Proceedings of the training workshop on Greenhouse Gas Inventory Preparation for Forestry in Bangladesh

Forest Department
The Food and Agriculture Organization of the United Nations
The UN-REDD Programme

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Contents

The UN-REDD Programme, implemented by FAO, UNDP and UNEP, has two components: (i) assisting developing countries prepare and implement national REDD strategies and mechanisms; (ii) supporting the development of normative solutions and standardized approaches based on sound science for a REDD instrument linked with the UNFCCC. The programme helps empower countries to manage their REDD processes and will facilitate access to financial and technical assistance tailored to the specific needs of the countries.

The application of UNDP, UNEP and FAO rights-based and participatory approaches will also help ensure the rights of indigenous and forest-dwelling people are protected and the active involvement of local communities and relevant stakeholders and institutions in the design and implementation of REDD plans.

The programme is implemented through the UN Joint Programmes modalities, enabling rapid initiation of programme implementation and channeling of funds for REDD efforts, building on the in-country presence of UN agencies as a crucial support structure for countries. The UN-REDD Programme encourage coordinated and collaborative UN support to countries, thus maximizing efficiencies and effectiveness of the organizations' collective input, consistent with the "One UN" approach advocated by UN members.

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1. Executive summary

FAO Bangladesh organized a training course on "Greenhouse Gas inventory Preparation for Forestry" held at Bangladesh Bureau of Statistics, Dhaka under the UNREDD programme during 19-22 November 2012 with the cooperation of Forest Department. The training is organized for the stakeholders for capacity building for the implementation of MRV Action Plan and the REDD+ Readiness Roadmap of Bangladesh.

Participants from the Forest Department, Department of Environment, Bangladesh Forest Research Institute, Bangladesh Forest Industries Development Corporation, Bangladesh National Herbarium, Bangladesh Bureau of Statistics and the participants from forestry discipline of Chittagong University, Shahjalal University, and Khulna University joined at the training.

The training workshop provided numerous technical presentations on principles, guidelines and protocols for reporting GHG emissions for REDD+; updated information on remote sensing/forest cover maps, national forest inventory and other components of the UN-REDD Programme; and a short practice with United Nations Framework Convention on Climate Change (UNFCCC) software for default reporting.

The first biennial update report to the UNFCCC is due by December 2014. Therefore it is crucial to have a system that works very well to ensure that institutions with mandate to do the reporting and prepared the GHG inventory received the data. The workshop helped achieve capacity building on GHG inventory among potential stakeholders and various sectors.

2. Introduction and objectives

Measurement, Reporting, and Verification (MRV) play a crucial role in ensuring the success of international efforts to reduce the concentration of greenhouse gases (GHGs) in the atmosphere. For the REDD+ activities, where performance is linked to the accuracy of GHG estimates, an operational forest GHG inventory is an indispensable tool for supporting such activities. Despite the vast body of literature on the national inventory system (NIS) for GHG inventories[1], e.g. (Brunner and Radunsky,2000) (Hey and Sem,1999) (Leneva,2002) (Braatz and Doorn,2005), there is still limited literature available on the NIS when applied to GHG inventories in the context of REDD+.

According to Article 4, paragraph 1 of the United Nations Framework Convention on Climate Change (UNFCCC), Parties to the UNFCCC are required to keep, periodically update and submit national GHG inventories, taking into account their common but differentiated responsibilities (UNFCCC,1992). In line with Article 12, national GHG inventories include anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol. The purpose of the GHG inventory is to understand national trends in anthropogenic emissions by sources and removals by sinks, and to estimate the global GHG emissions balance. Annual balances of national net GHG emissions caused by human activity are expressed in the national GHG inventory in tons of carbon dioxide equivalent (CO_2eq). To produce the national GHG inventory on a regular basis, the Party shall establish a set of functions for planning, preparing and managing the inventory and maintaining the same over time. Under the UNFCCC Kyoto Protocol (KP) these functions have been formalised in a decision text and together constitute the national GHG inventories system to which Parties must conform (UNFCCC,2008). For non-Annex I Parties, the national GHG inventory forms part of the National Communication[2]. The preparation and delivery of the GHG inventory hence greatly depends on the availability of resources and the arrangements put in place for the National Communication.

As envisaged by the Cancun Agreements (UNFCCC,2011), the UNFCCC reporting requirements for non-Annex I Parties are becoming increasingly stringent: a national communication every four years and an updated national GHG inventory every two years. The biannual reporting requirement demands a transition from temporary arrangements for preparing the national GHG inventory to a permanent system. A permanent system for MRV is important to allow countries to report their mitigation actions under the UNFCCC and be eligible for potential financial compensation for REDD+ activities in the future. However, non-Annex I Parties and particularly Bangladesh face several constraints when developing their NIS.

Bangladesh submitted two national communications and is now in the process to prepare the third communication. Bangladesh has prepared its Initial National Communication (INC) in

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[1] The national inventory system includes all institutional, legal and procedural arrangements made within a Party included in the Annex I to the Convention that is also Party to the Kyoto Protocol, for estimating anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol, and for reporting as well as archiving the inventory information. Under Article 5, paragraph 1 of the Kyoto Protocol, Annex I Parties are required to establish a national system.

[2] Parties to the UNFCCC Convention must submit national reports on implementation of the Convention to the Conference of the Parties (COP). The core elements of the National Communications are information on emissions and removals of GHGs and details of the activities a Party has undertaken to implement the Convention. National communications usually contain information on national circumstances, vulnerability assessment, financial resources and transfer of technology, and education, training and public awareness.

2002 and this includes the National Circumstances; Greenhouse Gas Inventory (for 1994), Vulnerability and Adaptation, Mitigation and Climate Change Response Strategies (Ministry of Environment and Forest,2002) (2). According to this communication report, the main areas of GHG generation are energy, industrial process, agriculture, land-use change and forestry and waste sectors. The national GHG inventory was carried out for a base year 1994 following "Sectoral Approach" of revised IPCC guideline 1996. The Initial communication report exhibits that in Bangladesh, CO_2 emission has been the largest from the energy sector (62.74%) followed by land-use changes and forestry sector (32.26%) respectively. According to the INC report, total carbon uptake was 6155.73 Gg and carbon released was 8293.36 Gg in 1994. That means that there is a net Carbon emission of 2137.62 Gg, which is equivalent to 7837.97 Gg of CO_2 emissions from Land Use Change and Forestry sector (MoEF 2002).

Bangladesh has completed Second National Communication (SNC) in 2012 ((Ministry of Environment and Forest, forthcoming) to fulfil its voluntary obligations to the UNFCCC. The final report was endorsed by the Government recently. Five major activities are covered under the inventory, which include: (i) Energy (including biomass burning, transport sector, etc.); (ii) Industry (cement manufacturing, fertilizer, pulp and paper, etc.); (iii) Agriculture (ruminant livestock, livestock and manure management, wet rice cultivation, etc.); (iv) Waste and refuge management (municipal waste, waste water treatment/ management, etc.); (v) Land use change and forestry (change in forest cover and woody biomass, change in forest land use, etc.). According to the SNC, for change in forest and other woody biomass stocks, the base data on forest products of Bangladesh reported from 2003-2004 to 2007-2008 were collected from the website and headquarter of Bangladesh Forest Department. For SNC, the estimation of emissions from Land Use Change and Forestry (LUCF) focus upon four sub-sectors which are sources or sinks of carbon dioxide. These sectors are: (a) change in forest and other woody biomass stocks; (b) Forest and grassland conversion; (c) Abandonment of managed lands; (d) Change in soil carbon (MoEF 2012). According to the report of SNC, there is a decreasing trend in the carbon dioxide emission in the LUCF sector during 2000/01 – 2004/05 years. Total carbon emission due to LUCF was 28418.97 Gg in 2000/01 and 18205.52Gg in 2004/05. This decreasing trend may be attributed to the increase in the social forestry.

Project proposal has been developed by the Department of Environment (DoE) for conducting the Third National Communication (TNC) for GHG inventory and draft proposal is submitted to the MoEF for necessary revision. Meanwhile funding possibility by GEF through UNDP are evaluating by DoE.

3. Objectives of the workshop

The aim of this workshop is to reinforce national capacities of Bangladesh in development of GHG inventory and particularly for the AFOLU[3] and forestry sectors. The objectives were as follow:
- To support the national GHG inventory process;
- To support the efforts in the implementation of the national REDD+ roadmap;
- To support the preparation of the third national communication;
- To identify the gaps and necessary actions to support the inventory in the forestry sector.

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[3] Agriculture, Forestry and Other Land Uses

4. Summary of the sessions

Nine sessions were organized, from the general context of the GHG inventory under the UNFCCC to the technical details of the field measurements in sub-national projects. Session summaries in brief are presented below.

Session 1: Opening session

Opening remarks were addressed by Mr. Md. Shaheduzzaman, National Consultant, FAO and Mr. Haradhan Banik, DCCF, Forest Department and UNREDD Focal point. The global forest resources diminish at an alarming rate. The rapid decrease of forest cover has serious consequences on the global environment and lifestyle. Indeed, deforestation and forest degradation contribute to about 17% of CO_2 emissions, the main greenhouse gas responsible for climate change. There are many alternatives to contribute to the emission reductions and FAO and the UN-REDD programme tends to support the national process to decrease the emissions from the forestry sector. The implementation of the activities under the UN-REDD Programme started about one year ago and FAO supports actively in Rome, in Bangkok and in Dhaka the implementation of the technical activities to support the national forest monitoring system. As a first step, an MRV action plan has been drafted to identify the necessary actions to support the development of a forest monitoring system. Two parallel processes have been initiated. One process focuses on assessing the national capacities in order to identify the needs and to evaluate the most adapted options. The second process focuses on supporting the building capacities. Training exercises focus on the three main pillars of the national forest monitoring system, namely: (1) the GHG inventory, (2) the National forest Inventory, (3) the satellite forest monitoring system. The first training focused on satellite forest monitoring system and particularly the use of remote sensing and geographic information system to monitoring forest land area changes. The training was held in Belem in Brazil and provided technical inputs to improve the satellite forest monitoring system in Bangladesh. This training workshop on GHG preparation for the forestry sector will provide the following main information: (1) an overview on methods and guidance to be applied for preparing transparent, accurate, complete and consistent estimates, (2) how to prepare a GHG estimate in general and particularly for the forestry sector, (3) the importance of the GHG inventory to guide national policies to mitigate climate change.

Session 2: Basic Principle of GHG Inventory

Facilitators: Dr. M. Al-amin,
                             Professor
                             Institute of Forestry and Environmental Science,
                             Chittagong University

                             Mr. Ratan Kumar Mazumder,
                             Deputy Chief Conservator of Forests,
                             Forest Department

Presenters: Dr. Mariam Akhter,
                             FAO MRV Coordinator for Bangladesh, UN-REDD Programme

                             Dr. Matieu Henry,
                             FAO Forestry Officer

                             Dr. Sandro Federici,
                             Expert

At the beginning of the session Dr. Mariam Akhter presented the outline and the structure for the training programme of "GHG inventory preparation of Forestry". She mentioned that the training is organized for the stakeholders for capacity building for the implementation of MRV Action Plan and the REDD+ Readiness Roadmap of Bangladesh.

In the second presentation Dr. Matieu Henry on objectives of the GHG inventory under the UNFCCC. He illustrated some questions which is needed to be observed during this training programme, more particularly
- Why do we need knowledge about anthropogenic GHG fluxes?
  In illustration he added climate change is the main environmental crisis where human activities are significant driver and need to be quantified (GHG emission/removal)
- Then he placed another questions, how do we quantify anthropogenic GHG flux?
  Here he illustrated the estimation procedure and mentioned uncertainty. He then placed methodology, good practices, IPCC guidelines for estimating GHG for the inventory. Eventually he reminded that country has an obligation to prepare a report on GHG inventory.

Third presenter Dr. Sandro Federici personated a paper on reporting principals and guidelines. He illustrated important five principles to make GHG inventory report.
- Transparency: data should be clearly explained and defined. Input data are consistent with technical requirements. However the main message is
       A non transparent estimate = non estimate
- Consistency: GHG inventory should be internally consistent
- Comparability: Compare the emission/removal data among the
- Completeness: At least all leaves of GHG inventory i.e. totality. However definitions should be accurate
- Accuracy: this is the most important trigger, he mentioned. However systematically approach to mitigate uncertainties need to be taken.

Session 3: Background of GHG Inventory of Bangladesh

Facilitators: Mr. Md. Faruque Hossain
Conservator of Forests, Forest Department

Mr. Md. Shaheduzzaman,
National Consultant, FAO

Presenters: Proffessor Dr. M. Al-amin,
Chittagong University

Dr. Muhammad Eusuf ,
Bangladesh Centre for Advanced Studies

Dr. Sandro Federici,
Expert

First presentation of this session was made by Prof. Dr. M. Al-Amin on GHG inventory for LULUCF in Bangladesh. The presenter gave the brief definition of different terms related to GHG inventory for LULUCF. He discussed the GHG cycling in a forest ecosystem, carbon pool, and sources of non-CO_2 gases and CO_2 gases.

The presenter showed a flowchart containing different land use category, land conversion etc., and a model of national inventory system in the context of REDD+.
He also describe the important formulas and methods for estimation the carbon flux in different type of land use like forest, cropland, grassland, wetland, settlement (Homestead forest), and other lands (Like barren areas). Among this land uses, he emphasized to include the homestead forest for GHG inventory.

However, the presenter also suggest the followings for the inventory of GHG for LULUCF
- Design a national forest inventory
- Develop a suitable forest inventory
- Develop a forest management monitoring system

Moreover, he also pointed that lack of sufficient capacity in terms of skill personnel, fund etc. as some constrains in LULUCF inventory in Bangladesh. At the same time, some directive suggestions were made by the presenter.

The next presentation was done by Dr. Mohammad Eusuf on National communication and data collection methods for LULUCF. The distinguish presenter discussed on the national communication for UNFCCC and the components are as follows:
- National circumstances
- Inventory of GHG
- Measures to mitigate climate change
- Adaptation to climate change
- Relevant information towards the objectives of the UNFCCC

He pointed that national GHG inventory listed the sources and removal of GHG and the conditionalities of GHG inventory are given below and each of them discussed elaborately.

- Transparency
- Consistency
- Comparability
- Completeness
- Accuracy

GHG inventory consist of 5 activities in different sector like

- Energy
- Industry
- Agriculture
- Land use, land use change and forestry (LULUCF)
- Waste

He mentioned the 6 broad categories of land use and was well discussed. The broader categories are

- Forest land
- Cultivable land
- Village areas
- Buildup areas
- Wetlands

The presenter discussed on the methodology of LULUCF and mentioned that soil carbon pool in Bangladesh has been decreasing at a higher rate compared to other. On the contrary, good news is also there. Bangladesh showed decrease in emission of GHG in LULUCF sector. Moreover, important equations that are relevant to LULUCF according to IPCC guideline 2006 have also been discussed.

Third presenter Dr. Sandro Federici was presented his paper on Element of a GHG inventory. This expert gave the short description on the followings

- GHG
- Global warming potential
- Timing for reporting
- National GHGI cycling
- Methodological choice
- Uncertainty analysis
- Category by category description
- Quality control
- Data archiving
- Improvement plan

He discussed elaborately on the National GHG inventory cycling. The cycle consists of four components i.e. 1) Planning, 2) Preparation 3) Inventory evaluation and 4) Inventory improvement.

Session4: GHG Inventory Methodologies

Facilitator: Mr. Haradhan Banik,
                                               Deputy Chief Conservator of Forests, Forest Department

Presenter: Dr. Sandro Federici,
                                               Expert

Presenter Dr. Sandro Federici presented his paper on Elements of GHG Inventory. In his presentation he discussed about

Greenhouse gases identified are
         -CO_2, CH_4, N_2O, PFCs, HFCs, SF_6

National GHG inventory cycle
         It's a four-step cycle. The cycle continues in order to improve data/estimates
         1. Planning for the inventory
         2. preparation for inventory
         3. evaluation of the inventory
         4. further improvement of inventory
            Cycle back to step (1)

Choosing the method
Since there are lot many alternative methods to choose among, we need to prioritize the method(s) that is/deemed relevant and conveniently doable.
         Different criteria have been described to identify key categories.
         Two approaches are discusses that are needed for quantitative analyses.

         Approach 1: this approach does include 95% of the emission with no uncertainty considered.
         Approach 2: this approach includes 90 of the emission with acceptable levels of uncertainly.

The above two approach have been widely discussed with necessary formulas involved there with numerical examples. Although it is not worth mentioning the formula here, it can be concluded (having a close look at the formulas) that, formula for approach 1 has no uncertainty term while approach 2 formula does have it.

An example has been provided as to how a method should be chosen. The presenter also has well-explained the sources, causes and calculation process of uncertainty involved in approach 2. While uncertainty is an integral part of inventory estimation and reporting, Monte-Carlo simulation might be a good option with 95% CI.

The presenter has highly emphasized on clear and candid descriptions (category by category) for all the three important components of inventory process (1) data, (2) methods and (3) estimates.

The lengthy description on choosing a methodology for an inventory process, as discussed

above, has been well explained with a real world example taken from Italy.

Quality of Data/methods/inventory:
The presenter has described the significance of quality checks. The steps needed to follow were:
1. Quality control
2. Quality assurance
3. Quality checks

Data archiving:
Data archiving has been explained with an attractive phrases- 'institutional memory'. The importance of data archiving is perceived from the following points-
1. Keeping constant records
2. Making the foundation for upcoming data collection/inventory
3. Improving previous or existing plan

At the end of the presentation a question was raised- "Can really GIS do the thing we need for the inventory?"

The discussion concluded that
1. GIS has a lot of limitation in supplying necessary info/data.
2. Although GIS has limitations, it is the cheapest means to get the inventory done.
3. GIS technology is improving and in future probably it will come to meet most of our inventory information needs.

In his next presentation, he presented a paper on IPCC methods for carbon stock changes. There are six carbon pools that are needed to be mentioned in the methods for carbon stock change. They are

Biomass	-1. Above ground biomass
	-2. Below ground biomass
Dead Organic Matter	-3. Dead wood
	-4. Litter
Soil Organic Matter	-5. Mineral soils
	-6. Organic soils

All the above sources have been clearly defined and explained.

Carbon stock change calculation methods/formulas have been provided and explained. The presenter made the long story short through- "Carbon stock change can be quantified examining the steps involved in carbon cycle."

While discussing the framework of AFOLU methods, the presenter explained how different tiers (three) come into play.

Two methods have been explained in measuring C-stock.
1. Process based approach- It includes the net loss (to be subtracted from previous stock) and gain (to be added to the previous stock) of carbon to estimate the present carbon stock
2. Stock-based approach- It is just the difference of total stocks at two points of time

The presenter has explained that in most cases the former is preferable to the latter since the latter requires two inventories. The stock difference method has its pitfalls too. It has been explained with a relevant example.

The process based approach has been widely discussed with most important formulas explained. The presenter has provided formulas to calculate C-stock change for all the six pools of carbons (discussed above) and other sources that contribute to C-stock changes.

Session 5: Data Compilation and Management

Facilitator: Dr. Muhammad Eusuf,
                                  Bangladesh Centre for Advanced Studies

Presenter: Dr. Matieu Henry

Dr. Matieu Henry presented his paper on Data compilation, measurement and archiving. Whatever robust methods we might have, the estimate will mislead us if data is not correct. He has presented one of the most important pieces of presentation of the day.

Points needed to be remembered while compiling data:
1. Select the relevant method based on what data you need
2. While collecting data, keep in mind that the existing data is not the last data you are collecting; your goal is to have a consistent time series.
3. Take care of error to improve data qualities.

Principles in data compilation
1. Data should be such that it would improve the targeted estimates.
2. Method should be chosen in such a way that it will ensure data quality.
3. Put in place the data collection activities, i.e. the fixation of priority is needed.
4. Data should have a level of details
5. Data collection method should be reviewed from time to time
6. Agreement between data supplier and data users should be clear to maintain consistency.

National Vs international data- which one to choose?
1. National data is preferable to international data. But international data should be used too to improve national data, checking error and other data improvement purposes.

Choosing among the data/methods
1. Survey and census data is the best data among all data sources.
2. Literature of could be another source of data/method. The literature includes;
   - peer reviewed articles
   - public document
   - Report/publication from the neighboring countries can be used as a source since they have similar ecological set up/species composition etc.

Data measurement
1. Measurement should be unbiased and consistent.
2. Data gaps can be filled in interpolation and extrapolation of existing data trend.

Need for recalculation
1. Erroneous data lead to erroneous estimates. So, recalculation is important to maintain quality.
2. Extrapolation can be mended with the new data when available.

3. New methods can be incorporated to improve estimates.

Data archiving
1. Archive all information relating the data.
2. All reference materials also need to be archived.
3. Keep internal document if any.
4. Keep even the explanation as why you are selecting a certain methodology.

An archive system needs the following components:
1. Responsible person/institute
2. A database
3. Database should be stored at least at two separate locations.
4. Information of the archive should be easily accessible but not changeable / modifiable.

Session 6: Software practice

In this session, UNFCCC software was supplied for installation and the participants practiced with the software for default reporting.

IPCC 2006 software can be downloaded at http://ipcc2006.air.sk/.

Session 7: Forest inventory

Facilitators:	Mr. Haradhan Banik, Deputy Chief Conservator of Forests, Forest Department
	Mr. Md. Shaheduzzaman, National Consultant, FAO
	Prof. Dr. Niaz Ahmed Khan Chairman, Department of Development Studies, Dhaka University
Presenters:	Dr. Matieu Henry
	Dr. Sandro Federici, Expert
	Fakir Md. Abdul Latif, Retd. Director, Bangladesh Forest Research Institute
	Dr. Mahmudur Rahman, Senior Scientific Officer, Space ARRSO
	Mr. Zaheer Iqbal, Deputy Conservator of Forests, Forest Department

First presentation of the session was done by Dr. Matieu Henry on National forest Inventories in the world: non-exhaustive descriptive analysis. In this presentation Dr. Matieu Henry, FAO Forestry Officer, through light on the system of forest inventories done in different countries of the world including Bangladesh, Japan, Tanzania, Salvador, Cameroon, Tomppo but vividly highlighted that of France and Italy. He mainly highlighted the concept and objectives of forest inventory, steps followed in FI and various sampling strategies and issues to be considered in the context of UN-REDD program.

Forest inventory mainly consist of collecting accurate, up-to-date information about the size, distribution, composition and condition of forests and woodlands essential for developing and monitoring policies and guidance to support their sustainable management. A FI should include trees not only found in forests but also trees outside the forests (TOF). Different elements that should be considered in the inventory are forest and other lands, TOF, national forests/plantations, forest variables, socioeconomic variables among others, he emphasized. In the FI to be carried out, sampling is a better way to make the complete enumeration of forest resources. Commonly used sampling in many countries is stratified random sampling and stratified systematic sampling. The sample plots may be temporary or permanent. Shape of the sample plots may be circular, rectangular or quadrate. Rectangular plots may be of varying size e.g. small plot (50 -1000 m2), medium plot (1000- 5000 m2) or large plot (5000-10000 m2).

The case of FI in France: In France, forest is defined as an area having > 10% tree cover and occupying a minimum of 0.5 ha of land with height of the trees at least 5 m. All land cover/land use classes are included in the inventory. Total forest area in France = 15,954 Kha.

Systematic sampling with aligned clustered permanent plots is done. Number of plots = 55,000 with plot size = 1962.5 m² (25 m radius). First national FI (NFI) was done in 1960. Presently the NFI cycle is 5 years. Aerial photo is used for locating sample plots in the fields. For TOF, transact of 1km is used. The data in the FI is collected on age, canopy cover, soil properties, standing deadwood, lying deadwood, sapling/seedlings, herbs, biodiversity, commercial value/timber, slope, data for remote sensing calibration, rock cover, fires, disturbances, erosion, grazing, feelings, shrubs, mosses, lichens, litter, liana, palm and other socioeconomic variables. It takes 2-3 hours to inventory a single plot. Several institutions are involved in undertaking the inventory operations.

<u>The case of FI in Italy:</u> Definition of forest in Italy is same as that of France. Systematic random sampling is adopted here. Only trees in forest land are considered for enumeration. Total forest area in Italy = 9,149 Kha. Number of forest classes = 23. Stratified systematic random sampling with unaligned permanent plot is adopted. Number of plots = 30,000 with plots size = 530 m². First NFI was done in 1983. NFI cycle is 5 years. NFI is done by 7 organizations including National Forest Service. Data is collected on the variables like age, canopy cover, soil properties, standing deadwood, lying deadwood, sapling/seedlings, herbs, biodiversity, commercial value/timber, slope, data for remote sensing calibration, rock cover, fires, disturbances, erosion, grazing, feelings, shrubs, mosses, lichens, litter, liana, palm and other socioeconomic parameters.

The second presentation made by Dr. Sandro Federici on Land representation under the IPCC guidelines. The presentation includes mainly the different approaches of land representation.

AFOLU sector require land representation to estimate emissions and removals like C stocks changes (e.g. Biomass, DOM and SOM) and Non-CO2 emissions (e.g. from biomass burning, grassland, forestland, and crop residues). Emission factors are assigned based on land representation, i.e., stratification of land. Typical strata include current land use, climate, soil types, ecological zones, management and, where relevant, past land use. There are three general methods for collecting activity data on area of land.

- Approach 1: Data that is not spatially explicit and does not track land use through time.
- Approach 2: Data that provides land use change through time but is not spatially explicit
- Approach 3: Data that provides land use change through time and is spatially explicit

 Mixed approaches can be used for different regions of the country. It is likely that Approach 3, or Approach 2 with additional information on land use dynamic, would be needed for REDD+ implementation.

Third presentation was made by Mr. Fakir Md. Abdul Latif on Stratification of forests in Bangladesh. The presenter explained the Sampling method of large population for inventory in details; in his lecture he described the definition and various categories of Sampling. He also explained the advantages and disadvantages of different sampling methods.

Afterwards he discussed details of the stratified sampling method. The necessity of forest stratification and the categories used forest stratification. Stages of Pre-stratification and post stratification also were emphasized in his speech.

In his presentation he recommended the stratified sampling methods for forest survey in Bangladesh. Just after completion of speech, it becomes a lively session of open discussion with active participation of maximum number of participants. The presenter stated his experience in National Forest Inventory in response to the questions.

Facilitator of this session was explained the selection process for stratification and told about different formula to find out the intensity and size, to minimize the error of the inventory done.

In the forth presentation of the session, Dr. Mahmudur Rahman had to present a paper on Remote Sensing for Assessing Forest Resources and Changes. Mr. Mahmud started his presentation with representing different types of Images and described optical imagery and remote sensing principals in general and the application of Remote sensing technique. Aerial photographs and satellite imagery were used in mapping different land use in Bangladesh including forests. He explained about Synthetic Aperture Radar, Lider, High resolution and Very high resolution satellite imageries as an example for land use and change information extraction. Bangladesh used landsat data in most cases to analyze the land use types.

He has presented satellite imageries of different time series to make the audience realize that changes have happened in the forest cover. He demonstrated the state of Chakaria Sundarbans in the year using the imagery of 1974, 1980 and 1989. The photograph shows that all vegetation cover of Chakaria Sundarbans has been converted to shrimp cultivation in 1989. The imagery of the Sundarbans in the years of 1989, 2000 and 2010 was also presented. The affect of cyclone Sidr in 2007 was shown using two imageries that was taken in March (before cyclone sidr) and November of 2007 (after cyclone sidr). His photographs in the presentation also shows that the Tsunami has damaged a lot of Andaman but Sundarbans were saved. Coastal area images for the year of 1980 and 2010 shows that substantial amount of lands are being accreted in the coasts of Bangladesh.

One of the slides revealed slightly more than 7% tree coverage in the forests of Bangladesh. Other slides show the land accretion in coastal area. Different pictures of the coastal area show that gain and loss of coastal land due to land accretion and erosion respectively was balanced till 1990 but after 1990 the land erosion is more than accretion. And Sundarbans also lost 233 sq km in last 2 decades.

Information regarding 7% tree coverage of Bangladesh in forests and 233 sq km loss of Sundarbans was highly reacted by the participants. Then it was realized that the data presented to conclude only 7% tree coverage of country is missing water of Sundarbans, most part of Sal forest converted to Social forestry with different species and the tree coverage of village forests of Bangladesh. Therefore ground truthing was suggested by the participants.

Fifth presentation of the session was done by Mr. Fakir Md. Abdul Latif on National/Forest inventories in Bangladesh and analyses of ground data. He started his speech with the History of Inventory in Bangladesh and described the Forest Inventory carried out by Forestal in 1959-64, FAO in 1988, ODA during 1981-85, FAO in 1979-81, FRMP in1994-98, Techsult 1999-2000, BFRI 1981-82, FAO 2005-2007, USDA 2009. And also presented the area covered, sampling technique used, the intensity of sampling, size and nature of sample plots, Parameter used for study and the results of each inventory in short.

According to the inventory result of 2009, Number of stems of almost all species and the volume of timber has been increased manifold in Sundarbans. Such interferences were highly appreciated by the participants though some raise the question of accuracy.

Sixth presentation was done by Mr. Zaheer Iqbal on Forest Mapping and Ground Data Analysis through GIS. Mr Iqbal presented on different forest inventories conducted by Bangladesh Forest Department since the late 1950s. He mentioned about the several forest inventories and mapping activities, for example, Sundarbans Forest Mapping (1958), Chittagong Hill Tracts (CHT) North Division Forest Mapping (1964), CHT South Division Forest Mapping (1984), Chittgaong and Cox's Bazar Forest Mapping (1984-85), Sylhet Forest Mapping (1984-85), National Forest Assessments (2005-2007) etc. Currently, forest mapping activities are going on under the project 'Forest Information Generation and Networking System Project' funded by Climate Change Trust Fund. Forest maps are expected to be available within the next three months.

Mr. Iqbal also presented on different mapping techniques generated from remotely sensed imagery. He mentioned about various classification methods like supervised classification, unsupervised classification, image segmentation and image digitization. Examples were cited for Dehradun Forest, India and Lawachara National Park, Bangladesh. Supervised classification and image segmentation techniques were used to prepared forest maps in those examples, respectively.

The techniques for integration of ground survey data into GIS layers have also been discussed. Examples are shown for Sundarbans Reserve Forest with different vector attributes. Finally, Banshkhali Eco Park mapping activity was presented. The map was prepared form the image data of Google Earth and Forest Block Maps.

Session 8: Sub-national activities

Facilitators:	Mr. Md. Mozaharul Islam Assistant Chief Conservator of Forest, Forest Department
	Mr. Md. Shaheduzzaman, National Consultant, FAO
Presenters:	Mr. Ruhul Mohaiman Chowdhury, Integrated Protected Area Co-management
	Mr. Haradhan Banik, Deputy Chief Conservator of Forests, Forest Department
	Dr. Sandro Federici, Expert

First presentation of the session was done by Mr. Ruhul Mohaiman Chowdhury on Experience in carbon inventory from the protected areas. He shared his experience of carbon inventory in six protected areas of Bangladesh.

He informed the name of the protected areas where the carbon inventory took place. They are
1) Teknaf Wildlife sanctuary
2) Inani proposed national Park
3) Medhakachhapia National Park
4) Faciakhali National Park
5) Dudpukuria Dopachari Wildlife Sanctuary
6) Sitakunda Forest Reserve

He has explained the detailed explanation of the inventories. Here is the some key point of his discussion. The study was conducted by analyzing the satellite imageries and Landsat TM 5 Imageries for three time i.e. 1989, 2000 & 2009. The findings were negative changes in the forest land, coverage's & carbon stock is all the protected areas except two protected areas.

In this presentation the proposed some 9570 ha. Land to consider as candidate area and more 16000 ha could be included by afforestation & reforestation throughout the six protected areas. After the presentation two questions were raised on the definition of seedling on exclusion of climber.

The second presentation was done by Mr. Haradhan Banik on Participatory carbon measurement and monitoring.

IN his presentation an special importance was given to the local people's participation in measuring and monitoring of carbon assessment. He explained the necessary steps of concluding the study, criteria of selection of the local people and their training. He told about some important equations are need to be developed for necessary calculations.

Two of the participants supplemented that good number of equations have developed by them and their organizations to calculate the tree biomass and these will be shared with the presenter.

At the end Dr. Sandro Federici was presented a paper on Institutional Arrangements for National GHG Inventory. On his paper he clarifies which kind of entities and institutional, legal and procedural arrangements are needed to prepare a GHG inventory. He also provides examples of a framework of institutional arrangements among different entities to fulfill all functions needed to prepare a sustainable GHG inventory. Such as

To accomplish the GHGI functions a set of relations between institutions and other subjects are needed to ensure:
- sustainability of the inventory preparation;
- consistency of reported estimates;
- Quality results.

He mentioned Institutional Arrangement consist of a set of formal arrangements (such as regulations, directives, laws, decrees, or Memorandums of Understanding) aimed at providing the needed financial, technical and human resources, as well as legal authority to ensure that GHGI functions will be entirely and efficiently performed. An implementing entity must be identified for each of the functions. An "appropriate" entity has at its disposal the necessary financial resources, facilities, skilled personnel and legal authority to deal with the assigned function.

Functions to be assigned through Institutional Arrangement in 3 Areas:
- Inventory Planning
- Inventory Preparation
- Inventory Management

Functions for Inventory Planning
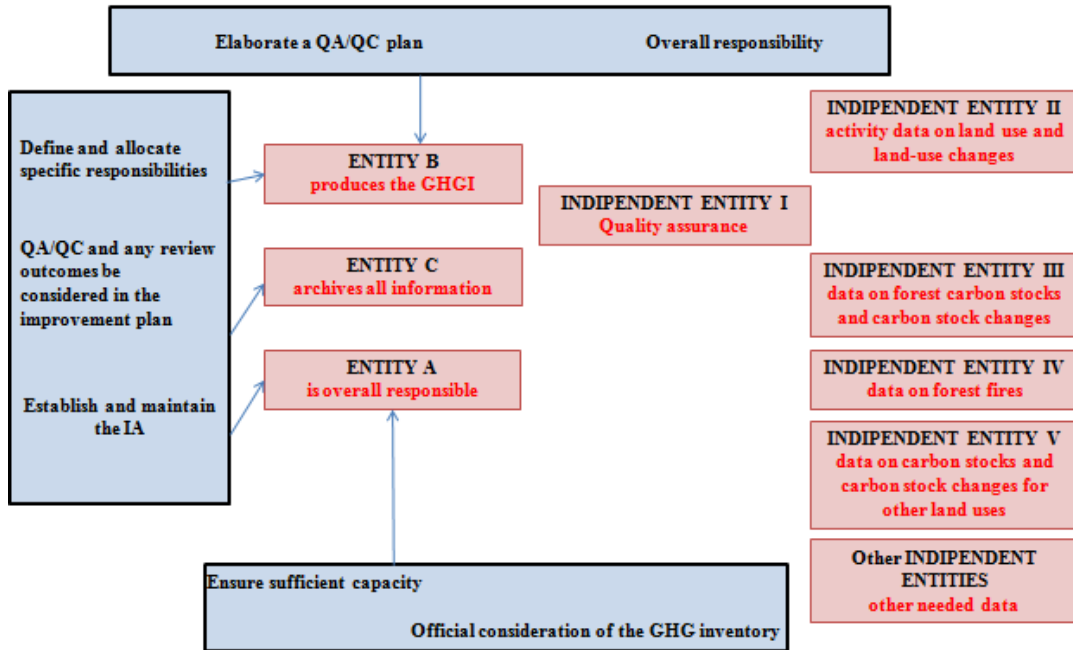
Functions for Inventory Preparation
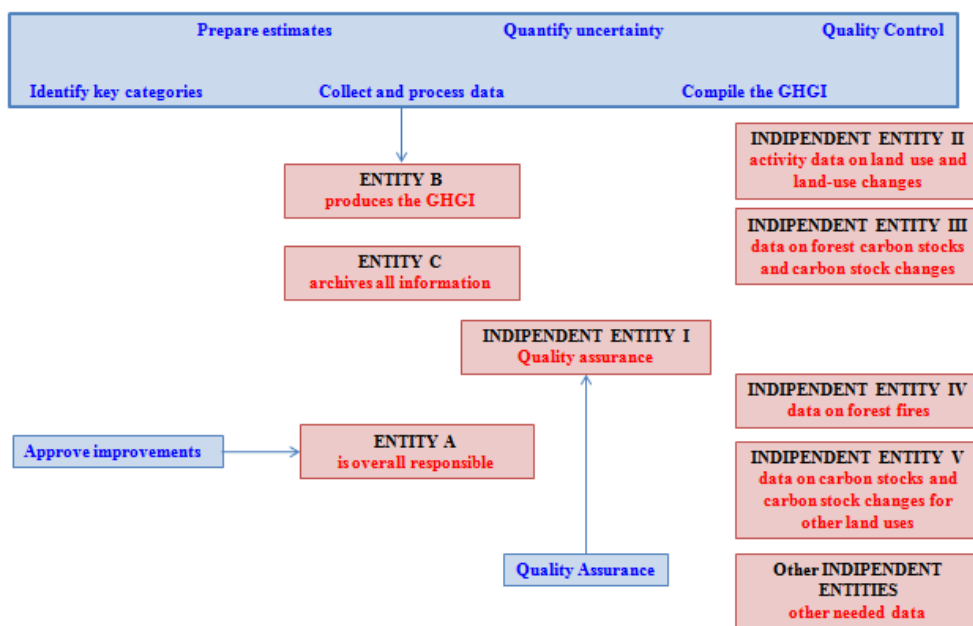
Functions for Inventory Management
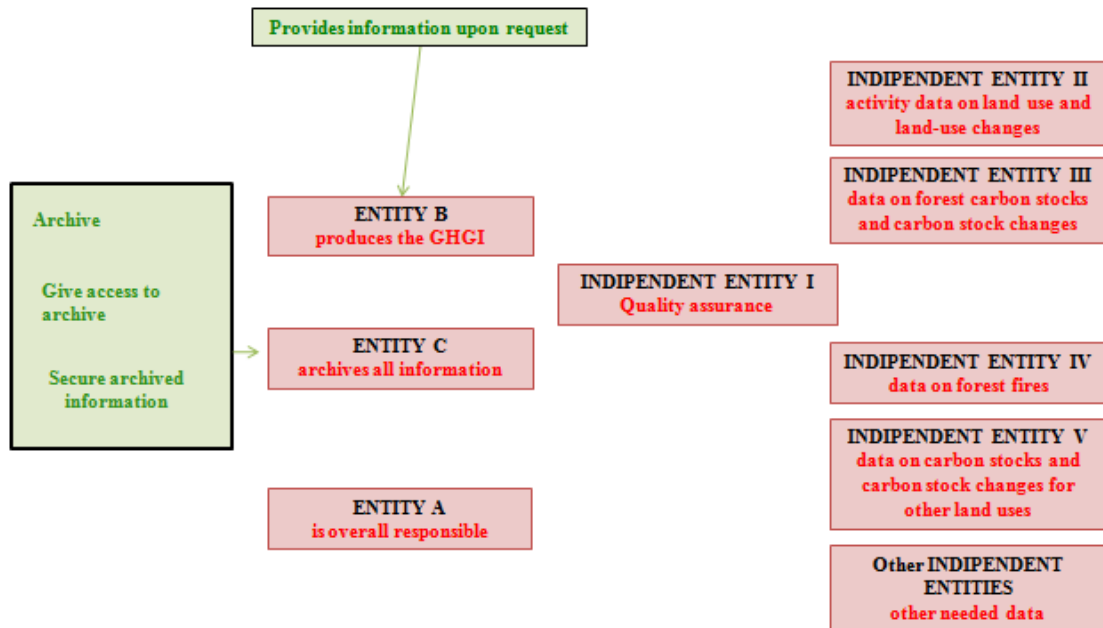
He ended his presentation by presenting some examples of the institutional arrangement by the entities with their respective functions to be performed for conducting a successful GHG inventory.

5. Group Discussions:

Thirty one participants of the training were subdivided into five groups. The group members attended in discussions in three consecutive days during the training. Group works and their discussions compiled bellow.

Results from first day Group discussions

1. Can you summarize the progress made in Bangladesh for the preparation of the GHG inventory in general and for the AFOLU/LULUCF sector?

- National Forest Inventory with the support from FAO during 2006-07
- Mobilization of resources
- Assessment of the carbon in Sundarbans and six other protected areas during 2010 and 2011 respectively
- Initial National Communication and Second National Communication are submitted to the UNFCCC and Third National Communication is under preparation
- GIS units/agencies like RIMS and SPARRSO could be engaged with GHG inventory

2. Based on your opinion, what are constraints and limits faced for the preparation of the

forestry GHG inventory preparation?

- Lack of expert human and technological resources
- Lack of baseline information and coordination among the organizations
- Lack of databases
- Insufficient fund
- Lack of complete inventory of C-pools
- Lack of related policy and target
- Lack of infrastructure

3. What are the alternatives to improve the GHG inventory?

- Higher resolution imagery
- Determining different conversion factors based on species, diameter and height classes.
- Training for capacity building to the stakeholders
- Provision of sufficient fund
- Provide adequate logistics
- Adequate and qualified manpower
- Infrastructure development among the implementing agencies
- Effective coordination among the respective departments and ministries

4. What are necessary steps to allow the preparation of the GHG inventory every two years?

- Establishment of the GHG inventory cell
- Baseline database preparation
- Data archiving
- Mass awareness
- Fixing policy targets and tools
- Continuation of existing process with possible improvements
- Making necessary fund available

5. How to make data readily available for preparation of the GHG inventory (AFOLU sector only)?

- Data archiving
- Establishment of info hubs
- Coordination among agencies
- Improvement of RIMS at Forest Department
- Sector-wise database management
- Regular update of database and prepare proper data documentation
- Databases should have easy access to it

Results from second day Group discussions

1. Which are the data available for assessing the land use change in Bangladesh?

    - Land use data of 2006-07 from the Forest Department (FD) and SPARRSO
    - Land use data of 1996 and 2004 from the Department of Environment (DoE) or BCAS

2. Have you compared the data from different time period? Which is the difference? Have you identified any methods to ensure the consistency of the data?

    - Data bases for the forest present at the sub-national level was compared for different time period, such as for sundarbans with the data bases prepared with aerial photograph of 1985-1995
    - Data base developed for the period of 1996 and 2004 for the whole country by BCAS to conduct the NC, but changes identified in terms of areas coverage but no change matrix was prepared
    - No accuracy was tested so far for the data bases
    - Different inventories provided data bases for the forests at sub-national level under different project and followed different methodology to build the data bases for a single forest

3. In your institution/org, do you have an archiving system? How do you store the data? Is it adequate? How can it be improved? Who is the person responsible for the archive (provide the name)?

    - At DoE there is an archiving system, i.e. server exists
    - At FD, no server functional for archiving. FD archiving at CD, DVD or in computer
    - SPARRSO archived also in CD, DVD.
    - Hard copy or soft copy of the data and document can be found in the libraries of the respective departments
    - Bangladesh Bureau of Statistics (BBS) has a data archiving system and archived them for public dissemination

4. Do you have any agreement between institutions for data sharing?

    - No, but Right to Information Act, 2009 is present to share the information among all the organizations and publics

5. Do you use international data to prepare the GHG inventory? Which ones?

    - Yes, IPCC default conversion factors

6. Can you provide an example of data extrapolation in the context of Bangladesh?

    - SPARRSO do not do any extrapolation as it can be dangerous
    - In Hydrology Department they forecast the tidal height

7. Which institution is in charge of reporting the GHG estimates for REDD+?

- The main agency is responsible for reporting the GHG inventory is Ministry of Environment of Forests (MoEF) with the help of FD, DoE, and other departments

Results from third day Group discussions

1. Which institution has the mandate to implement the following steps in the context of the National Forest Inventory?

Institution has the clear mandate to:

Inventory planning	= > FD
Data collection (RS)	= > FD,SPARRSO
Data collection (field data)	= > FD, SPARRSO
Data management and analysis QA/QC	= > FD, BFRI, FAO/UNDP, BBS, Academy experts or consultants, other research org.
Improvement plan	= > FD, BFRI, FAO, Academy expert or consultants, other research org.
Archiving and Documentation	= > FD, MOEF, SPARRSO, BBS
Uncertainty analysis	= > FD, BFRI, BBS, Academy experts or consultants, other research org.

2. Which are the relevant data to design and implement the national forest inventory

Relevant data for land mapping	Description	Institution
Land Use Classes	Forest types (natural or plantation), Cultivation (croplands, grassland, village), Built-up Areas (settlements), Inland water (wetlands)	FD, LGED, FD, BWDB, SPARRSO, SoB,
Hard copy maps	Topographic maps	SoB
Boundary shape file	GIS file	FD, SPARRSO, SoB
Land area map	Sheet map	Office of DGLR,LGED
Satellite image/ Aerial photograph	High resolution(Spot , Landsat,IRS)	SPARRSO, SoB
Forest map	Forest boundary & block map	FD

3. Which are the relevant data to design and implement the national forest inventory

Relevant data for Biomass assessment	Description	Institution
Volume Data	Inventory	FD, BFRI
Stand Density data	Stand density inventory	FD, BFRI

Wood density data	Average wood density	BFRI
Satellite data	High resolution	SPARRSO

4. Which are the relevant data to design and implement national forest inventory

Other relevant data	Description	Institution
Historical data	Past inventory record	FD,BBS
Land use data	Present inventory record	FD, SoB, SPARRSO
Socio economic data	Present inventory record	BBS
DEM (Digital Elevation Model)	High resolution data	SoB, IWM
Climatic/Environmental, Biotic, abiotic, edaphic, Topographic (site-specific)	Disturbance factors like soil erosion, loss of soil fertility, fires, pests & diseases, landslide, tsunami, drought, flood, over-exploitation, over-grazing etc.	FD, BFRI, DoE, SPARRSO, SoB, BBS

5. Can you identify the constraints and alternatives when designing and implement the national forest inventory?

Constraints	Alternatives	Remark
Lack of skill man manpower	Training	Training for senior ,mid and subordinate stuff
Lack of modern technology / Logistics	Provision of funds, instruments, software/ procurement	Sufficient budget
Lack of fund	Adequate fund	Sufficient budget
Lack of Data/ Information gap	Data archiving & storing, access to information	FD, BBS,SPARRSO
Discontinuation of historical data	Extrapolation or interpolation	It is risky sometimes does not give real picture

6. Which are the different sampling designs and sampling methodology used by the different forest inventories?

Forest Inventory (Institution, Location and Year)	Sampling design (random, Systematic sampling)	Plot shape (Circular, rectangular or quadrate)	Measured variables	Are the data used to access forest carbon or carbon stock changes
Forestal , Sundarban, 1959-1962	Stratified random	Rectangular	DBH & Ht	Stand/stock table, forest cover

				assessment
ODA, Sundarban, 1981-1985	random line sampling, (interval 100/200 m)	Circular	DBH, Ht, stem quality, soil type, regeneration, etc.	Vegetation types, stocks, dbh & MAI increment and regeneration
Sal forest inventory, 1999-2000	Systematic with 400m between lines and 200m between plots	Circular	DBH, Ht, stem quality	Stock, volume, regeneration
National forest and tree resource assessment 2005-2007	Systematic sampling at 15X10 minute interval	Square	DBH, Ht, etc	Volume, land use type, biomass etc
Carbon assessment in Sunarban, 2009-2010	Stratified random	Quadrate	Biomass	C-assessment

7. Which are the different satellite and aerial photographs used for forest mapping?

Forest Inventory (Institution, Location and Year)	Type of sensor	Year	Forest classes identified (number)	Are the data used to access forest land area changes
Sundarbans, FD	Aerial photographs/ landsat/geo-eye	1959, 1985, 1995, 2011 respectively	6, 14, 18, ongoing respectively	Yes
Chittagong hill tracts (kassalong, rainkheong reserve), FD	Aerial photographs, rapid eye	1958-59, 2011 respectively	5, ongoing respectively	no
Chittagong and Cox'sBazar forest, FD	Aerial photographs, geo-eye	1995, 2011respectively	8, ongoing respectively	no
Sylhet forest, FD	Spot, rapid eye	1995, 2011	7, ongoing respectively	no
Sal forest, 2011	Geoeye	2011	Ongoing	no
Conducted in other 16 protected areas of FD, FD	Landsat, IRS P6, Geo eye, Spot, corona, LISS 3,	Up to recent	Depends, varies 6 to 8	Yes for some of them

8. Which are the variables to be collected during the national forest inventory?

- DBH, Ht, Area, canopy cover, Basal Area factor, Volume, root-shot ratio, Species

composition, site classification, conversion factors for different GHGs etc.

9. How the National Forest Inventory will contribute to other institution mandates?

- Providing timely, reliable & accurate information on LUs, forests, C-pools, ecosystems also called life-support systems that are essential for the stakeholders, as well as, local, national, international or global public interests for understanding, as well as, informed and integrated decision making with respect to the local and global CC mitigation and adaptation.

6. Conclusion and recommendations

Active participation and coordination of thirty one participants from different organizations made the training programme successful and kept the programme all along lively by sharing their experience, concerns, understanding etc. In the training programme, the participants became aware on the principles, guidelines and protocols for reporting GHG emissions for REDD+; updated information on remote sensing/forest cover maps, national forest inventory and other components of the UN-REDD Programme. UNFCCC software was practiced for default reporting.

The term and the content of GHG are not so new to the participants of Forest Department and Department of Environment but it was to some extent new for the participants of other organizations. Participants enriched/updated their knowledge on conducting GHG inventory for forestry in particular. Materials provided during the training were of interest among the participants. Some of the participants wished to study more about the topics that are presented in the training.

The training also provided a scope for coordination among the organizations for data and information sharing. In reality there is no inter-governmental mechanism for data sharing. But right to information act 2009 exists that support the information sharing among the organizations. Participants emphasized to build a data sharing platform so that data and information could be shared deliberately.

There is no regular infrastructural arrangement for National Forest Inventory (NFI) as it is a project based activity due to lacking of funds on a regular interval. During the discussions, Importance was given to build up a NFI unit and necessary infrastructural arrangement at the Forest Department to conduct NFI at a regular interval. Discussions also focused that required funding for NFI also should be arranged through regular budget of the Forest Department.

Forest Department has the capacity of GHG inventory in a very limited extent. But there need to improve the knowledge at different level related to updated software, technology and IPCC methodology to organize and conduct a GHG inventory for forestry. Organize a training at the national level is not enough for dissemination of the knowledge and technology. Training also need to be conducted at the sub-national level by engaging more participants from the GO,s and NGO's from different level.

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convention, description, explaination, climate change

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UNFCCC, policy, climate, agreement, redd+

7. Appendix

7.1. Appendix 1: Agenda

Training Workshop on "GHG Inventory Preparation for Forestry"

Forest Department
Food and Agriculture Organization of the United Nations
UN-REDD National Programme
Venue: Parishankhan Bhaban, Agargaon, Dhaka, Bangladesh
19-22th November 2012

Day 1			
Time	**Topic**	**Speakers**	**MC/Facilitator**
9:00-9:30	**Registration**		
Session 1:	**Opening Session**		
9:30	Welcome speech : FAO Representation		Mr. Md. Shaheduzzaman, National Consultant, FAO
9:35	Address by DCCF, Education and Training Wing and UNREDD National Focal Point		Mr. Haradhan Banik, DCCF, Forest Department
Session 2	**Basic Principle of GHG Inventory**		
9:45	Presentation of the content of the training	Dr. Mariam Akhter	Prof. Dr. Alamin, Chittagong University
10:00	Objective of the GHG inventory under the UNFCCC	Dr. Matieu Henry	
11:00	Tea Break + Group Photo		
11:15	Reporting principals and guideline	Dr. Sandro Federici	Mr. Ratan Kumar Mazumder DCCF, Forest Department
12:30	Questions		
1:00	Lunch Break		
Session 3:	**Background of GHG Inventory of Bangladesh**		
14:00	GHG inventory for LULUCF in Bangladesh	Prof. Dr. Alamin, Chittagong University	Mr. Md. Faruque Hossain CF, Forest Department
15:00	National communication and data collection methods for LULUCF	Dr. Muhammad Eusuf	
15:30	Tea Break		

15:45	Elements of a GHG Inventory	Dr. Sandro Federici	Dr. Matieu Henry, FAO
16:15	Group Discussion : Debate 1		
17 :15	Closing of the Sessions – Day 1		

Day 2 :

09:00	Group Presentation on Debate 1		Mr. Md. Shaheduzzaman, National Consultant, FAO
Session 4	GHG Inventory Methodologies		
10:00	IPCC methods for assessing carbon stock and stock changes	Dr. Sandro Federici	Mr. Haradhan Banik, DCCF, Forest Department
11:00	Tea Break		
11:15	IPCC methods for non-CO2 emissions	Dr. Sandro Federici	
Session 5	**Data Compilation and Management**		
12:00	Data compilation, management and archiving system	Dr. Matieu Henry	Dr. Muhammad Eusuf, BCAS
13:00	Lunch Break		
Session 6	**Software practice**		
14:00	Presentation of the data for exercise (2006 IPCC Software)	Dr.Mariam Akhter & Dr.Matieu Henry	Dr. Mariam Akhter, FAO
16:15	Group discussion : Debate 2		
17:15	Closing of the Sessions – Day 2		

Day 3

09:00	Group presentation on Debate 2		Mr. Md. Shaheduzzaman, National Consultant, FAO
Session 7	**Forest inventory**		
10:00	National forest Inventories in the world: non-exhaustive descriptive analysis	Dr. Matieu Henry	Mr. Haradhan Banik, DCCF, Forest Department
11:00	Tea break		
11:15	Land representation under the IPCC guidelines	Dr. Sandro Federici	Mr. Haradhan Banik, DCCF, Forest Department
11:30	Stratification of the forests of Bangladesh	Fakir Md. Abdul Latif	Mr. Md. Shaheduzzaman, National Consultant, FAO
12:00	Remote Sensing for Assessing Forest Resources and Changes	Dr. Mahmudur Rahman	
13:00	Lunch		
14:00	National/Forest inventories in Bangladesh and analyses of ground data	Fakir Md. Abdul Latif	Mr. Md. Shaheduzzaman, National Consultant, FAO
14:45	Forest mapping and ground data analysis	Mr. Zaheer Iqbal	

		through GIS		
	15:30	0 Tier for forest land, deforestation and afforestation for Bangladesh	Dr. Sandro Federici	Prof. Dr. Niaz Ahmed Khan Chairman, Department, Department of Development Studies, Dhaka University
	16:00	Tea Break		
	16:15	Group discussion : Debate 3		
	17:15	Closing of the Sessions – Day 3		

Day 4				
	09:00	Group presentation on Debate 3		Mr. Md. Shaheduzzaman, National Consultant, FAO
Session 8	**Sub-national activities**			
	09:45	Experience in carbon inventory from the protected areas	Mr. Ruhul Mohaiman Chowdhury	Mr. Md. Mozaharul Islam Assistant Chief Conservator of Forest, Forest Department
	10:15	Participatory carbon measurement and monitoring	Mr. Haradhan Banik	
	11`:00	Tea break		
	11:15	National System for GHG Inventory	Dr. Sandro Federici	Mr. Md. Shaheduzzaman, National Consultant, FAO
Session 9	**Closing Remarks**			
	12:00	Certificate Distribution	Mr. Haradhan Banik, DCCF, FD and UNREDD National Focal Point Ms Rosanne Marchesich, FAO Representative a.i. in Bangladesh	Mr. Md. Shaheduzzaman, National Consultant, FAO Dr. Mariam Akhter, FAO
	12:15	Closing Remarks	1. Mr. M. Mahfuzur Rahman, Assttt. Professor, IFES, Chittagong University 2. Mr. Henry Matieu, FAO, Rome 3. Mr. M. Tarikul Islam, Asstt. Country Director, UNDP, Bangladesh	

		4. Ms Rosanne Marchesich, FAO Representative a.i. in Bangladesh 5. Mr. Haradhan Banik, DCCF, FD and UNREDD National Focal Point	35
12:50	Vote of Thanks	Mr. Md. Shaheduzzaman, National Consultant, FAO	
01:00	End of Workshop and Lunch		

Training Workshop on "GHG Inventory Preparation for Forestry"
Venue: Parishankhan Bhaban, Agargaon, Dhaka
19-22 November 2012

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Appendix 3.

Topics of the group discussions are given below:

Group discussion 1:

1. Can you summarize the progress made in Bangladesh for the preparation of the GHG inventory in general and for the AFOLU/LULUCF sector?
2. Based on your opinion, what are constraints and limits faced for the preparation of the forestry GHG inventory preparation?
3. What are alternatives to improve the GHG inventory?
4. What are necessary steps to allow the preparation of the GHG inventory every two years?
5. How to make ready-available data for the preparation of the GHG inventory (AFOLU sector only)?

Group discussion 2:

1. Which are the data available for assessing the land use change in Bangladesh?
2. Have you compared the data from different time period? Which is the difference? Have you identified any methods to ensure the consistency of the data?
3. In your institution/org, Do you have an archiving system? How do you store the data? Is it adequate? How can it be improved? Who is the person responsible for the archive (provide the name)?
4. Do you have any agreement between institutions for data sharing?
5. Do you use international data to prepare the GHG inventory? Which ones?
6. Can you provide an example of data extrapolation in the context of Bangladesh?
7. Which institution is in charge of reporting the GHG estimates for REDD+?

Group discussion 3:

1. Which institution has the mandate to implement the following steps in the context of the National Forest Inventory?

    Institution has the clear mandate to:

Inventory planning	=> ?
Data collection (RS)	=> ?
Data collection (field data)	=> ?
Data management and analysis QA/QC	=> ?
Improvement plan	=> ?
Archiving and Documentation	=> ?
Uncertainty analysis	=> ?

2. Which are the relevant data to design and implement the national forest inventory

Relevant data for land mapping	Description	Institution

3. Which are the relevant data to design and implement the national forest inventory

Relevant data for Biomass assessment	Description	Institution

4. Which are the relevant data to design and implement national forest inventory

Other relevant data	Description	Institution

5. Can you identify the constraints and alternatives when designing and implement the national forest inventory?

Constraints	Alternatives	Remark

6. Which are the different sampling designs and sampling methodology used by the different forest inventories?

Forest Inventory (Institution, Location and Year)	Sampling design (random, Systematic sampling)	Plot shape (Circular, rectangular or quadrate)	Measured variables	Are the data used to access forest carbon or carbon stock changes

7. Which are the different satellite and aerial photographs used for forest mapping?

Forest Inventory (Institution, Location and Year)	Type of sensor	Year	Forest classes identified (number)	Are the data used to access forest land area changes

8. Which are the variables to be collected during the national forest inventory?

9. How the National Forest Inventory will contribute to other institution mandates?