Proceeding of the training on field data collection for allometric equation development in Bangladesh

Bangladesh Forest Department
17 – 24 May 2016

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Food and Agriculture Organization of the United Nations

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

Assessment of forest biomass and volume are obvious for knowing the forest stocking, productivity, nutrient cycling and budgeting, carbon stocking and predicting future status of forest resources, which are important consideration for the sustainable management of forest. Tree biomass and volume can be measured from both destructive (clear-cut) and non-destructive (allometric equation) methods. Allometric method is frequently used for estimating the biomass and volume of forest plant species, which is the most powerful tool of measurement. The use of appropriate equations for biomass and volume estimation will contribute to improve the accuracy in forest resource assessment and also guide the forest policies and its management.

Development of allometric equations for biomass and volume requires extensive planning, field work (sampling of forest within each forest strata, sampling of plots within each forest, sampling of plants within each plot; measurement of standing tree dimensions; felling of sampled plant; separating and weighing of different plant parts; sub-sampling of different plant parts for further assessment and data recording), sample analysis in the laboratory, and data compilation and analysis. Most of the cases, these activities are destructive, difficult and expensive to repeat. Consistency in field data collection for the development of allometric equation is vital for quality control and accuracy of the derived equations.

FAO is currently assisting Bangladesh Forest Department (BFD) in National Forest Inventory (NFI) activities and also to establish a national forest monitoring system. As a part of these activities, FAO tries to strengthen national capacities of BFD in field data collection for the development of allometric equation which was an important project activity. Total ten participants (all male) attended in the training.

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1. Introduction

In most of the cases, the assessment of tree volume, biomass or carbon stocks is made using tree allometic equations and dendrometric field measurements. Allometry refers to the statistical relation between two size characteristics of individuals in a population. Therefore a statistical relation can be developed between parameters easy to measure tree characteristics (i.e. diameter, height or density) and difficult to measure variables such as biomass or volume. Consequently, costly and destructive measurements can be limited to a sample of trees and the results can be extrapolated to all trees in a given area. Appropriate allometric equation use is required to improve the quality of estimates for a multitude of purposes including timber volume, wood energy biomass, carbon stocks etc., and to support forest policies for better management.

The selection and development of inappropriate allometric models is the main source of error in estimating biomass and volume of a particular species. Development of allometric equations for biomass and volume requires extensive planning, field work (sampling of forest within each forest strata, sampling of plots within each forest, sampling of plants within each plot; measurement of standing tree dimensions; felling of sampled plant; separating and weighing of different plant parts; sub-sampling of different plant parts for further assessment and data recording), sample analysis in the laboratory, and data compilation and analysis. Most of these activities are destructive, difficult and expensive to repeat. Consistency in field data collection for the development of allometric equation is vital for maintaining quality and accuracy of the derived equations.

A series of capacity-building exercises have been organized to enhance national capacity of the national institutions on various elements of national forest monitoring including development of data management system, data management and analysis for the NFI inventory data, assessment of GHG, R software for allometric model selection, management and analysis of forest data, quality assurance and control of the data. At the same time, several activities like database of verified allometric equations for biomass and volume, national consultation workshop on allometric equations, development of field measurement protocol on tree allometric equation for estimating above-ground biomass and volume have been conducted to find out the gaps and needs for further works have also been identified.

Allometric equations can be derived more accurately by following a standard field measurement procedure. Some errors in development of allometric equations are associated with the use of different methods of field measurement, sample processing, data compilation, statistical analysis, use of different units of measurement. To overcome these uncertainties, a training programme on field data collection for the development of biomass and volume allometric equations was jointly organized by FAO, Bangladesh Forest Department and Khulna University from 17 to 24th May 2016 at Tangail Forest Division. The outputs of this training will contribute to support the effort to National Forest Inventory in Bangladesh and implementation of the national forest monitoring system.

2. Objectives

The general objective of this training was to strengthen the national capacities in field data collection for the development of biomass and volume of allometric equation for the implementation NFI and future monitoring of forest resources.

The specific objectives were as follow:

- To discuss all the steps involved in developing allometric equation for trees
- To give field training on use of different instruments used in field data collection for the development of allometric equation
- To give field training on measurement of different dendomectric variables of trees
- To give field training on felling, debranching, bucking of a tree and separating different parts of felled trees (Leaves, smaller branches, Bigger branches, stems)
- To give field training on the measurement of fresh biomass of plant parts (Leaves, smaller branches, Bigger branches, stems) and measurement of diameter at thicker and thinner end of each section of stem and bigger branch as well as bark thickness at each end of each stem and bigger branch
- To give training on data recording in prescribed forms as given in "field measurement protocol on tree allometric equation for estimating above-ground biomass and volume in Bangladesh"
- To give field training on sub-sampling of different parts (Leaves, smaller branches, Bigger branches, stems) for fresh to oven-dried conversion weight
- To give field training on processing and transporting sub-samples of different parts (Leaves, smaller branches, Bigger branches, stems)
- To test the "field measurement protocol on tree allometric equation for estimating above-ground biomass and volume in Bangladesh" for its finalization
- To derive allometric equations of *Acacia auriculiformis* and *Acacia mangium* from the collected field data

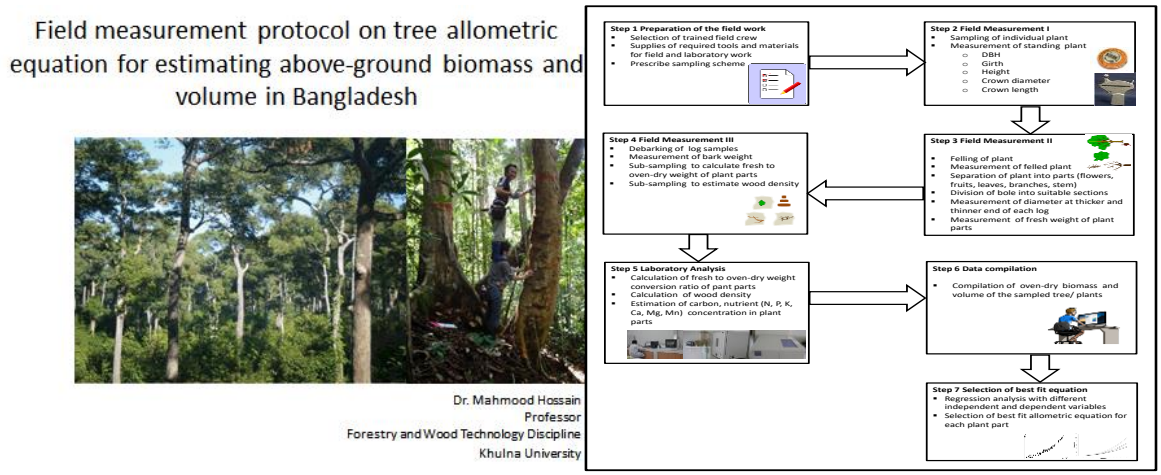
3. Summary of the training programme

3.1 Inauguration session

Dr. Mariam Akhter, Assistant Conservator of Forest and Forestry Officer of FAO Bangladesh delivered her welcome speech at the inaugural session. Mr. Luca Birigazzi, FAO discussed the different steps involved in the field data collection for the development of allometric equation. Dr. Matieu Henry, Chief Technical Advisor discussed the importance of this training programme and technical assistance provided by the FAO for this training programme. Mr. Mozaharul Islam, Conservator of Forests and National Project Coordinator, was the Chief Guest of the inaugural session. He highlighted important of field training on field data collection for the development of allometric equation and the importance of allometric equation in assessing forest stock.

3.2 Overview of the training programme

The first day (17th May) of the training programme, Dr. Mahmood Hossain, Khulna University presented the field measurement protocol on tree allometric equation for estimating above-ground biomass and volume in Bangladesh to the participants. He discussed all the necessary steps during the field work and field data collection. He also discussed the different measurement techniques for standing trees (Diameter at 0.3 m, DBH, total height, bole height, crown length, crown diameter) and felling of trees (total height, bole height), precaution during felling of trees, felling and bucking operation, separation of plant parts, weighing of plant parts and data recording procedure. Mr. Luca Birigazzi, FAO demonstrated use of different instruments to measure the dendrometric parameter of trees.



2nd day (18th May) was field visit to Jharka beat of Dholapara range under Tangail Forest division to find out and fix the felling operation of *Acacia auriculiformis* and *Acacia mangium* from social forestry wood lot plantation. A detail planning of field activities was done with participant for felling and measurement of *A. auriculiformis*. Next two and half days (19th to half of 21st May), participants were engaged for felling and measuring *A. auriculiformis* and remaining days were involved for felling and measuring *A. mangium*. The activities during the field work have been briefly discussed as follows.

Dr. Mahmood Hossain and Mr. Mohammad Raqibul Hasan Siddique, Khulna University conducted the reconnaissance survey of the woodlot to get a range of DBH of the desired species and to select places for weighing tree parts. The range of DBH from 5 to 30 cm was divided into 5 DBH classes keeping 5 cm from interval. Representative number of individuals (preferably 6 from each class) were selected considering good form and marked with number (1, 2, … 30) for next step. Geographical coordinate of each individual tree with its dengrometric parameters were recorded before felling the marked one in the following prescribed data sheet (Figures 1 and 2).

FIGURE 1: MEASUREMENT OF DENDROMETRIC PARAMETER BY THE PARTICIPANT

Annex 1: Field data form for fresh biomass and diameter measurement of logs of individual tree

Survey date:
Name of team leader:
Tree no:
Scientific name:
Local name:
Administrative location:
Coordinates of the sample tree:
Longitude: Latitude:
Altitude: Average slope:
Forest types:

A. Measurement of tree dimension

Diameter at 0.3 m (cm)					
DBH (cm)					
Total height (m)	Standing tree		Felled tree		
Bole length (m)	Standing tree		Felled tree		
Merchantable bole length (m)	Standing tree		Felled tree		
Crown diameter (m)	A =		B =	(A + B)/2 =	
Crown thickness or crown length (m)					
Crown shape (Annex 2)					
Crown form (Annex 2)					
Buttress no (if any)					
Buttress height (m)					
Buttress width (m)					
Buttress length (m)					
Age (year)					

B. Fresh biomass measurement of the sample tree

SL no	Fresh weight of tree parts (kg)						Weight (kg) of buttress (if any)
	Bole	Leaves	Flowers	Fruits	Smaller branches (<7 cm diameter)	Bigger branches (> 7 cm diameter)	
Total							

C. Length and diameter measurement of logs

Log ID	Log length (m)	Bark thickness (cm)	Diameter with bark (cm)		Diameter without bark (cm)	
			Thicker end	Thinner end	Thicker end	Thinner end

D. Length and diameter measurement of bigger branches

Log ID	Log length (m)	Bark thickness (cm)	Diameter with bark (cm)		Diameter without bark (cm)	
			Thicker end	Thinner end	Thicker end	Thinner end

E. Volume and Biomass ratio or relationship for bole samples (If Required)

Log ID	Log length (m)	Diameter with bark (cm)		Biomass with bark	Diameter without bark (cm)		Biomass without bark
		Thicker end	Thinner end		Thicker end	Thinner end	

F. Volume and Biomass ratio or relationship for bigger branch samples (If Required)

Branch ID	Branch length (m)	Diameter with bark (cm)		Biomass with bark	Diameter without bark (cm)		Biomass without bark
		Thicker end	Thinner end		Thicker end	Thinner end	

G. Leaf fresh biomass and leaf containing smaller branch biomass ratio or relationship (If Required)

Sample no	Fresh weight of leaves and leaf containing smaller branches (kg)	Fresh weight of leaves (kg)	Fresh weight of smaller branches without leaves(kg)

H. Fresh biomass of leaf containing smaller branches (Required to estimate fresh biomass of leaves from derived ratio or relationship of leaf fresh biomass and leaf containing smaller branch biomass)

Sample no	Fresh weight of leaves and leaf containing smaller branches (kg) (FWLB)	Ratio or relationship of leaf fresh biomass and leaf containing smaller branch biomass)	Fresh weight of leaves (kg) (LW) = Ratio X (FWLB)	Fresh weight of leaf containing smaller branches (kg) = (FWLB) – (LW)

FIGURE 2: PRESCRIBED DATA ENTRY SHEET FOR INDIVIDUAL TREE

After measuring the dendrometric parameters, the selected trees were felled at the ground level. The felled trees were delimbed, bucked and separated in parts (leaves, smaller branches, bigger branches, stems) for further processing (Figures 3 and 4). Mr. Luca Birigazzi, FAO supervised the activities of the participants.

FIGURE 3: ELLING AND BUCKING OPERATION BY THE PARTICIPANTS IN THE FIELD

FIGURE 4: SEPARATION OF PLANT PARTS

Diameter at thicker and thinner end of each section of individual tree stem and bigger branches and length of each section were measured and record in data entry form as presented earlier (Figure 5). Moreover, bark thickness at thicker and thinner ends of each stem section and bigger branches were also measured to get under bark biomass of wood.

FIGURE 5: MEASUREMENT OF LENGTH AND DIAMETER OF EACH LOG SECTION

Fresh weight of each part (leaves, smaller branches, bigger branches and stem sections) of individual felled tree was measured in the field and recorded in the prescribed data form as mention earlier. Some of the photographs of weighting activities are given below (Figure 6).

FIGURE 6: FRESH WEIGHT TAKING ACTIVITIES

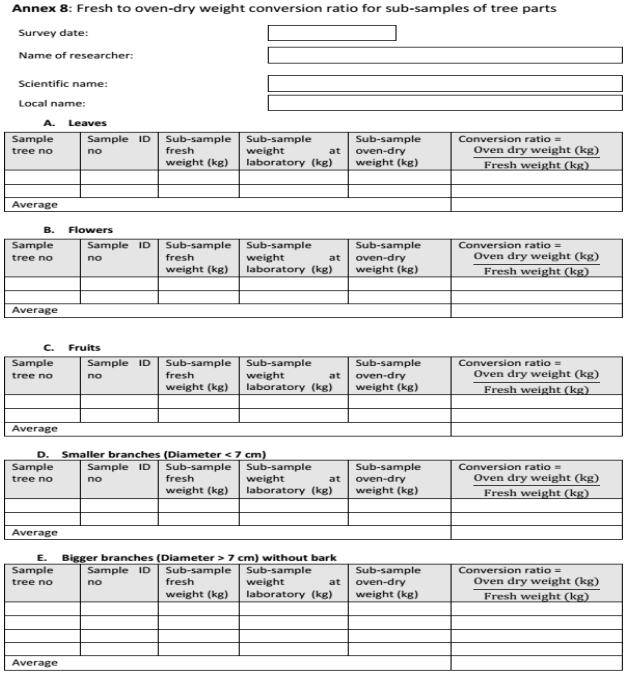
Mr. Mohammad Raqibul Hasan Siddique, Khulna University has given training on debarking of stem section to get ratio of fresh weight of bark and bole. Thus, participants were estimated the fresh weight ratio of bark and stem wood, and bark and bigger branches in the field (Figure 7).

FIGURE 7: FRESH WEIGHT TAKING ACTIVITIES

Dr. Mahmood Hossain and Mr. Mohammad Raqibul Hasan Siddique, Khulna University have given field training to collect the subsamples for each part (leaves, smaller branches, bigger branches, stem without bark and bark) from the sampled tree. They also showed the procedure of giving codes to the subsamples as well to record their fresh weight in the following data form (Figures 8 and 9). Some of the photographs of collection of sub-samples are given in Figure10.

Level 1 (Plant life form)	Code	Example for code of trees	Level 2 (Plant parts)	Code for plant parts	Example of Code for fresh weight	Level 3 (Sub-sample)	Code for sub-samples	Example of code for sub-samples of plat parts
Tree	Tr	Tr1, Tr2 ..Trn	Leaf	L	Tr1L1, Tr1L2.....TrnLn	Leaf	SubL	Tr1SubL1 ....TrnSubLn
			Flower	Fl	Tr1Fl1, Tr1Fl2.....TrnFln	Flower	SubFl	Tr1SubFl1.. TrnSubFln
			Fruit	F	Tr1F1, Tr1F2.....TrnFn	Fruits	SubF	Tr1SubF1.. TrnSubFn
			Smaller branch	Bt	Tr1Bt1, Tr1Bt2...TrnBtn	Smaller branches	SubBt	Tr1SubBt1.. TrnSubBtn
			Bigger branch	Bg	Tr1Bg1, Tr1Bg2 ..TrnBgn	Bigger branches	SubBg	Tr1SubBg1.. TrnSubBgn
			Dead Branch	Bd	Tr1Bd1, Tr1Bd2..TrnBdn	Dead Branch	SubBd	Tr1SubBd1.. TrnSubBdn
			Bole or stem	T	Tr1T1, Tr1T2.....TrnTn	Bole or stem	SubT	Tr1SubT1 ... TrnSubTn
			Bark of bole	Ba	Tr1Ba1, Tr1Ba2..TrnBan	Bark of Bole or stem	SubBa	Tr1SubBa1.. TrnSubBan
			Bark of bigger branch	BaBg	Tr1BaBg1.....TrnBaBg	Bark of bigger branch	SubBaBg	Tr1SubBaBg1. TrnSubBaBgn
			Wood Density	WD	Tr1T1WD1.....TrnTnWDn	Wood Density	SubWD	Tr1T1SubWD1...TrnTnSubWDn

FIGURE 8: IDENTIFICATION CODES FOR FRESH WEIGHT OF SUBSAMPLES



Annex 8: Fresh to oven-dry weight conversion ratio for sub-samples of tree parts

Survey date:

Name of researcher:

Scientific name:

Local name:

A. Leaves

Sample tree no	Sample ID no	Sub-sample fresh weight (kg)	Sub-sample weight at laboratory (kg)	Sub-sample oven-dry weight (kg)	Conversion ratio = Oven dry weight (kg) / Fresh weight (kg)
Average					

B. Flowers

Sample tree no	Sample ID no	Sub-sample fresh weight (kg)	Sub-sample weight at laboratory (kg)	Sub-sample oven-dry weight (kg)	Conversion ratio = Oven dry weight (kg) / Fresh weight (kg)
Average					

C. Fruits

Sample tree no	Sample ID no	Sub-sample fresh weight (kg)	Sub-sample weight at laboratory (kg)	Sub-sample oven-dry weight (kg)	Conversion ratio = Oven dry weight (kg) / Fresh weight (kg)
Average					

D. Smaller branches (Diameter < 7 cm)

Sample tree no	Sample ID no	Sub-sample fresh weight (kg)	Sub-sample weight at laboratory (kg)	Sub-sample oven-dry weight (kg)	Conversion ratio = Oven dry weight (kg) / Fresh weight (kg)
Average					

E. Bigger branches (Diameter > 7 cm) without bark

Sample tree no	Sample ID no	Sub-sample fresh weight (kg)	Sub-sample weight at laboratory (kg)	Sub-sample oven-dry weight (kg)	Conversion ratio = Oven dry weight (kg) / Fresh weight (kg)
Average					

FIGURE 9: DATA ENTRY FORM FOR FRESH WEIGHT OF SUBSAMPLES TO CALCULATE THE FRESH WEIGHT TO OVEN-DRY WEIGHT CONVERSION RATIO

FIGURE 10: COLLECTION OF SUBSAMPLE FROM FIELD

On 22nd May, Dr. Liam Costello, FAO joined with the team in the field and inspired the participant in different activities of biomass measurement (Figure 11).

FIGURE 11: INSPIRING ACTIVITIES BY DR. LIAM COSTELLO IN THE FIELD

The participants have finished their task of training on field data collection for the development of allometric equation for two species *A. auriculiformis* and *A. mangium* 23rd May. In this training programme, they have felled 33 and 30 individual of *A. auriculiformis* and *A. mangium* respectively. The height range of *A. auriculiformis* was 9 to 22.2 m with an average of 17 m. Whereas the height range of *A. mangium* 10.5 to 26 m with average height of 17 m. Number of individual felled trees for each DBH classes are given below:

	Number of individual per species	
DBH class (cm)	*A. auriculiformis*	*A. mangium*
5 to 10	7	6
10 to 15	7	11
15 to 20	8	6
20 to 25	8	4
25 to 30	3	4

At the end of the day, a certificate given ceremony was organized in the field. Dr. Liam Costello, FAO was chief gust of that ceremony. He uttered that this type of field training is very much essential for the BFD people and students. Dr. Mahmood Hossain, Khulna University and Mr. Luca Birigazzi, FAO have given thanks to the Divisional Forest officer of Tangail Forest Division and other field staffs for their cordial cooperation during the field training. Dr. Mahmood also acknowledges the support of the auction holders of the woodlots during the field training and for their permission to take some subsamples of plant parts for further laboratory analysis. At the end of the speech, Dr. Liam Costello, FAO, Mr. Luca Birigazzi, FAO and Dr. Mahmood Hossain, Khulna University jointly handed over the certificate to the participant (Figure 12)

FIGURE 12: CERTIFICATE GIVEN CEREMONY AT TANGAIL FOREST DIVISION

4. Recommendation and next steps

This training was quite helpful for Forest Department personnel, researcher of Bangladesh Forest Research Institute and students of Forestry. Some observations were noted during this field training. The following recommendations are need to consider for the better field work for the development of allometric equation of biomass and volume of trees.

1. This type of training should be given in border scale to BFD people and students of Forestry.
2. Only one species should be considered at a time for field data collection.
3. Subsample of pant parts (leaves, smaller branches, bigger branches, stem disk and bark) should be transferred to the laboratory immediately from the field to avoid the decay loss.
4. Instrumental backup should be ensured in the field.
5. Some improvement is needed in field data collection form for the development of allometric equation of trees. These improvements are, stand characteristics (DBH range, species composition) and categories of sub-sample.
6. Season of the field work should be between November to April

Next step:

- Next training should be given on sample analysis in the laboratory and selection of allometric model through statistical analysis using R software
- Finalisation of the field measurement protocol based on ground destructive measurements.
- The opportunity of developing an Open Foris Survey to facilitate the field data collection using mobile and android applications will be investigated.
- Develop allometric equations using the data collected in the field Subsamples collected in the field will be measured and analyzed in the laboratory. The data will be analysed using R and the results will be organised in the form of a scientific article. The data, meta-data and the R script will be prepared with appropriate documentation to ensure it proper use by Forest Department, Forest Research Institute and other users and institutions.
- Identify the potential land area for the destructive measurement Information will be collected on available felling of social forestry trees under different forest division and

private areas to prepare a report on potential land area for the destructive measurement to develop allometric equations with different species

Appendix 1. Agenda

Training on Field Data Collection for Allometric Equation Development in Bangladesh
17th to 24th May 2016
Tangail Forest Division, Tangail

Date	Session	Resource person
17th May	Training on allometric equation development (preparation of the field equipment, the manual and theory)	Dr. Mahmood Hossain, Khulna University Luca Birigazzi, FAO
18th May	Training on allometric equation development (going to the field)	Dr. Mahmood Hossain, KU Mr. Mohammad Raqibul Hasan Siddique, KU
19th May	Training on allometric equation development (field measurements)	Dr. Mahmood Hossain, KU Mr. Mohammad Raqibul Hasan Siddique, KU
20th May	Training on allometric equation development (field measurements)	Dr. Mahmood Hossain, KU Mr. Mohammad Raqibul Hasan Siddique, KU Mr. Luca Birigazzi, FAO
21st May	Training on allometric equation development (field measurements)	Dr. Mahmood Hossain, KU Mr. Mohammad Raqibul Hasan Siddique, KU Mr. Luca Birigazzi, FAO
22nd May	Training on allometric equation development (field measurements)	Dr. Mahmood Hossain, KU Mr. Mohammad Raqibul Hasan Siddique, KU Mr. Luca Birigazzi, FAO
23rd May	Training on allometric equation development (field measurements)	Dr. Mahmood Hossain, KU Mr. Mohammad Raqibul Hasan Siddique, KU Mr. Luca Birigazzi, FAO
24th May	Training on allometric equation development (travel back to Dhaka)	Dr. Mahmood Hossain, KU Mr. Mohammad Raqibul Hasan Siddique, KU Mr. Luca Birigazzi, FAO

Appendix 2. Participant List

ID	Name	Gender	Organization	Designation	Phone no	E-mail
1	Narottam paul	M	Forestry and Wood Technology Discipline, Khulna University	Student	01621484341	Narottamfwt.ku@gmail.com
2	Subir Nandi Sarker Nayan	M	Forestry and Wood Technology Discipline, Khulna University	Student	01670147054	Nayan140526@gmail.com
3	Mr. Abdullah Al Mamun	M	Bangladesh Forest Department	ACF, Sylhet Forest Division	01776834219	Almamun.0022@gmail.com
4	Shakkhor Ahmed	M	Department of Forestry and Environmental Science, Shahjalal University of Science & Technology	Student	01680134568	Shakkhorsust21@gmail.com
5	Md. Mahmudul Hasan	M	Department of Forestry and Environmental Science, Shahjalal University of Science & Technology	Student	01748136738	pabonworld@gmail.com
6	Safayetur Rahman	M	Institute of Forestry and Environmental Science, University of Chittagong	Student	01735226062	sr.sayem@gmail.com
7	Md. Muslim Uddin	M	Institute of Forestry and Environmental Science, University of Chittagong	Student	01815567995, 01911274778	md.muslimuddin315@gmail.com
8	Mofizul Islam Khan Forhad	M	Bangladesh Forest Research Institute, Chittagong	Field officer	01817771345	bfriforhad@gmail.com
9	Md Tariq Aziz	M	Bangladesh Forest Department	Research Officer	01790284328	Tariqaziz9718@gmail.com
10	Md. Sayed Ali	M	Bangladesh Forest Department	DFO, Sundarbans West Forest Division	01819810303	sayed13143@gmail.com

Appendix 3. Evaluation of the training

In total 10 (10 Male) participants attended the training and among the 9 took part in the evaluation process		
Male	9	100%
Female	0	0%
1. How often do you participate in training related to forest monitoring?		
First time	6	67%
1-3 every year	3	33%
More than 3 per year	0	0%
Regularly (approximately one per month)	0	0%
2. I would describe my self as?		
A professor/academic	0	0%
A student	6	67%
Forest Department staff	3	33%
Government staff (outside Forest Department)	0	0%
NGO staff	0	0%
Private consultant	0	0%
Other	0	0%
3. My professional background relates most closely to:		
Forester	7	78%
GIS/RS	1	11%
Statistics	1	11%
Social survey/assessment	0	0%
Economics	0	0%
Natural Resource Management	0	0%
Ecology	0	0%
Other	0	0%
4. My years of relevant experience is		
1-2 years	5	56%
3-5 years	1	11%
5-7 years	2	22%
8-10 years	0	0%
More than 10 years	1	11%
5. The training was relevant to my daily work		
Strongly agree	8	89%
Agree	1	11%
Neutral	0	0%
Disagree	0	0%
Strongly disagree	0	0%
6. I had enough previous knowledge to understand the content of the event		
Strongly agree	3	33%
Agree	4	44%
Neutral	0	0%
Disagree	2	22%
Strongly disagree	0	0%
7. This field training met my expectations in terms of the content and learning outcomes		
Strongly agree	3	33%
Agree	6	67%

Neutral	0	0%
Disagree	0	0%
Strongly disagree	0	0%
8. The learning resources provided were adequate and useful		
Strongly agree	7	78%
Agree	2	22%
Neutral	0	0%
Disagree	0	0%
Strongly disagree	0	0%
9. The resource person presented information in a way that i could understand and was easy to follow		
Strongly agree	9	100%
Agree	0	0%
Neutral	0	0%
Disagree	0	0%
Strongly disagree	0	0%
10. I feel confident to be able to carry out the tasks described in the training without supervision.		
Strongly agree	4	44%
Agree	5	56%
Neutral	0	0%
Disagree	0	0%
Strongly disagree	0	0%
11. I was pleased with the venue/meeting room/snacks etc		
Strongly agree	3	33%
Agree	4	44%
Neutral	2	22%
Disagree	0	0%
Strongly disagree	0	0%
12. Are there other people/agencies/organisations that you think should have been included in the training?		
NGOs and private planters should be included		
More people can be included		
More forestry related people like students, teachers and FD people should have been included in this training		
More students should be included in such kind of training		
SPARRSO can be included		
13. Any other comments?		
This training helps to develop my professional field experience and knowledge in collecting field data for tree measurements.		
Lab training, the other parts, to develop allometric equation is a must. I request FAO, to arrange a training on this engaging more people from BFRI as this institute carry out some research in forests volume measurements. Statistical method or design should be included. Field or site selection should cover the whole of Bangladesh		
I think the training is partially incomplete because I did not get any related lab training.		
It should include field work, laboratory work and model development and selection.		
This type of training should be arranged in every regional university.		
It should include laboratory analysis and allometric model selection		