Proceeding for the national consultation to validate the manual for assessing the soil properties as part of the Bangladesh Forest Inventory

Bangladesh Forest Department
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The Forest Department of Bangladesh leads actions to improve forest management and conservation, adopting forward thinking, innovative approaches in its management of approximately 1.55 million hectares of land across the country.

In 2015, the Forest Department began a process to establish a National Forest Inventory and Satellite Land Monitoring System for improved forest and natural resource management. The process supports national objectives related to climate change mitigation and provides information in support of the UN-REDD programme aimed at Reducing Emissions from Deforestation and Forest Degradation (REDD+). The process also addresses domestic information needs and supports national policy processes related to forests and the multitude of interconnected human and environmental systems that forests support.

The activities implemented under the Bangladesh Forest Inventory process are collaboration between several national and international institutions and stakeholders. National partners from multiple government departments and agencies assist in providing a nationally coordinated approach to land management. International partners, including the United Stated Agency for International Development (USAID) and the Food and Agriculture Organization of the United Nations (FAO) are supporting the development of technical and financial resources that will assist in institutionalizing the process.

The results will allow the Forest Department to provide regular, updated information about the status of trees and forests for a multitude of purposes including for assessment of role of trees for firewood, medicines, timber, and climate change mitigation.

CONTACTS:

Md. Zaheer Iqbal
National Project Coordinator
Bangladesh Forest Department
Email: z.iqbal60@gmail.com

Matieu Henry
Chief Technical Advisor
Food & Agriculture Organization of The United Nations
Email: matieu.henry@fao.org

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EXECUTIVE SUMMARY

On 13 October 2016, a consultation workshop was held at the Soil Resource Development Institute in Dhaka to validate the field manual for assessing the soil properties as part of the Bangladesh Forest Inventory. The field manual was prepared under an agreement that was signed between the Food and Agriculture Organization of the United Nations and SRDI for the project titled *Strengthening National Forest Inventory and Satellite Land Monitoring System.* In total, twelve representatives from three national entities participated in the consultation. The consultation involved presentations on the assessment of soil organic carbon stocks and its importance for the country, country-specific methodology for the collection and analysis of soil samples, manual for soil measurement for the Bangladesh Forest Inventory. During the consultation, participants discussed into groups the questions prepared by FAO on topics related to soil properties, soil texture and soil bulk density – organic carbon.

1 INTRODUCTION:

The Food and Agriculture Organization of the United Nations (FAO) and Soil Resource Development Institute (SRDI) have signed an agreement to provide "Technical support for the preparation of the manual for assessing the soil properties as part of Bangladesh Forest Inventory" under the project 'Strengthening National Forest Inventory and Satellite Land Monitoring System'. Under this agreement SRDI will provide a) Literature review on soil organic

assessment in Bangladesh; b) Preparation of a field manual for soil assessment including organic carbon; and finally c) Conduct a national consultation on soil assessment in Bangladesh.

SRDI prepared a draft field manual for soil assessment including organic carbon and literature review on soil organic assessment in Bangladesh and provided to FAO. To validate draft "Manual for assessing the soil properties as part of the Bangladesh Forest Inventory", a consultation workshop holds on the 13 October 2016 at Conference Room of SRDI. List of participants is annexed herewith. The program was conducted in two sessions such as a) inaugural session and b) technical session.

2   INAUGURAL SESSION:

Inaugural session was chaired by Md. Nazmul Hasan, Principal Scientific Officer, SRDI. Mr. Liam Costello, FAO consultant at BFI welcomed the participants of the workshop with a brief on the BFI and soil manual. Mr. Matieu Henry, Chief Technical Advisor (CTA) of BFI on his address as special guest describe elaborate of soil carbon assessment and relation to BFI. He also describes importance of Soil Organic Carbon assessment as because it is the largest carbon pool. Mr. Delwar Hossain Mollah, Chief Scientific Officer (CSO) of SRDI and special guest of the workhop, also describes importance of SOC in agriculture and climate change adaptation. He also gave importance of proper soil sampling. Mr. Khandker Moyeen Uddin, Director, SRDI in his speech as chief guest detailed the relation of SRDI and FAO and also the activities of SRDI under

Mr. Khandker Moyeenuddin, Director, SRDI addressing as Chief Guest

Mr. Matieu Henry, Chief Technical Advisor (CTA) of BFI addressing as Special Guest

the LOA signed between SRDI and FAO. He mentioned that SRDI usually collect the soil samples for soil fertility analyses along with SOC determination. SRDI's effort is always concentrated with mainly with agriculture and soil genesis. The workshop is facilitated by Dr. Md. Taiabur Rahman, PSO of SRDI. In concluding speech as chair, Mr. Nazmul Hasan thanks all participants from different institutes and invite for their active participations in the technical session.

3   TECHNICAL SESSION:

The technical session was chaired by Mr. Khandker Moyeenuddin, Director, SRDI. In the technical session four power point presentations were presented by Dr. Sirajul Hoque, Professor and Chairman of the Department of Soil Water & Environment of Dhaka University, on literature review on soil carbon assessment in Bangladesh and on laboratory analysis for soil carbon and bulk density; Mr. Nazmul Hasan, PSO, SRDI gave his presentation on field sample collection special reference to Bangladesh; and Dr. Frida Sidik, FAO consultant to BFI gave her presentation on Manual for Soil Measurement for the Bangladesh Forest Inventory.

Professor Dr. Sirajul Hoque in his presentation stated that Carbon stored in soils worldwide exceeds the amount of C stored in phytomass and atmosphere. Despite the large quantity of C stored as SOC, consensus is lacking on the size of global SOC stocks, their spatial distribution, and the carbon emissions from soils due to changes in land use and land cover   (Scharlemann et al., 2014). About two thirds of global soil carbon is held as SOC, composed of decaying plant, animal, fungal, bacterial materials and, the remainder is inorganic. Soil organic carbon acts as a source and sink of C and undergoes various transformations leading to formation of CO_2 and several intermediate products of decay and finally humus, the stable form of organic matter. Forests are a large carbon sink, but they are ecosystems that gain and loss carbon continually. Croplands can be very productive ecosystem and the majority of carbon is held in the soil as annual litter additions, slowly decompose and become a part of soil organic matter. He also describes the factors affecting SOC as a) climate (rainfall and temperature), b) drainage, c) textural properties, d) types of clay, e) topography, f) cultural operations, g) green manuring and use of crop residues, h) fertilizer application and i) other soil properties. Most of soils contain organic matter in range of low to medium except Gopalgonj and Khulna Beels have organic matter at high level. He also mentioned that Hasan and Rahman (2016) reported organic matter content based on data of 46,500 soil samples of 30 AEZs and most of the values are around 2% and the values are in the range of low to medium. In conclusion he stated that, almost all the upland soils of Bangladesh are low in organic matter content, Low –lying areas of most floodplains have a good reserve of organic matter higher than that in highland and medium highland. These soils remain under water for a considerable period of time of a year. So accumulations of organic matter rather than decomposition occur. Growths of aquatic plants also contribute to organic matter content. On the other hand in high and medium highland luxuray growth of plants occur due to tropical monsoon climatic conditions, but conditions favourable for the growth of microorganisms enhance the biomass decomposition. As a result there is little scope for organic matter accumulation. Moreover, lack of organic recycling, and cultural operations carried out for intensive cropping also enhance the decomposition of organic matter and thus create unfavourable condition for organic matter accumulation. He also describes the methods of soil carbon analysis employed in Bangladesh.

Professor Sirajul Hoque delivering his presentation

Participants in open discussion

Mr. Md. Nazmul Hasan in his presentation stated that The Bangladesh Forest Inventory is a multipurpose inventory aiming at providing information for resource and carbon inventory, including soil carbon stocks. This manual is prepared for Bangladesh Forest Inventory that will support the Government of Bangladesh in establishing updated forest management plan and climate change mitigation and adaptation strategy. There are numbers of methods for measuring forest resources and C stocks; however our focus is to adapt international standards per guidelines of IPCC. The international standards commonly divide forests into five carbon pools: 1) aboveground and belowground biomass of live trees, 2) non-tree vegetation, 3) dead wood, 4) forest floor (litter), and 5) soil. Soil testing, in a broad sense, is any chemical or physical measurement that is made on a soil. Soil testing includes collection of soil samples, sample preparation, laboratory analyses, calibration and interpretation of the tests. Soil analysis is conducted both in

the field and in the laboratory. Color is determined in the field by visual assessment and with the aid of an appropriate color chart. Further analysis related to texture and bulk density sample will be collected in the laboratory. Processes must be followed to ensure soil samples collected for laboratory analysis are prepared and stored appropriately. A soil sample should be representative of the area from which it is taken to ensure accurate results. **He specially mentioned that the error in sampling in the field is generally greater than error in the laboratory analysis.** He also stated his deep concern about the person employed for soil sample collection. If they are not qualified and skilled enough to collect soil samples that will be considerable drawback of the carbon assessment. He gave the importance of leveling, documentation and preservation of soil samples. He presented Method for **Collection of Soil Samples by Specially Designed Soil Sampler and Collection of Soil Samples by Open Pit Method.** He also describes the processing of soil samples for laboratory analyses. He presented the methods of soil sampling for determination of bulk density.

Dr. Frida Sidik, FAO consultant to BFI gave her presentation on Soil Manual for the Bangladesh Forest Inventory. She describes the back ground of the manual as the aim and consideration of manual preparation; soil sampling strategy; soil sampling including soil information, soil texture, and soil bulk density-organic carbon in mangrove and non-mangrove area. She also stated litter sample collection and composite of soil texture. She invites discussion of the audience on the presentations so that she can incorporate in the final soil manual.

Mr. Liam Costello, FAO consultant at BFI took the notes on the discussions.

The participants were than divided into three groups for discussion on the questionnaires supplied by FAO. Group-1 discussed on 'Soil Properties Information (moisture, colour, humus), Group-2 on 'Soil Texture' and Group-3 on 'Soil Bulk Density – Organic Carbon'. The questionnaires and the salient points of the discussion are given below:

Group 1: Soil Properties Information (moisture, colour, humus)
  A. How the sampling method can be improved for unskilled person ?
- No unskilled person should collect soil samples.
- Good training should be carried out prior to training.
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  B. How the sampling method can be improved based on soil properties in Bangladesh (equipment arrangement, personal skill, etc..) ?
- Uncontaminated soil sampling should be used.
  o The push auger may lead to contamination.

  C. Estimate error may occur in national soil survey ?
- If there is good protocol and skill it will minimize error.
- Good documentation and software can reduce error.

  D. Are the data collection variables sufficient?
- Sampling site should have good descriptions on soil type, topography and other physiographic details to relate USDA classification of soils.
- All elements including heavy metals should be analyzed.
- Pit method – Full pit description should be described and sample taken.
- Top soil sample – Normal a v-shaped sample is taken to avoid contamination.

  E. Other comments
    a. Disseminate manual to others for comment.
    b. Should be software based.

Group 2: Soil Texture

A. **How the sampling method can be improved based on soil properties in Bangladesh (equipment arrangement, personal skill, etc..) ?**
- The circle system proposed is only suitable for mangroves
- Deep soil sample should be collected in four layers as opposed to three
- Soil texture hydro method is sufficient

B. **Estimate error may occur in national soil survey?**
- No comments.

C. **What are the best options for sample transportation? (please list at least 2)**
- Any is fine

D. **Other comments**
    a. Disseminate for broader comment.
    b. Lab analysis – different chemicals to be considered.
    c. Sampling depth should be on the basis of the ploughed layer.

Group 3: Soil Bulk Density – Organic Carbon

A. **How the sampling method can be improved based on soil properties in Bangladesh (equipment arrangement, personal skill, etc..)?**
- Equipment list in manual is confusing – list different equipment below each sample type, also for different areas different equipment is required.

B. **What is the best method for ensuring sample viability in remote area (consider sample transportation, preservation, etc…)?**
- Water and vehicular transport.

C. **Estimate error may occur in national soil survey ?**
- No data is available for forest soil, particularly for mangrove and forest soil.

D. **Experience on lab technique ?**
- Walkley and Black is sufficient through ignition method is also appropriate
    o Potential to correlate between methods.
    o Question whether the labs have sufficient resources to process all samples.

E. **Any other comments**
- Catena concept not considered. This relates to all areas of the slope being considered for analysis.

Other comments
- Areas for soil samples is often difficult to access, so while there all relevant soil assessment should be carried out.
- UCAT or other software should be considered.
- Objectives of the sampling methodology not clearly mentioned.
- Different sampling method for different forest types.

After group discussion a open discussion on the presentation and outcome of the group discussion were hold. Most of the participants actively participated in the discussion. Noted among are Mr. Mainul Ahsan from IFDC, Mr. Jalal

Uddind Md Shoaib from Barisal University, Professor Alok Kumar Paul of Shere-e-Bangla Agricultural University, Mr. Delwar Hossain Mollah of SRDI, and Professor Md. Khalilur Rahman of Dhaka University.

Mr. Matieu Henry, Chief Technical Advisor, BFI in his concluding remarks again describes the importance of SOC assessment in Bangladesh Forest Inventory. He also describes some of R software.

Mr. Khandker Moyeenuddin, Director, SRDI, stated the accuracy of soil sampling for carbon assessment, soil texture and soil bulk density. He gave importance of skilled and knowledgeable manpower for soil sampling. He also requested concerned to incorporate the outcome of the workshop in the final manual.

4   CONCLUSION:

Objectives of the sampling methodology should be clearer. No unskilled person should collect soil samples. Good training should be carried out prior to collection of soil samples, leveling, documentation and processing of soil samples for laboratory analyses. If there is good protocol and skill it will minimize error. Good documentation and software can reduce error. Sampling site should have good descriptions on soil type, topography and other physiographic details to relate USDA classification of soils. Disseminate manual to others for comment. Should be software based. Disseminate for broader comment. Walkley and Black is sufficient though ignition method is also appropriate but need to correlate between methods. Outcome of the workshop will be incorporated in the final manual.

List of participants for Consultation Workshop on Soil Manual

Sl. No.	Name	Designation	Institution
1.	KhandkerMoyeenuddin	Director	SRDI
2.	Md. DelawarHossainMollah	CSO	SRDI
3.	Md. NazmulHasan	PSO	SRDI
4.	Dr. Md. MoqbulHossain	PSO	SRDI
5.	Bidhan Kumar Bhander	PSO & PD	SRDI
6.	Md. Kamaruzzaman	PSO	SRDI
7.	Md. LiaquatHossain	PSO	SRDI
8.	Dr. Md. TaiaburRahman	PSO	SRDI
9.	Dr. Md. Abdul Bari	PSO	SRDI
10.	Dr. Mohiuddin Ahmed	PSO	SRDI
11.	Dr. Md. AltafHossain	PSO	SRDI
12.	Monfique Ahmed Chowdhury	PSO	SRDI
13.	Dr. Md. Moniruzzaman	PSO	SRDI
14.	A. F. M. ManzurulHuq	SSO	SRDI
15.	Dr. Md. Afsar Ali	SSO	SRDI
16.	Md. Shamsuddin	SSO	SRDI
17.	Dr. Gazi Md. ZainalAbedin	SSO	SRDI
18.	Dr. SirajulHoque	Professor	DU
19.	Dr. Md. AkhtarHossain Khan	Professor	DU
20.	Dr. Md. KhalilurRahman	Professor	DU
21.	Dr. A. J. M. SirajulKarim	Professor	BBSMRAU
22.	Dr. Md. MizanurRahman	Professor	BBSMRAU
23.	Dr. M. Jahiruddin	Professor	BAU
24.	Dr. Md. AbulHashem	Professor	BAU
25.	Dr. Md. Sultan Ahmed	MD, NRM	BARC
26.	Dr. Md. AbdusSatter	CSO, Soil	BARC
27.	Dr. Alok Kumar Pal	Professor	SAU
28.	Chaitanya Kumar Das	Director, FSW	DAE
29.	Dr. Md. Mohshin Ali	CSO & Head, SSD	BINA
30.	Dr. RowshanAra Begum	CSO & Head SSD	BARI
31.	Dr. Jatish Chandra Biswas	CSO & Head SSD	BRRI
32.	Dr. Md. MizanurRahmanBhuiyan	Professor	KU
33.	KhandokerQudrataKibria	Associate Professor	KU
34.	Dr. M. MasudurRahman	Divisional Officer, Mangrove Silviculture, Khulna	BFRI
35.	MainulAhsan	Soil Scientist	IFDC
36.	Jalal UddinMdShoaib	Visiting Teacher	BU

List of the participants from FAO, Forest Department.

Participants	Organization	E-mail
1. Matieu Henry	FAO	Matieu.Henry@fao.org
2. Mariam Akhter	FAO	Mariam Akhter@fao.org
3. Laskar Muqsudur Rahman	FAO	Laskar.Rahman@fao.org
4. Frida Sidik	FAO	Frida.Sidik@fao.org
5. Liam Costello	FAO	Liam.Costello@fao.org
FOREST DEPOARTMENT		
6. Md. Yunus Ali	Chief Conservator of Forests	yunusbfd@gmail.com
7. Md. Mozaharul Islam	Deputy Chief Conservator of Forests, Forest Department Ban Babhan, Agargaon, Dhaka	mazhar.raj@gmail.com
8. Zaheer Iqbal	Deputy Conservator of Forests RIMS Unit, Forest Department Ban Bhaban, Agargaon, Dhaka	z.iqbal60@gmail.com
9. BaktiarNurSiddiqui	Divisional Forest Officer, Dhaka Forest Division, Ban Bhaban, Mohakhali. Dhaka	baktiar1971@gmail.com
10. Hossain Mohammad Nishad	Divisional Forest Officer, Dhaka Social Forest Division, Ban Bhaban, Mohakhali. Dhaka	hmnishad@gmail.com
OTHER AGENCIES		
11. RuhulMohaimanChowdhury	Climate Resilient Ecosystems and Livelihoods (CREL-USAID) House # 13/B, Road # 54, Gulshan-2, Dhaka-1212	ruhulforester@yahoo.com
12. Dr. Mahmood Hossain	Professor, Forestry and Wood Technology Discipline, Khulna University	MahmoodHossain@hotmail.com