Federal Democratic Republic of Ethiopia
Ministry of Agriculture

ROYAL NORWEGIAN EMBASSY

Federal Democratic Republic of Ethiopia
Environmental Protection Authority

Terms of Reference for Developing Capacities for a National Measuring, Monitoring, Reporting and Verification System to support REDD+ participation of Ethiopia

Background, Capacity Assessment and Roadmap

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List of Abbreviations

AD	Activity Data
AGB	Above-Ground Biomass
BGB	Below-Ground Biomass
BoARD	Bureau of Agriculture and Rural Development
CIFOR	Center for International Forestry Research
COP	Conference of Parties (UNFCCC)
CRGE	Climate Resilient Green Economy
CSA	Central Statistics Agency
EF	Emission Factor
EIAR (FRC)	Ethiopian Institute of Agricultural Research (Forestry Research Centre)
EMA	Ethiopian Mapping Agency
(F)EPA	(Federal) Environmental Protection Agency
(UN-)FAO	Food and Agriculture Organization of the United Nations
FCFP	Forest Carbon Partnership Facility
FRA	Forest Resource Assessment
GFOI(GEO)	Global Forest Observation Initiative (Group on Earth Observations)
GO	Governmental Organization
GOFC-GOLD	Global Observation for Forest Cover and Land Dynamics
GPG	Good Practice Guidelines
HU	Hawassa University
IBC	Institute of Biodiversity Conservation
ICRAF	World Agroforestry Centre (International Centre for Research in Agro-Forestry)
IPCC	Intergovernmental Panel on Climate Change
MOA	Ministry of Agriculture
MRV	Measuring Reporting and Verification
NIFCI	Norway's International Forest and Climate Initiative
NFI	National Forest Inventory
NFM/NFMS	National Forest Monitoring (System)
NGO	Non-Governmental Organization
NSDI	National Spatial Data Infrastructure
NTFP	Non-Timber Forest Products
PFM	Participatory Forest Management
RARI `	Regional Agricultural Research Institute
REDD+	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
REL/RL	Reference Emission Levels / Reference Levels
R-PIN	Readiness Plan Idea Note
R-PP	Readiness Preparation Proposal
SNNPR	Southern Nations, Nationalities and People's Region
UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD	United Nations Collaborative Programme on REDD
WB	World Bank
WBISPP	Woody Biomass Inventory and Strategic Planning Project
WG	Working Group
WRI	World Resources Institute

1. Introduction

The government of Ethiopia has embarked upon a growth path that fosters development and sustainability. Ethiopia's Climate-Resilient Green Economy (CRGE) strategy aims to achieve middle-income status by 2025 while developing a green economy, thus avoiding a sharp increase in GHG emissions and unsustainable use of natural resources. The CRGE strategy involves several sectors, such as agriculture, energy and forestry.

Despite their economic and environmental value, the remaining forests in Ethiopia are under threat. The growing population requires more fuelwood and more agricultural production, in turn creating needs for new farmland and timber – both of which currently result in deforestation and forest degradation. Through the Forest Carbon Partnership Facility (FCFP) of the World Bank, a REDD Readiness Preparation Proposal (R-PP) was prepared which included projected deforestation and forest degradation figures with input from FAOSTAT, FRA (2010), WBISPP (2004), IPCC, and other expert sources[1]. Projections indicate that unless action is taken to change the traditional development path, an area of 9 million ha might be deforested between 2010 and 2030. Over the same period, annual fuelwood consumption are expected to rise by 65% – leading to forest degradation of more than 22 million tonnes of woody biomass. The forestry sector contributes about 25% to projected GHG emissions levels under business-as-usual assumptions and offers great abatement potential through reduced deforestation and forest degradation. Ethiopia has chosen REDD+[2] as a climate change mitigation mechanism for the forest sector.

The implementation of REDD+ activities should be measured, reported and verified (MRV) and thus require an appropriate national forest monitoring system. The assessments of Ethiopia's current forest monitoring capabilities and available data (i.e. World Bank R-PP for Ethiopia) have emphasized the need for a dedicated capacity development effort that also encompass the agriculture and energy sector.

The cooperation between the Governments of Norway and Ethiopia, and other partners expresses a willingness to work together to provide a relevant, replicable model for how REDD+ can align the development objectives of forest countries with the world's need to combat climate change. The initiative will require the development of capacities for monitoring, reporting and verification (MRV) of forest carbon stocks and changes.

2. Objectives

The ultimate objective of this Roadmap document is to facilitate the development of a national system which will enable Ethiopia to provide measurable, reportable and verifiable estimates related to the implementation of REDD+ activities (hereafter referred to as a "REDD+ MRV System"). As an initial step in the development of this system, a road map for the development of a REDD+ MRV system should be designed and agreed following a stakeholder participation workshop and

1 Forest Carbon Partnership Facility (FCPF) Readiness Preparation Proposal (R-PP), Submitted by the Federal Democratic Republic of Ethiopia, 2011. Available at http://www.forestcarbonpartnership.org/sites/forestcarbonpartnership.org/files/Documents/PDF/Jan2012/R-PP%20Ethiopia-final%20May%2025-2011.pdf

2 REDD+ = "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"

consultations The development of such a road map considered several aspects that have been elaborated in the facilitation process and for preparing Terms of Reference for developing a REDD+ MRV system:

1. Considerations for designing an MRV system:

- Follow guidance for the estimation of carbon emissions and removals at the national level as outlined by the IPCC Good Practice Guidelines, as well as guidance for reporting laid out by the UNFCCC
- The specific needs of the national REDD implementation strategy including the identification of different land change drivers; in particular the relationships among deforestation and forest degradation with agriculture (i.e. cropland expansion and emissions) and energy (i.e. fuelwood & charcoal)
- Other monitoring and reporting commitments in the forest sector in Ethiopia[3]

2. Bridging the capacity gap through a detailed plan to establish sustained MRV capacities within the country:

- Capacity gap assessment based on the state of the existing national forest monitoring technical capabilities and the requirements for the provision of carbon emissions estimates as part of a REDD+ MRV system
- Implement a sustained and efficient institutional framework including competence in measuring and monitoring, support of national policies and REDD+ actions, establishment of forest reference levels, suitability for international reporting and verification, and linking with REDD+ actions on the sub-national level

The MRV road map presented here was facilitated by international experts from Wageningen University. It is developed in ownership of the appropriate Ethiopian REDD+ institutions, builds upon available datasets and the current national GHG inventory (as used for the UNFCCC national communications), and is based on a detailed data and capacity gap assessment, involves key national stakeholders and includes the specification of both near-term priorities and long-term targets for MRV capacity development. While it is widely agreed that the agriculture sector in Ethiopia can play a large role in climate change mitigation, to the point that this sector is explicitly included in the Ethiopia CRGE Strategy, the objectives of this MRV Road Map are limited to activities encompassed under REDD+. It is important to note that there are key linkages between the forest sector and others such as energy (in the case of fuelwood) and agriculture.

3 For this reason, the term “REDD+ MRV System” is occasionally used in conjunction with National Forest Monitoring System (NFMS) in this document to indicate complementarity and synergies between these two objectives (shown in Figure 1).

3. Background

3.1. Principles of MRV and National Forest Monitoring Systems

In order to report on REDD+ activities[4], countries participating in REDD+ require national forest monitoring systems[5] that use an appropriate combination of remote sensing and ground-based and national inventory approaches for estimating anthropogenic forest-related greenhouse gas emissions by sources, removals by sinks, forest carbon stocks and forest area changes. Such systems provide the foundation for estimating, reporting and verifying the effect of forest-related or REDD+ activities on forest carbon (Herold and Skutsch, 2011). In addition, they provide data for policy assessment, may take advantage of local communities in monitoring, be linked to monitoring of other forest values, such as biodiversity, social aspects, and provide information on the success of policy implementation.

It is agreed that the 2003 IPCC Good Practice Guidelines on Land Use Land Use Change and Forestry (LULUCF) provide methodologies that allow for the estimation of carbon emissions by sources or removals by sinks resulting from deforestation, forest degradation, forest conservation, reforestation, afforestation, etc. In carrying out such estimates, the five IPCC principles should be considered, particularly transparency, comparability, consistency, accuracy and completeness as far as is possible, and uncertainties should be reduced as far as national capabilities and capacities permit. It is further indicated that these monitoring systems and their results will be suitable and open to independent review as agreed by the UNFCCC Conference of the Parties (COP).

The UN-REDD Programme NFMS Approach[6] is built on several 'pillars' that support the development of REDD+ NFMSs under the UNFCCC. This approach is based around the methodological equation proposed by the IPCC (i.e. emissions (E) = activity data (AD) x emission factors (EF)), combined with the monitoring for the REDD+ pillar.

The three technical pillars or building blocks of the NFMS can be described as follows:

- Pillar 1 = AD: A Satellite Land Monitoring System (SLMS) to collect and asses over time AD related to forest land;
- Pillar 2 = EF: National Forest Inventory (NFI) to collect information relevant for estimating emissions and removals and provide emissions factors, i.e. forest carbon stocks and forest carbon stock changes;
- Pillar 3 = Emissions/Removals: Provide the bases for a national GHG Inventory as a tool for reporting on anthropogenic forest-related GHG emissions by sources and removals by sinks under the UNFCCC.

These pillars could in practice support the implementation of a NFMS[7] , which has the dual functions of monitoring and MRV for REDD+. Figure 1 illustrates the dual functions of the NFMS, as interpreted

4 The five REDD+ activities are: (i) reducing emissions from deforestation; (ii) reducing emissions from forest degradation; (iii) conservation of forest carbon stocks; (iv) sustainable management of forests; and (v) enhancement of forest carbon stocks.

5 With, if appropriate, subnational monitoring and reporting as an interim measure (UNFCCC Decision 16/CP.1)

6 National Forest Monitoring Systems: Monitoring and Measurement, Reporting and Verification (M & MRV) in the context of REDD+ Activities. UN-REDD PROGRAMME NINTH POLICY BOARD MEETING, 26-27 October 2012. Brazzaville, Republic of the Congo.

7 Decision 1/CP.16 paragraph 71(c); Decision 4/CP.15 paragraph 1(d)

through the UN-REDD Programme NFMS Approach. Within the Monitoring Function box are listed several illustrative examples of the types of monitoring approaches a country might select to meet its monitoring needs and to suit the national context, while under the MRV Function the elements as recommended under the UN-REDD Programme NFMS Approach are listed. It is important to note that remote sensing and up to some extent the NFI can be used as an approach both for yielding activity data for MRV as well as for meeting broader monitoring needs. Pillars 1 and 2 are relevant for both the monitoring and the MRV function, while pillar 3 is particularly relevant for the MRV function.

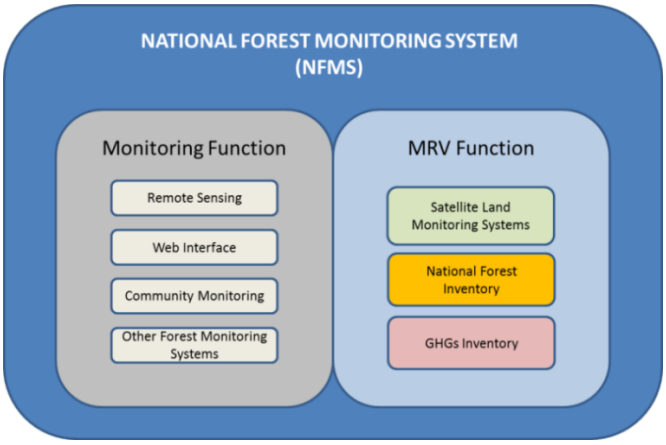

Figure 1 - Approaches and Tools to fulfil the functions of the National Forest Monitoring Systems

In the Good Practice Guidelines (GPG) outlined for the Land Use, Land Use Change and Forestry (LULUCF) sector, the IPCC provides guidance on the usage of so-called tiers for estimating emissions from various carbon pools[8]. Tier 1 estimation entails the use of default emission factors and/or coarse global or regionally produced activity data and emission factors (e.g. deriving above-ground carbon stock data from coarse-resolution global biomass maps). Tier 2 expands on tier 1 methodologies by including country-specific data, but may still include coarse-resolution activity data and emission factors. Tier 3 estimation includes the use of finer spatial resolution data, often with spatially explicit mapping of carbon stocks and land use changes and accounting for temporal variability (e.g. responses to climate variables).

3.2.Overview of Ethiopia's forest resources

3.2.1. Forest Area and Forest Area Change

Establishing a robust system to assess forest area and forest area change over time is a vital step in the assessment of Activity Data (explained in Section 3.1)[9]. To ensure transparency and consistency in reporting, a national forest definition is needed at the national level. This definition is a key requirement for ensuring consistency in the estimation of forest related emissions both in the reference period and in the assessment period. While no definition has been specifically communicated by Ethiopia[10], a working definition has been employed in preparation of the 2010 FAO

8 IPCC Good Practice Guidelines for LULC. 2006. Available at: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html

9 See also the GOFC-GOLD Sourcebook for more information on how to assess these variables: http://www.gofcgold.wur.nl/redd/index.php

10 Some developing countries that are developing CDM projections have communicated forest definitions for this purpose.

FRA. This definition is based on previously defined land cover types from the WBISPP report and is shown in Table 1.

FAO Class	Definition
Forest	Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.
Other wooded land (OWL)	Land not classified as —Forest , spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.
Other Land	Land classified as —Other land , spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity.

Table 1 – Forest definition employed by FAO (FRA 2010) and derived from WBISPP (2004)[11]

According to these definitions, the 2010 FAO Forest Resource Assessment (FRA) projected forest change rates from 1990 to 2000 using satellite and *in situ* data on forest cover included in the Woody Biomass Inventory (WBISPP 2004) and the Ethiopian Forest Action Program (EFAP 1994). A projection to 2010 was made from these estimates to give an estimate of average forest loss per year of approximately 140000 hectares from 1990 to 2010 as shown in Figure 2.

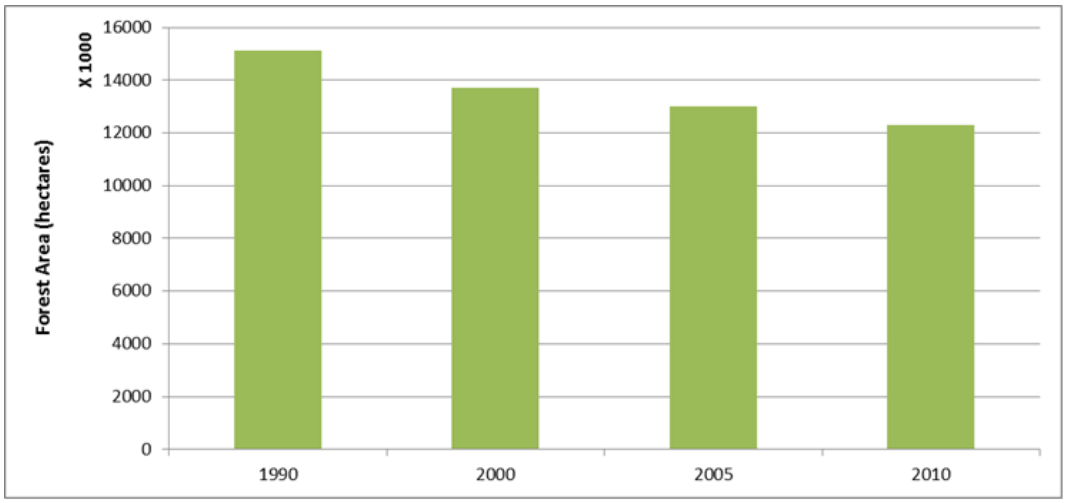

Figure 2 – National forest cover in hectares in Ethiopia from 1990 to 2010[12].

Given the diversity of local contexts within Ethiopia, forest change is expected to occur at different rates in different parts of the country. Data from the FAO Global Remote Sensing survey, which focusses on forest cover change from 1990 to 2000 and 2000 to 2005, forest change throughout Ethiopia during these time periods was calculated and shown in Figure 3. From these data the rate of forest cover change does not seem to be constant. Average annual forest loss during 1990 to 2000 seems to be higher than loss in 2000 and 2005 indicating a slowing in deforestation trends between these time periods. In both time periods, forest loss is especially concentrated in the southern and southwestern forested areas.

11 FAO Forest Resource Assessment (FRA) for Ethiopia. 2010. Available at http://www.fao.org/docrep/013/al501E/al501e.pdf

12 Ibid. no. 8

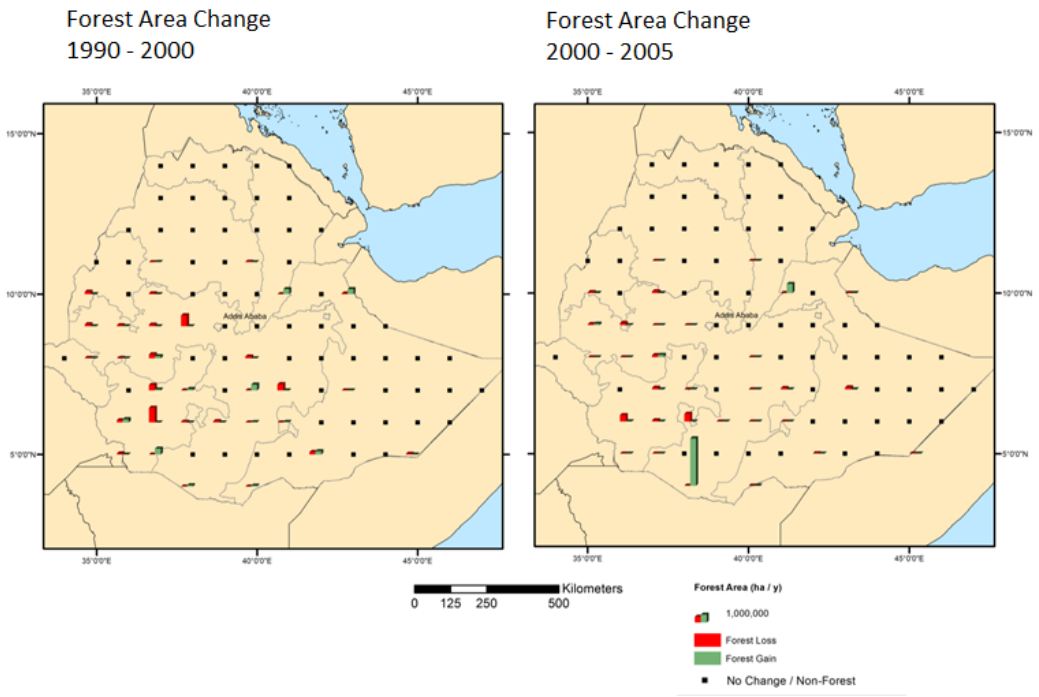

Figure 3 – Forest area change from 1990 to 2000 (left panel) and 2000 to 2005 (right panel). Results were derived from the grid-based FAO Remote Sensing survey [ref]. Red bars indicate forest lost (in hectares per year) and green bars indicate forest gain (in ha/y). Black squares indicate grid cells where either no forest cover or no change was detected.[13]

The progression of forest area change in a country is often conceptualized using the Forest Transition (FT) theory. According to the FT theory (shown in Figure 4), as industrialization progresses in a country, forest cover is lost first a rapid pace, and eventually slows over time. In early stages, the country is rich in natural forest cover, having experienced very little historical deforestation. As economic forces drive the conversion of forests to other land uses, previously high forest cover is rapidly lost. This stage is followed by a period characterised by low but stable forest cover, where very little deforestation occurs, and what forest does exist is typically found in relatively inaccessible areas or in patchy mosaics. In the fourth stage, forest regeneration occurs as a result of natural regrowth or afforestation and forestation.

The position of a country along the FT curve is determined by socio-economic factors which drive deforestation and degradation. Addressing these drivers under a REDD+ framework can mitigate against the effects of these drivers on forest cover loss over time. The dotted red line in Figure 4 indicates a possible alternative FT pathway for Ethiopia given the implementation of certain REDD+ actions. In this case, addressing the main drivers of forest loss can decrease the rate of forest loss over time. In this way REDD+ could be seen as a key element in a low-carbon growth strategy for Ethiopia.

13 FAO Global Remote Sensing Survey for 1990-2005. 2012. Available at: http://www.fao.org/forestry/fra/remotesensingsurvey/en/

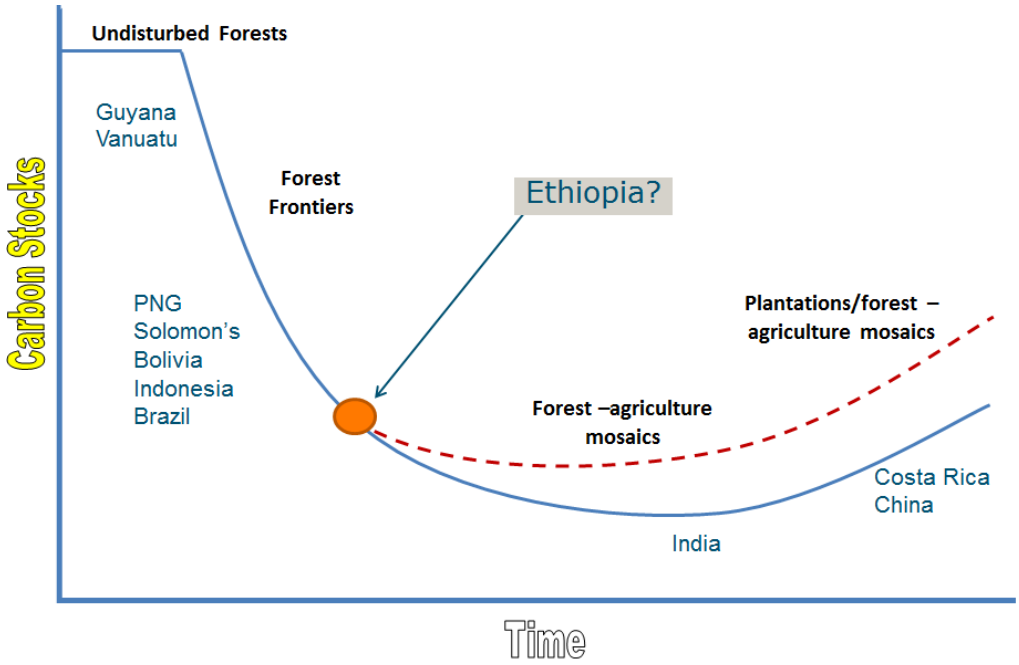

Figure 4 – The forest transition (FT) curve indicating the expected or observed pathways of forest carbon stock change over time. Given high historical deforestation rates, Ethiopia's expected location on the curve is indicated on the curve. The red dotted line indicates a possible pathway of carbon stock change given implementation of REDD+ activities in Ethiopia.

3.2.2. Forest Carbon Stocks

Despite previous efforts to measure and map biomass stocks nationwide (notably the Woody Biomass Inventory, WBISPP 2004), obtaining high-quality information on biomass carbon stocks often proves to be one of the most evasive tasks associated with REDD+ MRV. Several recent global or pan-tropical studies, including Baccini et al. (2011)[14] and Harris et al. (2012)[15], have shown that remote sensing data can aid in the rapid and coarse assessment of above-ground biomass stocks over a country. Using a pan-tropical biomass map based on coarse resolution MODIS data, the estimated above-ground biomass (AGB) over Ethiopia is shown in Figure 5. While these figures are very coarse and are no substitute for national forest inventory (NFI) data in a higher-tier MRV system, such maps provide a first glance of a country's AGB stocks. From this map it is clear that Ethiopia's biomass stocks are largely concentrated in the afro-montane cloud forests of the south and southwest of the country, most notably in the south-central Oromia (Bale Mountains region), northwest SNNPR (Kafa-Sheka zones) and western Oromia (region surrounding Yayu Biosphere Reserve). Lower AGB stocks can be found in Gambella, Beni-Shangul Gumuz, Amhara, and Tigray regions, and significantly lower AGB stocks in the drier regions of Afar and Somali.

14 Baccini, A., Laporte, N., Goetz, S. J., Sun, M., & Dong, H. (2008). A first map of tropical Africa's above-ground biomass derived from satellite imagery. Environmental Research Letters, 3(4).

15 Harris, N. L., Brown, S., Hagen, S. C., Saatchi, S. S., Petrova, S., Salas, W., Hansen, M. C., et al. (2012). Baseline Map of Carbon Emissions from Deforestation in Tropical Regions. Science, 336(6088).

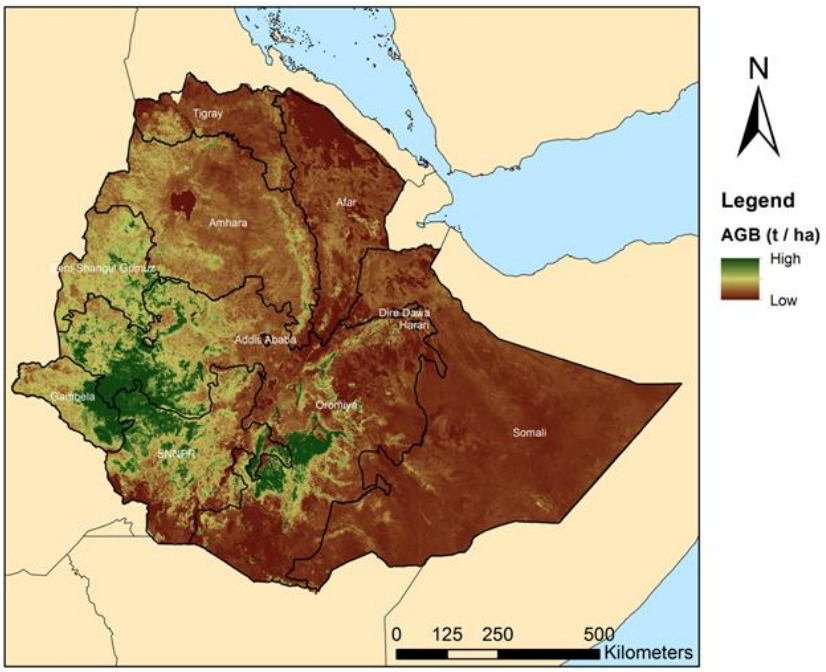

Figure 5 – Coarse-resolution above-ground carbon stocks in Ethiopia. Green regions indicate areas of high biomass, while dark brown regions indicate areas of low biomass.[16]

3.3.Drivers of DD and planned REDD+ interventions

Monitoring and provision of robust information on drivers and the related activities that lead to deforestation and forest degradation provide an essential data stream for countries in their REDD+ strategy and policy design and its implementation (Herold and Skutsch, 2011). There is need for identifying forest change drivers and causes (locally, nationally, internationally), tracking them over time, attributing measured emissions to specific causes, designing dedicated mitigation actions that address them, and to assess the impact of these.

Identifying and assessing drivers on the national level requires resources and efforts additional to regular estimation and reporting for GHG accounting using the IPCC Good Practice Guidelines (IPCC, 2003 and 2006). In order to be more cost effective, countries should integrate and combine capacity development efforts for monitoring drivers with on-going national forest monitoring for REDD+. In particular countries should, where possible, link activity data monitoring (i.e. forest area change) with the monitoring of drivers.

Commonly, there is a distinction between direct and indirect drivers of deforestation and degradation. Proximate/direct drivers are human activities or immediate actions that directly impact forest cover and loss of carbon. Underlying/indirect drivers are complex interactions of social, economic, political, cultural and technological processes-strengthen direct causes.

In the R-PP and based on work done in 2010 by the EDRI, a general and tentative assessment was made of the drivers of D&D in Ethiopia. The two main direct drivers of D&D are agricultural land (crop land) expansion and unsustainable fuel wood consumption. These drivers are strengthened by

16 Ibid. no. 11.

current demographic and economic trends, and enabled by a deficient regulatory and institutional framework for forestry.

3.3.1. Direct drivers

The most prominent deforestation driver is conversion of forests to agricultural land, as agriculture is more attractive than forestry. In a 'business as usual' scenario, the impact of this deforestation driver would be expected to increase, as agricultural land requirements will increase by an estimated 19 MHa by 2030, spurred by strong governmental support to develop agriculture and sustained demographic growth of 2-3 % per year.[17] It is important to note, however, that future deforestation rates could slow due to the inaccessibility of remaining forest areas, resulting in an overestimate of projected deforestation rates using a 'business as usual' assumption.

Conversion of forests, woodland and shrub land into agricultural land is by far the largest driver of deforestation in Ethiopia, causing the emission of an estimated 40 Mt of CO_2 from deforestation in 2010. Its impact is bound to increase up to 65 Mt per year in 2030, as development of agriculture continues to accelerate under the impulse of strong governmental support and demographic growth. In a 'business as usual' growth path, requirement for agricultural land will increase by 19 Mha by 2030, from 15 Mha in 2008, to meet booming demand. This land will mostly be taken from forestry: based on historical deforestation rates as per WBISPP, 80% of new agricultural land developed between 2000 and 2008 was converted from forests, woodlands or shrub lands[18]. While in Ethiopia a significant proportion of agricultural expansion is due to small-holder agriculture, large-scale commercial agriculture is having a growing impact on deforestation rates. In accounting for these drivers, it is important to keep in mind that different actors are involved in these activities.

The second most prominent driver, with most of its impact focused on forest degradation, is unsustainable fuel wood consumption. Ethiopia's energy consumption is predominately based on biomass energy sources (94%) (Energy Policy of Ethiopia, 2006). This includes traditional energy sources such as fuel wood, charcoal, branches, leaves and twigs, and current needs largely exceed the level of sustainable production (e.g. from dead wood and plantations), leading to massive degradations of the biomass. Between 2000 and 2010, degradation due to fuel wood consumption claimed an estimated 135 Mln tons of woody biomass from the total woody biomass existing in 2000. As the evolution of fuel wood consumption is strongly correlated to population growth, its impact on degradation is expected to reach, in a 'business as usual' scenario, 22Mt of CO_2 per year by 2030, as the Ethiopian population reaches 130 Mln people. Other sources of energy may compete with fuel wood, mostly electricity and diesel or kerosene, but uncertainties remain on whether they will be accessible in rural areas, and competitive with firewood in both rural and urban areas. Although it has no clear impact on deforestation, unsustainable fuel wood consumption prevents forests from regenerating, offsets their impact on carbon sequestration and leads to increased vulnerability to the adverse impacts of climate change.[19]

17 Ethiopia FCFP R-PP. Ibid. no. 1.

18 Ibid.

19 Ibid.

The other drivers that can be considered in Ethiopia are logging, clearing to convert to pastureland, infrastructures expansion and fire use to clear forest land and invigorate grass growth. None of the consultation and studies conducted in the preparation phase identified logging and infrastructures building as significant drivers of deforestation or degradation though. Conversion to pastureland was identified as a potential threat, as livestock population is expected to increase in Ethiopia, to meet the demand of a growing population reaching middle income level by 2020-2025. According to the preliminary analyses conducted by the EDRI in 2010, total cattle population is expected to increase from 51 Mln animals in 2008 to 110-120 Mln in 2030[20].

3.3.2. Underlying drivers

Agriculture is a core component of Ethiopia‘s ambitious Growth and Transformation Plan (GTP), which will bring Ethiopia to the status of middle income country by 2030. Government policies and services geared towards the achievement of food security and agriculture development have often competed with incentives to preserve forest cover, and the development of profitable agriculture, including horticulture, coffee, tea and others has been given strong national support by the government‘s industrialisation and agricultural development policies. Federal/regional investment bureaus and investment authorities sponsor medium/large scale agro-industrial developments, while policies also exist to support small-scale farmers producing market-oriented agricultural products such as livestock and crops. In contrast, government support for forestry management, especially in natural forest, has tended towards conservation rather than supporting sustainable forest management. Moreover, social demographic evolutions will be an additional strong driver of both demand and supply of agricultural products. The Ethiopian population is expected to reach ~130 Mln people in 2030, from 81 Mln in 2010, and demand is likely to increase as revenues and diets evolve. The combination of these factors, result in agriculture being significantly more attractive than sustainable forestry, encouraging conversion of forests to agricultural land. In a business as usual‘ scenario, the level of degradation due to firewood consumption is expected to increase in the same proportions as the Ethiopian population (2-3 percent per year until 2030).

Other underlying drivers that enable the direct drivers, are deficiencies in the regulatory and institutional environment: Unclear user rights, low empowerment of local communities and absence of benefit sharing mechanisms encouraged an ‘open access’ mentality and conversion to agriculture. Inappropriate regulation, or the absence of means of implementation, combined with the absence of a strong, dedicated forestry institution, failed to protect forests. Many regulatory policies regarding forest use have been un-implementable because of either lack of resources (i.e. financial, human and institutional capacity, including weak institutional structures) or inherent deficiency of the forest regulatory instrument, and have resulted in widespread illegal/uncontrolled use of the forest. This, combined with irregularities and inconsistencies in the implementation of bans on forest products, created a disincentive for forest-dependent people to invest in forest management/protection because of a lack of security over future returns.

There is disagreement among professionals and forest-dependent communities on what they perceive as the underlying drivers of deforestation. Professionals referred to a lack of strong forestry institutions and the poverty of forest-dependent people as root causes of forest degradation, while

20 Ibid.

forest dependent communities cited unclear user rights, lack of support, motivation and reward/penalty leading to an 'open access' mentality as the key driver of forest deforestation.

The drivers presented are a generic and tentative overview of the relevant drivers, and further investigation will be required during the R-PP implementation phase. Data presented on deforestation, emissions and removals are just indicative estimates; national REDD+ MRV should be defined and applied for implementing performance-based incentives.

3.4.REDD+ interventions

The mitigation levers identified based on the work carried out by the CRGE initiative focus on addressing the main two drivers of deforestation and degradation (conversion to agricultural land and unsustainable fuelwood consumption), through a combination of proposed measures to increase agricultural yields, manage soils and forests better, and adopt alternative energy sources and energy-efficient cooking technologies (**Error! Reference source not found.**). Particularly for the latter nitiative, REDD+ will strongly interact with rural energy strategies.

Macro levers	Levers	Description
Reduce pressure from agriculture on forests	Agriculture intensification on existing land	Decrease requirements for new agriculture land by increasing yield and value of crops per unit area
	Prepare new land for agriculture through medium- and large-scale irrigation	Shift of new agricultural land from forest to degraded land brought into production due to irrigation and use of organic fertiliser
	Prepare new land for agriculture through small-scale irrigation	Shift of new agricultural land from forest to degraded land brought into production due to irrigation and use of natural fertiliser
Reduce demand for fuelwood	Introduce Fuelwood efficient stoves and other alternative energy sources	Reduce wood requirements due to efficient stoves (mostly in rural areas)
	Electric stoves	Switch to electric stoves (mostly in urban areas)
	LPG stoves	Switch to LPG stoves
	Biogas stoves	Switch to Biogas stoves (in rural areas)
Increase sequestration	Afforestation and reforestation	Large-scale afforestation and reforestation of degraded areas
	Forest management	Large-scale forest management programmes

Table 2 - Identified levers for GHG mitigation. [21]

Main changes in the regulatory environment to enable the proposed mitigation mechanisms to be implemented should, according to the consultations made in the preparation phase, focus on local people's rights, and better coordinate land-use planning. While the Federal MoA and EPA are set to coordinate initial steps, capacity building should focus on the continual development of these institutions to be able to tackle forest-related issues in more coordinated and integrated manner, and potentially explore how institutional arrangements can be improved to ensure that in the long-term.

In the preparatory phases of a national REDD+ programme, a series of pilot activities could be designed to begin to address the drivers of deforestation and forest degradation in identified key

21 Ethiopia's Climate-Resilient Green Economy Strategy. Federal Democratic Republic of Ethiopia. Available at: http://www.epa.gov.et/Download/Climate/Ethiopia%27s%20Climate-Resilient%20Green%20economy%20strategy.pdf

forest areas. Pilot activities would provide an opportunity for an impact assessment of these activities according to various criteria, including effectiveness, efficiency, benefit sharing and social justice, from which proven methods could be selected for scaling up. Additionally, pilot programmes would feed into a national REDD+ learning network through which experiences can be shared across regions. By scaling up experiences from such programmes and projects can also provide an opportunity to integrate local-level consultation into the national MRV process.

REDD+ and its associated activities are intended to help capture the mitigation potential from forestry that has been estimated to be up to 130 Mt CO2e in 2030. REDD+ initiatives will help not only to put an institutional structure in place that supports the implementation of abatement levers in forestry, but also to finance these levers, e.g. by monetising abatement potential and putting in place the necessary prerequisites such as a reference scenario and an MRV system.

4. Outcomes of the Ethiopia REDD MRV Workshop

4.1. Data and Capacity Gap Analysis

A capacity gap assessment for an Ethiopian National MRV system was carried out taking into account IPCC Good Practice Guidelines. Specifically, current national capacities and capacity gaps were identified and tied to key data requirements. Data requirements were grouped into three broad categories, including Activity Data (relating to deforestation, reforestation and forest degradation), Emission Factors (relating to changes in above-ground carbon stocks and stock changes in other carbon pools), and Auxiliary Spatial Data (see Section 3.1 for a more detailed explanation of these variables). The results of the data and capacity gap analysis are summarized in Appendix A.

In the process of taking inventory of data capacities and capacity gaps at a national level, the following national priorities were identified to address these gaps towards establishing a national MRV system:

- Evaluate and decide on a national forest definition
- Develop capacity in remote sensing for forest change assessments (image interpretation, change analysis)
- Develop clearinghouse for data access
- Develop a plan/system for data acquisition at regular time intervals
- Standardize forest inventory methods and establish minimum criteria for developing allometric models for individual species (capacity building needed). Conduct new and consolidated NFI.
- Include other carbon pools in a national forest inventory (NFI)
- Develop a centralized system for archiving carbon data to be made available for national level MRV.
- Specific data infrastructures to be developed for different sectors
- Development of a National Spatial Data Infrastructure (NSDI), including a national database and/or catalogue of metadata. An NSDI is currently being developed by several institutions at the national level that need to be better coordinated.

4.2. Analysis of data and capacities for monitoring by drivers

National monitoring of drivers is valuable for designing and performing REDD+ but in particular to facilitate engagement with different (non-forest) sectors and for developing incentives in the context of broader development objectives such as those linked to national mitigation actions or low carbon development strategies. The types and intensity of different drivers determine priorities for REDD+ interventions and thus are important for assessing current gaps in national forest monitoring for REDD+. Starting from previous assessment of drivers (see section 3.3), data gaps regarding the monitoring of current and recent drivers were analysed. The analysis included the identification of current data sources and capacities to track specific types of drivers and the related change processes. The assessment put focus on the impacts on designing an MRV system for Ethiopia, in particular with respect to monitoring forest degradation.

A summary of the main drivers, their importance on the national level and the current data available is included in Appendix B. The analysis emphasizes that current data to assess the carbon impact for different forest change processes is rather weak and suffering from a lack of fundamental consistent sources for activity data and emission factors; this is true even for the most relevant forest change processes on the expansion of agriculture and extraction for fuelwood and charcoal. To track the different drivers, data from various sectors and agencies need to be harmonized and integrated. Thus, the following key issues can be summarized for the MRV roadmap development:

- Importance of different drivers of deforestation and degradation and carbon impact should be better quantified – there is need to consider driver assessments as part of the national forest monitoring system
- Need for consistent national forest area change assessments using archived satellite data combined with ground data
- Forest area change to include identification of fate of land/follow up land use, incorporating multi-sector land use data
- Conduct new national forest/woody biomass inventory to accommodate needs for forest carbon change monitoring. The previous woody biomass survey can be used as a benchmark, but should be revised (i.e. forest types, sampling etc.), in particular to develop emission factors for different forest change processes
- Need for broad stakeholder engagement. This will necessarily include regular updates on discussions on MRV/monitoring progress and for multi-sector involvement, providing a forum for consultation and review.

4.3.Proposed REDD+ Interventions

For REDD+ to be an effective climate mitigation agent, the key drivers of deforestation and degradation need to be addressed. To this end, specific REDD+ activities are necessarily context-specific and should be designed according to identified drivers. The principles behind REDD+ interventions and their relationships with drivers of deforestation and forest degradation are discussed in more detail in Section 3.4. A range of proposed activities were considered in terms of the drivers or processes expected to be affected by them, their relative importance, and the extra data entailed in including these activities in a REDD+ MRV. The results of this analysis are summarized in Appendix C. The following REDD+ implementation activities were proposed to address drivers of deforestation and forest degradation:

- Participatory Forest Management

- Agricultural Intensification - introduction of high yielding crop varieties which consume less land through integrated agricultural systems
- Protected natural forest areas, natural parks, sanctuaries, and biosphere reserves
- Afforestation and reforestation
- Agroforestry, agro-silvo-culture, silvo-pastural, agro-silvo-pastural
- Sustainable wood plantations – planting of fast growing trees for fuel wood, construction, furniture and watershed management
- Improved cooking technologies and other alternative energy saving technologies
- Irrigated agriculture on low-carbon land
- New technologies for extracting energy from biomass or other alternative energy sources (e.g. biogas)

4.4.Institutional Arrangements

Given the multitude of stakeholders involved in planning and implementation of REDD+ at all scales (sub-national and national), a REDD+ MRV system must also be designed to be able to accommodate these multiple stakeholders. Coordination of monitoring activities is essential for such a multi-stakeholder process to be successful. At the national level, a coordination mechanism should exist to provide a link between policy and practice at different scales. Additionally, MRV-related activities and arrangements should be linked to existing relevant structures, including higher education institutions and ongoing monitoring activities at the local level.

4.4.1. Coordination bodies

Given the wide variety of stakeholders involved in the REDD+ MRV process, there is a need for an MRV coordination structure at the national level. An assessment of relevant stakeholders to take part in the coordination of national MRV activities was carried out according to REDD+ MRV components. Several key components of REDD+ MRV were discussed and relevant stakeholders and suggested next steps were identified for each component. While the focus on Section 4.1 was on capacity gaps related to data requirements of a national MRV system, this assessment focussed on the institutional gaps related to these monitoring requirements, and identified steps to be taken to fill these gaps. A summary of the outcome of this exercise is shown in Appendix D, with the following components requiring institutional coordination at the national level:

- MRV coordination and links to REDD+ policy and implementation
- Remote Sensing data acquisition and analysis for NFM and MRV
- National Forest Inventory for NFM and MRV
- National data management infrastructure (including NSDI)
- Reporting to the international community (UNFCCC)
- Capacity Building for a national NFM/MRV system
- Research on NFM/MRV

4.4.2. Engagement with higher education institutions

Measuring, reporting and verification in forestry requires skill, knowledge and appropriate technologies and instruments. The available knowledge and infrastructure for MRV in a developing country such as Ethiopia may be limited to few institutions. Forestry institutions for example are highly dynamic in their nature as a result of their internal challenges or external forces (e.g. food security policies, economic pressure, etc.). As a result of these internal and external forces, forestry

institutions are subject to rapid restructuring. Because of this fact some of the already available infrastructures may be dismantled and skill and knowledge accumulated may also be lost (due to high staff turnover). This institutional instability frequently results in institutional memory loss and data disorder over time.

There are significant data gaps related to some parameters such as mean annual increment, growth stock, pest and disease in forestry, etc. For example, allometric equations which developed for biomes that are not relevant to the geographic situation at hand are often used in place of locally specific equations.

Dry regions do have different composition and structure in vegetation due to rainfall intensity, temperature and soil characteristics. Moist and wet regions exhibit vegetation with higher canopies, lush vegetation in the understories and different strata. Regeneration conditions also vary. Fire incidence is higher in the drier areas than in the moist forest. Due to the variation in structure and composition carbon stock and co-benefits including biodiversity also vary. Despite these variations, however, broad assumptions are often used because of lack of locally-specific data[22].

Higher learning and research institutions have skill, manpower and knowledge together with up-to-date instruments and necessary infrastructure. Turnover rate in these institutions is minimal and as a result, institutional memory is quite strong compared with the other government institutions. Most government institutions face difficulty in maintaining their status in decision making whenever political change happens, while higher learning and research institutions remain stable.

Because of this justification, higher learning and research institutions should be involved in REDD+ monitoring and MRV and should play a role in continuing development of capacities in this regards.

An assessment of opportunities for the engagement of higher education institutions was conducted, and the results are summarized in Appendix E. In this assessment, possible engagement was divided into three time scales: short, medium and long term engagement.

Short Term priorities and next steps are identified to tailor the available information in a simple and manageable way to get national consensus on confusing and ambiguous terms (e.g. a national forest definition). Furthermore, there are some skills scattered over agriculture institutions, but their capacity and training needs are not accounted for. Rapid training needs assessments and tailored trainings to those involved in forestry in the area of resource inventory, GIS and RS (among others) should be done as soon as possible.

Medium-term engagement should focus on more capacity building and knowledge management, where the emphasis would be given to transforming information from coarse to fine scale. At this stage, researchers could work on linking drivers and mapping information at the agro-ecological level, for example carbon estimates for different vegetation types[23]. In addition to research, MSc

22 For example, one study related to forest resources accounting was conducted (http://www.ceepa.co.za/Policy%20Brief%206.pdf) for which significant challenges in acquiring important parameters such as harvest loss during extraction of firewood and timber, percentage of forests affected by fire, disease and pest, etc. In place of locally specific parameters, mean annual increment developed for moist and dry forests in Uganda was used for the case of Ethiopia. Growing stock value and other parameters were also taken from the literature, and in some cases were developed in very different contexts.

23 Ethiopia has nine major vegetation types (see http://www.ibc.gov.et/biodiversity/ecosystems-of-ethiopia).

training is proposed in this time scale. Establishment of permanent plots to monitor different activities is recommended as priority in this phase.

Training at the PhD level is proposed as a long-term target. The PhD training may include the priorities and next steps planned for short term and medium term.

4.4.3. Integration with local-level monitoring activities

At present there are a variety of instances of monitoring activities taking place at local levels. Some examples of these monitoring activities are shown in Table 3. These activities can be founded embedded in local government programmes, international or local NGO projects, or a collaboration between both. In addition to individual (and independent) monitoring activities at the local level, there are also examples of existing coordination structures at the national level which could be a starting point for integrating these local monitoring activities into a national REDD+ MRV framework. The scaling-up of local monitoring activities and systems will not only serve to strengthen monitoring capacities at the national level, but will help to ensure that broader stakeholder consultation (especially at local levels) is incorporated into the national MRV process. Notably, a PFM working group (coordination unit)[24] exists at the national level and is coordinated by MOA. Regular sessions are held around the country by the PFM secretariat. Such a coordination body could be a vehicle for scaling up PFM activities in the country and could play an instrumental role in engaging with local level stakeholders in the design and implementation of a national MRV system at the local and national levels.

Region	Institution	Description
Various	Governmental and non-governmental organizations	PFM and Participatory Forest Resource Assessment (PFRA)
Various	Various	REDD+ start-up and pilot projects
Various	MOA	Forest demarcation in collaboration with local communities in the past 3-4 years)
Oromia	Oromia Forest and Wildlife Enterprise (OFWE)	Demarcation and mapping of forest area, as well as PFRA with NGO partners
Amhara	Regional BoARDs	Demarcation of forests and woodlands, and preparation of maps and data plans
Benishangul Gamuz	Governmental agencies and NGOs (FarmAfrica)	Implementation of PFM
Tigray	Kebeles, Region, and Federal government	Monitoring of enclosure areas (kebeles), state forests (region), and National Parks (Federal Wildlife Conservation Authority)

Table 3 – Examples of forest monitoring activities occurring at local scales in Ethiopia.

While existing local monitoring activities provide a strong basis on which to scale up or complement monitoring activities in Ethiopia, critical gaps in linkages and communication across scales were identified. For example, communication across local to national scales was identified as a particular challenge since the decentralization of government in Ethiopia. Weak linkages were also identified

[24] It should be noted that the PFM WG has had difficulties in maintaining regular meeting cycles, which could be due to a lack of resources or other reasons. Therefore, the PFM-WG should be targeted for capacity building measures to be able to take on this responsibility.

between woreda and regional BoARDs and between regional BoARDs and the national MOA as a result of human resource capacity gaps. In general, Increasing communication capacity and communication infrastructures should be included in measures increase institutional capacities. To address these gaps and to strengthen linkages between local, regional and national levels, the following steps are proposed:

- Initiate discussions with existing institutions regarding existing data (including governmental, NGO, CBOs)
- Begin sharing information from existing projects and house this information within MOA
- Establish a national forest inventory system with regular intervals
- Develop a standard database and monitoring and reporting framework, including common indicators for monitoring
- Link the REDD+ MRV system with existing initiatives using MOA and FAO as a platform
- Identify an institution that is responsible for managing data at the national level, and possibly involve higher education institutions in data storage and management
- Establish a REDD+ working group that works at national and regional levels and link this group with the existing PFM working group at national/regional levels. The REDD+ working group should be a group of experts working full-time to ensure progress on stated goals. In woredas where REDD+ pilot activities are being carried out, create a linkage between REDD+ WG and PFM WG in that woreda.
- Integrate participatory data (PFM maps, etc.) with remote sensing data acquired at the national level and communicate back to the local level (eg. to communicate carbon stocks of local forests)
- Each region should identify technical experts to manage (geo)-data at the regional, zonal, and woreda level (where pilot sites are selected)
- Forest definition has to be developed and communicated in a transparent manner to all stakeholders at all levels

5. Key activities for capacity development

5.1. Summary and description of activities

This list provides an overview of the key set NFM/MRV Road Map activities which is estimated to take 12 months to 24 months. There is flexibility to include additional activities or speed up the capacity development process if desired by Ethiopia and based on the outcomes of the international negotiations on REDD+ and associated mechanisms. It is clear that the proposed activities will rely on a stable source of funding the coming years. One of the key first steps to be taken therefore is to identify key sources of funding to carry out this road map.

1. Establish institutional arrangements

1.1 Establish steering/coordination body for the REDD+ NFMS/MRV system:

- This body would be overseen by the REDD+ secretariat and to provide central body for steering REDD+ NFM/MRV activities, and members would include MOA, EPA, MWE, and other relevant institutions (see Section 4.4). Activities of the body include:

642 – Linking MRV and policy
643 – Providing advice to Ethiopian negotiators at the UNFCCC COP's.
644 – Coordinating and steering the implementation of REDD+ monitoring and capacity
645 building activities
646 – Provide key advice on REDD+ monitoring issues to policy makers and REDD+
647 implementing bodies
648 • A discussion and decision will be needed on whether it is necessary to establish a body
649 separate from the REDD+ WG planned within MOA including several stakeholders. An
650 additional committee is not needed if the current WG can take on added
651 responsibilities and workload associated with a national MRV system.

652 1.2 Establish technical working group(s) and facilities:

653 • Equip and staff relevant technical units for REDD+ NFM/MRV
654 • Working group to facilitate access, assess and review of available datasets identified
655 on their usefulness for REDD+ monitoring purposes
656 • Implement a central national data infrastructure, data sharing and management
657 system for integration, transparency and support national and international reporting,
658 including to utilize common geo reference systems/data standards for REDD+
659 monitoring
660 • Establish WG's at regional levels where REDD+ pilot projects are active

661 1.3 Establish a mechanism for local engagement and exchange of capacities, experiences and
662 data between national and local forest monitoring activities:

663 • Develop partnership and joint support system with ongoing and planned REDD+ local
664 implementation activities and their monitoring activities

665 1.4 Develop framework to engage with research and higher education institutions:

666 • Scientific advice on NFMS/MRV issues
667 • Use, define and support dedicated research activities to improve national and local
668 NFMS/MRV system
669 • Training and education in higher education institutions on forest carbon monitoring

670 **2. Improve national forest monitoring: activity data**

671 2.1 Assess options for forest definitions:

672 • Assess national definition of forest currently use in Ethiopia
673 • Through a broad stakeholder engagement process, determine national definition of
674 forest land and forest land change, to capture human-induced changes and REDD+

675 2.2 Create an updated and improved national forest map:

676 • Take into account available map data and update and add detail using new data
677 sources (such as high-resolution remote sensing data) and calibrated and validation
678 with ground data

- Map categories and characteristics should serve as benchmark for assessing forest definition options and to support forest carbon monitoring and the forest inventory

2.3 Conduct consistent national forest area change assessments:

- Collaborate with national and international partner(s) to assist in access, processing and interpretation of satellite data and available all relevant national datasets, definitions, spatial reference system etc.
- Forest change analysis using available consistent time-series satellite data (such as from Landsat back to 1990?) combined with high resolution for calibration and validation
- Forest area change to include identification of fate of land/follow up land use,
- Aim to incorporate multi-sector land use data in the interpretation (i.e. from agriculture, infrastructure, plantations/reforestation activities)
- Conduct independent accuracy assessment for forest maps and change estimates
- Implement an operational processing and analysis system for satellite data for regular updates on national forest area changes in future periods
- Satellite data from areas encompassing Ethiopia should be considered as data sources.

2.4 Assess and estimate activity data for forest degradation

- Acquire relevant data from national data sources and local studies on the use patterns of fuel wood, charcoal and timber to test different proxy data for forest degradation processes
- Include an assessment of monitoring forest degradation from logging for more recent years using Landsat-type data or for selected areas with higher-resolution data (study of feasibility to see whether areas affected can be detected accurately)
- Assess and integrate satellite-derived fire and burnt area data records

3. Improve national forest monitoring: carbon stocks and emission factors

3.1 Design/update and implement a national forest inventory and carbon measurement system:

- Design/update a national and sub-national stratification and inventory design using previous woody biomass survey as benchmark (i.e. forest types, sampling etc.), but could be revised as needed to accommodate needs for forest carbon change monitoring
- Develop sample design and conduct statistical analysis for national systematic monitoring: national carbon density stratification and determination of plots establishment requirements (permanent and temporary plots aimed at measuring carbon stocks as well as monitoring change in carbon pools)
- Develop protocols and implement measurements in all carbon pools
- Provide national estimates of carbon stocks and a forest carbon stock distribution map (for estimating emissions from deforestation) and possibly make use of the East Africa Carbon map initiative which is currently underway (MOA)
- Implement the measurements for forest inventory as part long-term carbon measurement and monitoring plan including capacity development on national,

regional and local levels. Currently, MoA has started an initiative in collaboration with FAO to establish a NFI, but resources are limited, and not all requirements may be required by this initiative. A link is required between MRV processes and this process to harmonize.

- REDD+ MRV should make a decision regarding allocation of funds to establishing an NFI as described above, depending on whether the current initiative can satisfy the needs of a REDD+ MRV. Additional donors may be interested to support the implementation of a MRV roadmap, if current resources are not enough (*vis a vis* NFI)

3.2 Collect and further develop Carbon Conversion, Expansion Factors, Wood Density and Root/Shoot Ratio:

- Research and utilize current existing data (also look at UN-REDD efforts)
- Implement additional efforts for key missing data:
- Generate national factors through a process of destructive sampling
- Implement targeted sampling and surveys to establish national factors
- Develop Factors for: carbon conversion, expansion factors, wood density for key species, root/shoot ratio based through destructive sampling program
- Convert and re-assess existing forest and forestry data into carbon

3.3 Assess different drivers/processes of change and their carbon impact (emission factors):

- Address a variety of drivers and activities – which may require the setting up of temporary and/or permanent plots or other using other datasets:
- Key issues: carbon impacts of fuelwood, charcoal and timber extraction, and forest fires, plantations and using concession data
- Make use of available local project data and research projects or stimulate new ones
- Stratify areas of change activities to perform targeted sampling
- Decide on carbon pools, with an aim to measuring all pools initially. In this process selected locations, where are the high-carbon soils, will be explored for possible priority in assessment and may be the main pool measured following determination of significance.

4. Improve estimation and international LULUCF, GHG inventory and REDD+ reporting capacities

4.1 FEPA leadership to engage in technical support and training for national GHG inventories (using IPCC LULUCF GPG) and for upcoming REDD+ reporting

5. Prepare for MRV of REDD+ activities on the national level

5.1 Identify, integrate and conduct monitoring for local REDD+ demonstration activities:

- Scope for possible REDD+ demonstration activities addressing different drivers and associated national policy options, capacity building to be done at each stage of the implementation of the initiative
- Priority focus on intervention types: … to be defined as national policy discussions evolve but in particular those related to reducing emission from agriculture expansion and fuelwood/charcoal use

- Develop monitoring and test framework and conduct detailed monitoring (or make use of existing data) at demonstration sites using Tier 2 or Tier 3 methods (integrated with national monitoring) (for selected sub-national demonstration), and execute capacity building sessions with national and local stakeholders
- Study monitoring approaches for MRV of specific REDD+ activities as research or pilot activities (MOA is planning at least one pilot project per region)

5.2 Test approaches and options to derive forest reference (emission) levels:

- Use international guidance (UNFCCC) and improved data sources to explore different options to develop and step-wise improve a national forest reference level for Ethiopia

5.3 Develop foundations and data sources for a REDD+ safeguard information system:

- Use international guidance (UNFCCC) to seek available data sources and invest in acquiring additional ones to inform about safeguards, including information provided in the context of a NFMS

6. Implement a program for continuous improvement and capacity development

6.1 Design and implement a capacity development program building on available national capacities and international support where needed:

- Understanding forest carbon dynamics and climate change
- Measuring and monitoring tools: forest inventory, remote sensing, GIS and spatial analysis etc.
- REDD+ policy and implementation and links with monitoring and reporting

6.2 Seek partnerships with regional organizations and international research partners (i.e. South-South cooperation and student/staff exchange etc.)

6.3 Seek assistance from relevant international partners on key data and methods:

- UN-REDD Programme or GEO (satellite data)

7. Continued national and local communication mechanism on REDD+ monitoring

7.1 Conduct a series of regional workshops to inform about REDD+ and MRV among national and local actors, in order to both inform and seek input from local stakeholders.

7.2 Produce communication plan, web-site and outreach materials

5.2. Implementation of key actions

To be able to implement the actions outlined in Section 5.1, it is clear that coordination of the different institutions involved in the process is a large but very important task. To support the implementation of these activities, a framework is proposed in Figure 6. At the national level, a

National REDD+ Steering Committee (or equivalent body) would be responsible for directing REDD+ implementation activities in Ethiopia, including those activities of a National MRV/NFM Coordination Body (indicated as the first activity to be undertaken in Section 5.1). To support the activities coordinated by this body, a committee comprised of experts sourced nationally and internationally is proposed, whose role would be to advise on and support the implementation of key activities outlined in this road map. This committee would also be engaged in capacity building at different stages, and would be available as a backstopper to the MRV coordination bodies. At the national level, experts would likely be found in key academic and research institutions (e.g. Universities, FRC, IBC, etc.). At the international level, experts would ideally come from institutions already engaged in MRV/NFMS related work in Ethiopia (e.g. UN-REDD, FAO, WRI, etc.). The input from the Technical Expert Committee should be coordinated by a member of the National Coordination Body (National REDD+ Steering Committee).

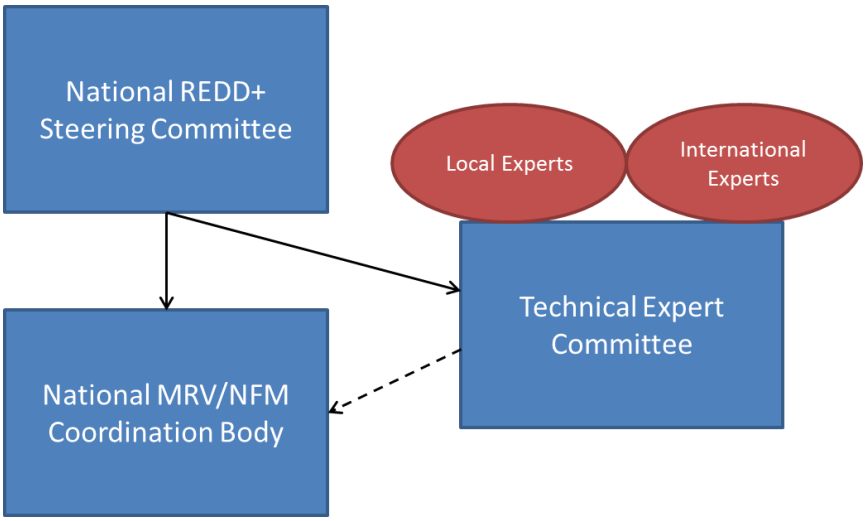

Figure 6 – Proposed framework to support the implementation of key activities related to the development of a REDD+ MRV/NFM system in Ethiopia. Solid lines denote coordination roles, whereas broken lines indicate a supporting role.

The following table summarizes the key actions outlined in Section 5.1 and indicates which national agencies/institutions should play a key role in following up on these activities. Also included are potential key international institutions (UN agencies, NGOs, academic institutions, or other international institutions) whose experience and current involvement in Ethiopia in forest and MRV-related issues position them to be able to make key contributions to the MRV Road Map activities. The timeframe for the implementation of the activities are indicated in terms of Immediate (within 6 months), Short-term (within 1 year), Medium-term (within 1-2 years) and Long-term (within 2-3 years).

Activity	**Responsible Agencies**	**Potential key international partners**	**Timeframe**
1. Establish Institutional Arrangements			
Establish steering/coordination body for MRV/NFM	MOA, EPA	NIFCI	Immediate *(6 months)*
Establish Technical WG's and facilities	MOA, EPA, Steering Bodies	Partners of international technical expert committee	Short-term *(1 year)*
Establish a mechanism for	MOA	CIFOR, NGOs	Short-term

Activity	Responsible Agencies	Potential key international partners	Timeframe
exchange of capacities, experiences and data between national and local forest monitoring activities			
Develop framework to engage with research and higher education institutions	MOA, Academic Institutions	Wageningen University, CIFOR	Short-term
2. Improve NFM – Activity Data			
Assess options for forest definition	MOA, EPA	CIFOR, FAO, consultancies	Immediate
Create an updated and improved national forest map	EMA, MOA	GOFC-GOLD, GEO/GFOI, Wageningen University, FAO/UN-REDD, consultancies	Short-term
Conduct national forest area change assessments	MOA, EMA	Wageningen University, FAO/UN-REDD, consultancies	Short-term; recurrent
Assess and estimate activity data for forest degradation	MOA, EMA	GOFC-GOLD, GEO/GFOI, Wageningen University, FAO/UN-REDD, consultancies	Medium-term *(1-2 years)*; recurrent
3. Improve NFM – Emission Factors			
Design and implement an NFI and carbon measurement system	MOA	FAO/UN-REDD, consultancies	Short-term
Collect and further develop Carbon Conversion, Expansion Factors, Wood Density and Root/Shoot Ratio	MOA, Academic/Research Institutions	FAO/UN-REDD, CIFOR, ICRAF, consultancies	Medium-term
Assess different drivers/processes of change and their carbon impact (emission factors)	MOA	FAO/UN-REDD, CIFOR, ICRAF, consultancies	Medium-term
4. Improve estimation and international LULUCF, GHG inventory and REDD+ reporting capacities			
	EPA	WRI	Short-term
5. Prepare for MRV of REDD+ activities at the national level			
Identify, integrate and conduct monitoring for local REDD+ demonstration activities	MOA, NGOs, Regional GOs	NGO's	Short-term
Test approaches and options to derive forest reference (emission) levels	MOA, EPA	CIFOR, Wageningen University	Short-term
Develop foundations and data sources for a REDD+ safeguard information system	MOA, EPA	NGOs, UN-REDD	Medium-term

Activity	Responsible Agencies	Potential key international partners	Timeframe
6. Implement a program for continuous improvement and capacity development			
Design and implement a capacity development program building on available national capacities and international support where needed	MOA, EPA, Steering Bodies	FAO/UN-REDD, NGOs, CIFOR	Medium to Long-term *(2-3 years)*
Seek partnerships with regional organizations and international research partners	MOA, EPA, Steering Bodies, all other stakeholders	FAO/UN-REDD, NGOs, CIFOR	Medium to Long-term
Seek assistance from relevant international partners on key data and methods	MOA, EPA, Steering Bodies, all other stakeholders	Partners of international technical expert committee	Medium to Long-term
7. Continued national and local communication mechanism on REDD+ monitoring			
Conduct a series of regional workshops to inform and seek input to REDD+ and MRV among national and local actors	MOA, EPA	NGOs	Short-term
Produce communication plan, web-site and outreach materials	MOA, EPA	FAO/UN-REDD, NGOs, CIFOR	Short-term

Table 4 – Outline of key activities to be implemented in the development of an MRV/NFM system in Ethiopia. Responsible agencies at the national level are indicated, with potential key international partners suggested for each activity.

Appendix A – Data and Capacity Gaps in Ethiopia related to IPCC GPG for LULCF

Variable	Focus	Analysis of Existing observations and data records	Missing data and capacities (gaps)
Activity Data	Deforestation	• Aerial photos from 1950's and 1930's 1960's, and national coverage from 1972-2004 • Landsat: MSS (1970's), TM (1980 – 2011), ETM+ (1999 – present), and LDCM (launched in February 2013) • SPOT5 (2006-2007, national coverage) • ASTER (after 2008, partial coverage) • IKONOS and Quickbird for selected areas (especially urban). • EUMETSAT (ongoing)	• High-resolution data are expensive and often unavailable for forest areas • Real time images are only available at low-resolution • Data on Forest conversion to other Land Uses (including settlements, investment areas) • Data on concessions
	Reforestation	• Reforestation data from international and local NGOs • Plantation data from regional BoARDs • Plantation development and management plans from forestry enterprises in Amhara and Oromia	• Accurate national data on replanted/reforested area
	Forest Degradation	• National consumption survey (CSA), including fuelwood consumption, conducted every 5 years (2010 is the latest) • Data on NTFP (gum, resin) and forest/woodland management plans (including acacia and other plantations)	• Regional statistics on timber harvest
Emission Factors	Changes in Above-ground carbon stocks (deforestation and degradation)	• WBISPP data (woody biomass data from the 1990's) • Inventory data for selected state forests (58 demarcated, some of which have inventory data)	• Age classification • Growing stock levels • Annual fuelwood removal • Basic wood density (WSG) • Fraction of biomass losses • Impact of livestock grazing on forest carbon stocks • Statistics regarding charcoal production and impact on forests/woodlands
	Other pools (i.e. soils) and other GHG emissions	• SOM dynamics and LUC data for Rift Valley Lakes region (Wondogenet College) • National and Regional Soil Laboratories • Exclosure studies on SOM and carbon sequestration (PhD/Msc studies) at universities, regional research institutes and federal research institutes. • Agricultural Transformation Agency initiative to compile national soil maps	• Wetland carbon stocks • Data on biomass burning and wildfires
Auxiliary Spatial Data	Factors of Forest change	• Topographic of different scales (EMA) • Road maps (EMA) • Vegetation types of Ethiopia (Addis Ababa University) • AMESD Land Degradation Mitigation and Natural Habitats Conservation data (low resolution satellite data) • Meteorological data	• Standardization of classification and methodologies

Appendix B – Capacities and Capacity Gaps Related to Drivers of Deforestation and Forest Degradation

Drivers of deforestation and forest degradation	How important is the process nationally (area affected)?	Current available activity data	Current available data for emission factors
Expansion of commercial agriculture (crops, pasture/livestock)	Medium – High (mainly in lowlands – very high there, only last 3-5 years and thus not quantified)	• Missing data on deforestation • Some data on expansion of commercial agriculture, through investments office	• Woody biomass inventory (data from 1990s) – outdated • Some regional inventories, demonstration and pilot projects as part of REDD+ efforts (last 5 years) – mainly C-stocks and not so much EF
Expansion of Subsistence / traditional agriculture (incl. shifting cultivation)	High (traditional practice)	• Missing data on deforestation (by encroachment) • Tracking of resettlement programs, location, number of people etc. (MoA has some data, in regional offices), data does not include illegal settlements	• Woody biomass inventory (data from 1990s) – outdated • Some regional inventories, demonstration and pilot projects as part of REDD+ efforts (last 5 years) – mainly C-stocks and not so much EF
Infrastructure (roads, etc.)	Low	• Missing data on deforestation • Some data on expansion of infrastructure	• Woody biomass inventory (data from 1990s) – outdated • Some regional inventories, demonstration and pilot projects as part of REDD+ efforts (last 5 years) – mainly C-stocks and not so much EF • Road Authorities at Federal and Regional Level
Settlement/urban expansion	Low	• Missing data on deforestation • Some data on expansion of	• Woody biomass inventory (data from 1990s) – outdated • Some regional inventories, demonstration and pilot projects as part of REDD+ efforts (last 5 years) – mainly C-stocks and not so much EF

Drivers of deforestation and forest degradation	How important is the process nationally (area affected)?	Current available activity data	Current available data for emission factors
Mining	Low	• Missing data on deforestation • Some data from mining sector	• Woody biomass inventory (data from 1990s) – outdated • Some regional inventories, demonstration and pilot projects as part of REDD+ efforts (last 5 years) – mainly C-stocks and not so much EF
Wood extraction for fuelwood	High	• Some data from MoE but little on area estimates	• Some data from MoE
Wood extraction for charcoal production	Medium (mainly in woodlands)	• Some data from MoE but little on area estimates	• Some data from MoE
Wood extraction for timber (from plantations)	Low (Important for wood products)	• Plantations data are outdated • Good data for Oromia	• Mostly sustainably managed and assumed to be C-neutral • Harvest estimates available (public orgs.)
Illegal logging (from natural forests)	Low (mainly for local construction, furniture, some illegal trade)	• No data and knowledge • No baseline studies – little knowledge	• No consistent data and estimates
Forest use for agriculture (free grazing in forest, coffee)	Low (coffee in South-West region)	• No consistent data and estimates	• No data and knowledge • No baseline studies – little knowledge
Forest fires	Medium (in woodlands and high forests)	• No consistent data and estimates	• No data and knowledge • No baseline studies – little knowledge

Appendix C – REDD+ interventions and current Drivers of Forest Carbon Change in Ethiopia

REDD+ intervention	Which drivers/processes will it affect	Importance (+, ++, +++)	What extra data is needed, and who should provide it?

Participatory forest management	• All drivers	+++	Extra data:
			• Data from communities (wide range of sustainability proxies)
			• Other pools then AGB
			  ○ Responsible:
			  ○ MoA
			  ○ Communities
			  ○ NGO
			  ○ Forest enterprises

Agricultural intensification	• Expansion of commercial and subsistence agriculture • Settlement/urban expansion • Forest use for agriculture	+++	
Protected areas of natural forests, national parks, sanctuaries, bio-reserves	• All drivers	+++	No extra data needed (Data already provided by MoA, EMA, EWCA, EPA)
Area closures of deforested/degraded forest areas for natural forest regeneration	• Forest use for agriculture • Free grazing • Wood extraction for fuelwood, charcoal and timber	++(+)	No extra data needed
Reforestation and/or afforestation projects	• Forest use for agriculture • Wood extraction for fuelwood, charcoal and timber	++(+)	No extra data needed

REDD+ intervention	Which drivers/processes will it affect	Importance (+, ++, +++)	What extra data is needed, and who should provide it?
Agroforestry: Agro-silvo-cultural Silvo-pastural Agro-silvo-pastural	• Forest use for agriculture • Expansion of subsistence agriculture • Wood extraction for fuelwood, charcoal and timber • Co-benefits: other forest products (honey)	Agro-silvocultural ++ Silvo-pastural + Agro-silvo-pastural +++	Extra data: • Land cover change – related to agroforestry systems • Carbon stock data on different agroforestry systems • Provided by: • MoA in collaboration with other stakeholders
Sustainable wood plantations	• Forest conversion for establishment of forest plantations • Illegal logging • Wood extraction for timber	+ Important in areas with paper factories, industry	Extra data provided by: • Forest enterprises (private and state) • Communities (when part of PFM)
Improved cooking/baking technologies	• Wood extraction for fuelwood • Wood extraction for charcoal	+(+) Important in rural areas	Extra data needed
Irrigated agriculture on land with low carbon content	• Expansion of subsistence agriculture • Expansion of commercial agriculture	+	Extra data needed
New technologies for energy from biomass or other alternative sources	• Wood extraction for fuelwood • Wood extraction for charcoal	++ Important in urban areas and in rural areas when there is transition to electricity as energy source	Extra data needed

Appendix D – REDD+ MRV Stakeholders and Coordination

REDD+ MRV component	Relevant stakeholders and respective roles and responsibilities	Suggested next steps
MRV coordination / links to REDD+ policy/implementation	• MRV coordination/chair - MoA • Cross-institutional REDD+ MRV task force as part of REDD steering committee: See following components for possible participants (e.g. Forest government institutions, EPA, Civil society, NGO) • Link to regional/local levels is necessary	• Need to convey technical task force on MRV: stakeholders/members need to be discussed • Mandate to start action by MoA, and MoA will chair technical REDD MRV task force • Important step is Memoranda of understanding for cooperation between different institutes • EPA is the link to other sectors (CRGE) and is responsible for overall GHG inventory • Link to EPA necessary for policy • (Note: MoA has coordination of forest and agriculture sector including forest and agricultural policies)
NFM/MRV monitoring – remote sensing	Responsible for Acquisition of Remote Sensing Data: • EMA Primary Users: • MoA • NMA • MWE • EPA • IBC • State forest enterprises Secondary Users: • Higher education/research institutions • CSA • EWCA • NGO	• Create institutional set-up for coordination of remote sensing data and for data flows between different users • New REDD+ MRV task force should take action on this • Link to national data management system important
NFM/MRV monitoring – forest inventories	Responsible for coordination: • MoA (responsible, collecting) Contributors: • MWE • IBC • Forest enterprises • Higher education/research (e.g. FRC) • CSA	• MoA will take the lead, and will coordinate • Linkage to other contributors important

	• EWCA • NGOs (FARMAfrica, etc.)	
NFM/MRV analysis	• Part of NFM/MRV monitoring components	
National data management infrastructure	Existing initiatives: • ETHIO-EIN (coordination by EPA; MoA member) • National Spatial Data Infrastructure (NDSI; MOA is a member) • National CRGE registry system (EPA) • IT centre (MoA) – upgraded to accommodate larger system (ETHIO-sys)	• Assessment whether this infrastructure can start from and link with existing infrastructure or if there is a need to create new overall infrastructure • New REDD+ MRV task force should take action on this
REDD+ international reporting	• Reporting is done through EPA	• EPA is lead, link to MoA and/or new REDD+ MRV task force necessary
NFM/MRV training – capacity building	• Relevant for all mentioned stakeholders in this table	• Extra mandate for REDD+ MRV technical task force to assess capacity gap and initiate short and long term capacity building and trainings • Higher education institutions start with trainings • Link to existing trainings/capacity building: • Training system at EMA (RS and GIS) • Higher education (specialist training on forest monitoring) • Access to international training and initiatives to provide capacities (FAO, UN-REDD,…) and South-south cooperation (supported by UN agencies, etc…) • Institutional capacity, organizational capacity • Building critical mass – need somebody to train people to make it resilient • Create awareness at all levels
NFM/MRV research – continuous improvements	Higher education and research institutes should contribute to improve monitoring systems (see Section 4.4.2)	

Appendix E – Involvement of higher education and research institutions

Time scale	Role of higher education and research institutions in REDD+ monitoring and capacity building	Thematic foci and areas of engagements	Relevant organizations and research partners	Existing capacities	Priorities and next steps
Short-Term	Identifying gaps in the process of implementing MRV	Data, quality, methods, accuracy, models, analysis and interpretation Drivers Levers	EIAR (FRC), RARIs, HU (Wondo Genet), MU, IBC, Harromaya U,	Technical staff Facilities (GIS lab. Other labs)	Defining forests (ecosystems that should be included in REDD+) Review existing research outputs, Adapting and setting standards Methodology development (procedures, tools) Develop/validate biomass models Drivers
	Training	Inventory GIS & RS Carbon accounting Data management	HU (Wondo Genet), MU, IBC, Harromaya U, EIAR (FRC), RARIs	Technical staff Facilities (GIS lab. Other labs).	Inventory GIS & RS Data management
	Networking	Information exchange Engaging stakeholders and international partners in new initiatives	HU (Wondo Genet), MU, IBC, Harromaya U, EIAR (FRC), RARIs, AAU and other stakeholders	ICT services collaborative research	Information Exchange
	Supporting data management	Providing scientific and technical information Generating data on sustainable forest management for vegetation types Support in data analysis and national data infrastructure, develop software	HU (Wondo Genet), MU, IBC, Harromaya U, EIAR (FRC), RARIs, AAU and other stakeholders	ICT services collaborative research	Vegetation changes sustainable forest management carbon accounting

Time scale	Role of higher education and research institutions in REDD+ monitoring and capacity building	Thematic foci and areas of engagements	Relevant organizations and research partners	Existing capacities	Priorities and next steps
Medium-term	Training	MSc Training	HU (Wondo Genet), MU, Harromaya U.	Technical staff Facilities (GIS lab. Other labs)	Resource inventory, Bio-energy development, Geo-information, Forest information systems, Carbon management, Alternative energy
	Research	Baseline data and time series monitoring of carbon and co-benefits Carbon stock changes (accounting) for different vegetation types (forest types) Vegetation dynamics (natural, anthropogenic-land use change, fire Improving field methodology Identifying alternative livelihoods Impact assessment of the existing interventions (e.g.PFM) - establishing permanent plots (vegetation zones) -Technology generation (tools, methods and procedures) -Undertake annual reviews on procedures and identifying gaps/challenges	EIAR (FRC), RARIs, HU (Wondo Genet), MU, IBC, Harromaya U, Professional society	Technical staff Facilities (GIS lab. Other labs)	Carbon accounting for different vegetation types (forest types) Improving field methodology Improving Tier levels
Long-term	Training	PhD	HU (Wondo Genet), MU, Harromaya U., (external collaboration)	Technical staff Facilities (GIS lab. Other labs)	Resource inventory, Bio-energy development, Geo-information, Forest information systems, Carbon management, Alternative energy