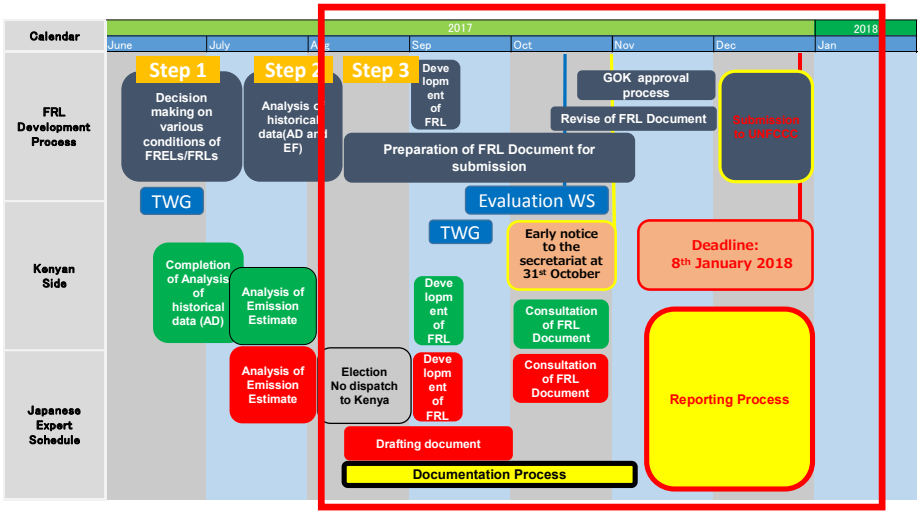
Kenya's National Forest Reference Level

Submission for UNFCCC Technical Assessment in 2018

AGENDAS for FRL Documentation

- Process of Documentation
- Table of Contents of Draft FRL Report

Plan by TOR Outline of schedule for development and submission of FRL to UNFCCC



AGENDAS for FRL Documentation

- ➢Process of Documentation
- ➢Table of Contents of Draft FRL Report

➢Process of Documentation

- **KFS required that JICA would assist whole FRL submission process until reporting process**

1) Draft making

The JICA expert team will work whole Documentation's process of FRL. After the TWG meeting (+Workshop(WS)) of FRL setting in the middle of September, The team makes a first draft of FRL report in collaboration with KFS by the end of September (expected).

2) Finalizing of Documentation

After the first draft making, the Workshop will be held on the middle of October. The participants will discuss the necessity of it's revise in the workshop where FAO and other stakeholders will join. Reflecting the result of the WS to the draft, the draft will be improved by the team and KFS. Then, the draft will be finalized through peer review.

3) Notification to the secretariat of UNFCCC

Notification to the secretariat of UNFCCC must be informed until 31st October if assurance of submission of the FRL report to UNFCCC is made in the workshop even though the revise work of FRL report is continued in November.

AGENDAS for FRL Documentation

- ➢Process of Documentation
- ➢Table of Contents of Draft FRL Report

➢Table of Contents of Draft FRL Report

1. Introduction
2. Definition
3. Scope
   - 3.1 Activities
   - 3.2 Carbon pools
4. Reference period
5. Scale
6. GHGs Gas
7. Historical data (Activity Data)
8. Emission Factor
9. Construction Approach Method
10. National circumstances
11. Forest Reference Level

Thank you for your attention.

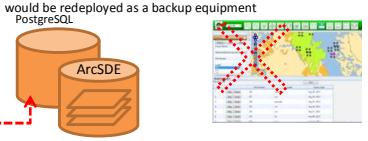
REPUBLIC OF KENYA
Ministry of Environment and Natural Resources
Kenya Forest Service
REDD+ Technical Working Group Meeting

Date: 28th June 2017

By Kohei YAMAMOTO

KFIS（Kenya Forest Information System）

- The Web Site including GIS to register and open the information related with REDD+
- The project Program Grant Aid for Environment and Climate Change "the Forest Preservation Programme" developed from 2010 to 2013
- RHEL5.7＋MapServer6＋PostgreSQL8.4＋ArcGIS Server（ArcSDE）
- The system is not used and even not run the system
- At this project the FIP program would not be used but the data itself and definition would be handed over. Especially about H/W equipment would be redeployed as a backup equipment



Migration

FIP（Forest Information Platform）

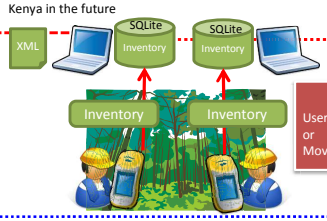
- The portal site for the all Forest related information including REDD+ Related information
- Capacity Development project for sustainable forest management from 2016 to 2021
- Windows Server＋ArcGIS Server＋SQL Server
- The implementation of the portal site for Forest information which inherit data record of KFIS and linked with FMIS such as Plantation and Inventory.
- H/W for FIP will be newly procured and existing H/W would be redeployed as back up
- Programming development should be reduced as much as possible taking advantage of Templates of ArcGIS server.
- → Requesting JICA to increase the budget for the task of programming development
- FRLs（Forest Reference Level）
- MRV（Measurement-Reporting-Verification）
- .

Challenge #2
How to link with FMIS

Link

Open Foris Collect

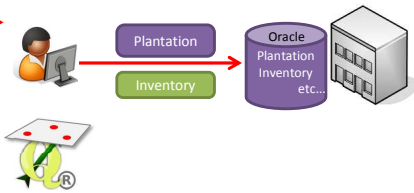
The software to collect and manage the data in field-based forest inventories.
Developed and installed by Finnish Project ICFRA till 2015
Open source program + SQLite, data records are managed by independent PC.
Manually registered to FMIS.
The function to read XML file is not operated
The observation points will be added the unique number for all over Kenya in the future



Challenge #1
User existing system
or
Move to new system

FMIS（Forest Management Information System）

The web site for the collection and management of the plantation data.
Developed and installed by Finnish project MMMB in 2015
The Forest Management Package System based on Oracle Web Center Portal
It is obscure internal algorithms and is hard to customize.
Because it manages and registers text based information GIS data are treated as an attached file.
It is independently browsed with QGIS
For the plantation data this system means the master data



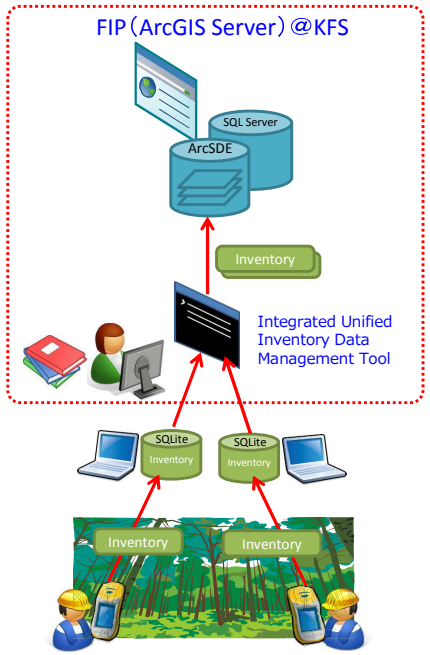
Preparation policy for Forest Inventory Collection Tool Case 1

Case1: Modification of existing tool

The Open Foris Collect as survey of forest inventory tool will be utilized as tool for inventory survey. For database unified management, it shall be required the development and installation.

[Developed Items]

- Function for submission the collected data to FIP server (Integrated Unified Inventory Data Management Tool)
- Preparation of operation manual as rule



Preparation policy for Forest Inventory Collection Tool: Case 1

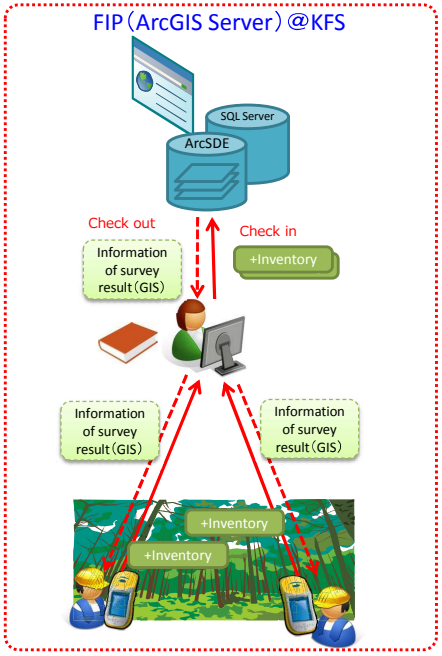
Case2: Development of new tool

Instead of existing tool, the new tool will be developed based on function of ArcGIS Server for registration, submission and management of inventory data

[Developed Items]

- To develop interface for inventory data registration as similar Open Foris Collect
- To develop function of submission the inventory data to the FIP

*Interface and function will be developed based on the function of ArcGIS Server



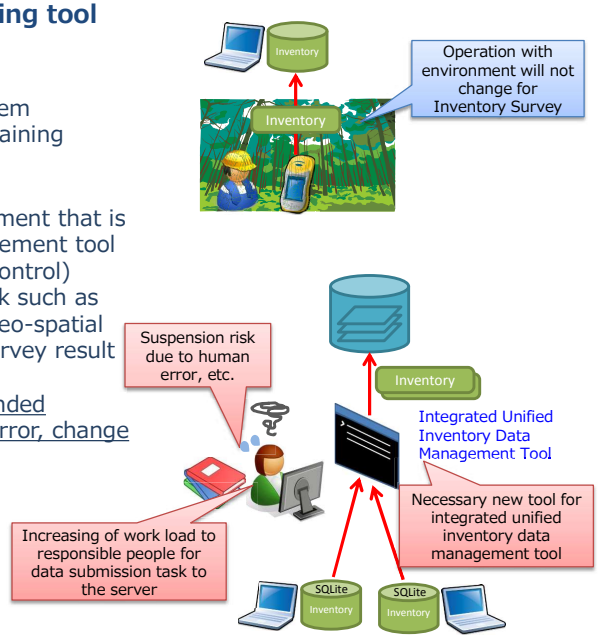
Preparation policy for Forest Inventory Collection Tool: Merit & Demerit

Case1: Modification of existing tool

[Merit]
- To reduce preparation of system operation environment and training

[Demerit]
- Necessary additional development that is unified inventory data management tool (which is included exclusive control)
- Increasing of operational work such as generate of survey point as geo-spatial information, submission of survey result data to the server, etc.

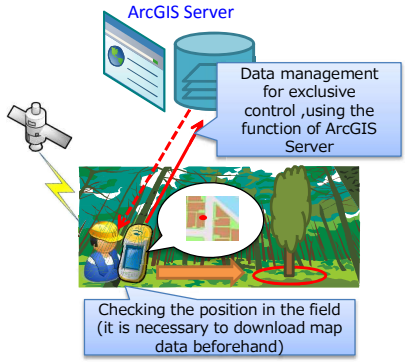
→ it will be happen some suspended situation as risk due to human error, change responsible people, etc.



Preparation policy for Forest Inventory Collection Tool: Merit & Demerit②

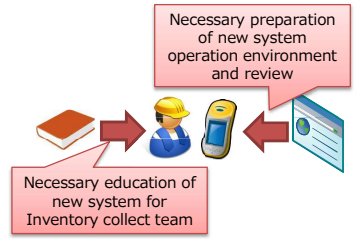
Case2: Development of new tool

【Merit】
- Checking the field with maps and automatic acquisition of ground data with GPS
- To reduce system development cost and to manage data including high quality exclusive control, using the existing function for data registration of ArcGIS Server



【Demerit】
- Necessary new system development (including GUI) although database definition is same or similar to current system
- Necessary preparation of system operation environment and training newly

*It is necessary to check the coverage of ArcGIS server functionalities for Mobile Devices



Thank you very much!

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