The Quality Assurance and Quality Control Report of Bangladesh Forest Inventory:
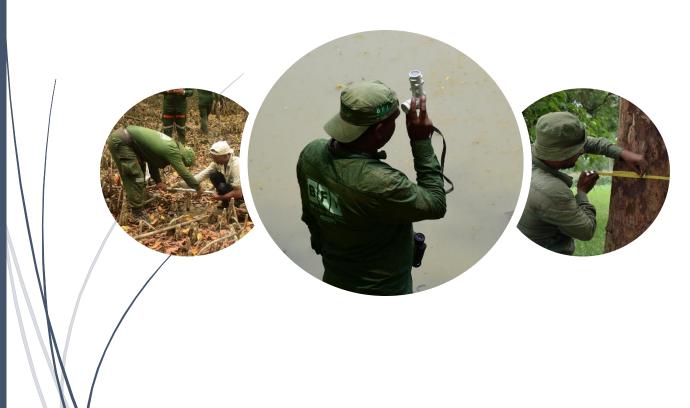## Biophysical Component

Bangladesh Forest Department

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), the Food and Agriculture Organization of the United Nations (FAO) and SilvaCarbon 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, climate change mitigation.

CONTACTS:

Md. Zaheer Iqbal
National Project Coordinator and
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

Table of Content

LIST OF ACRONYMS

Acronyms	Full Forms
NFI	National Forest Inventory
BFI	Bangladesh Forest Inventory
FAO	Food and Agriculture Organization of the United Nations
MoEFCC	Ministry of Environment, Forest and Climate Change
USAID	United States Agency for International Development
QA/QC	Quality Assurance and Quality Control
USFS	United States Forest Service
BFD	Bangladesh Forest department
RP	Reference Point
LF	Land Feature
WO	Witness Object
DWM	Down Woody Material
CWM	Course Woody Material
FWM	Fine Woody Material
SP	Sub plot
GPS	Global Positioning System

1. Background

The Bangladesh Forest Inventory (BFI) started in November 2016 with the objective to provide national estimates of the status of trees and forests, based on 1858 plots distributed all over of the country within five zones (BFD, 2016). Quality assurance and quality control (QA/QC) aims to assure the robustness of data collected from the field to achieve the desired quality (USDA, 2012) and avoid erroneous data that may lead to inaccurate estimates of tree and forest resources. From these quality-controlled data, national policies will be introduced, forest management approaches will be designed, and reports for international conventions will be prepared (Asrat and Tesfaye, 2013). Furthermore, the dataset will be used to estimate baseline volume, biomass, and carbon stocks in forests and soils (BFD, 2016) and enable the monitoring of changes in tree and forest resources and carbon stock over time.

1.1 Objectives of the report

The main objectives of the report are-

1) To find out major issues with field data collection, to be improved in future inventories.
2) To check field teams' performances in measuring different attributes and provide feedback to the Forest Department.
3) To establish a reporting system for the field data quality checking activities

2 QA/QC under the BFI

Biophysical field data collection was undertaken by 13 field teams including 52 forest department staff and 13 forestry diploma graduates. In parallel, five "QA/QC teams" were formed including Forest department officials and University teachers to ensure the data quality collected by field teams. Two trainings and a refresher training were conducted to make QA/QC staffs expert enough to guide and support the field teams (Kumar, 2016). In the end period of data collection due to unavailability of QA/QC teams, two field team leaders were also assigned for quality check. QA/QC was undertaken following hot and cold checks on 93 plots (39 Hot checks and 54 cold checks) total which is 5% of the total measured BFI plots[1].

2.1 Hot checks

In Hot checks QA/QC teams visit the plot with field teams to observe their activities and provide necessary technical support to measure plot (BFD, 2016). For hot checks, QA/QC team use a form (MS word) for scoring the field team's measurement capacity and efficiency of using equipment.

2.2 Cold Checks

QA/QC teams check plot measurement attributes separately after measuring plots by field teams and evaluate their performance, accuracy or deviation (BFD, 2016). For cold checks, an excel spreadsheet is used to score the performances of the field teams. The compliance standard is 90% for the dendrometric variables (such as diameter, height, etc.) and 100% for all other variables (BFD, 2016).

---

[1] Originally to be planned 3% and 7% for hot and cold checks (BFD, 2016)

3 Field team-wise cold check and hot check distribution

In total 93 plots were visited by QA/QC teams, among which 54 were cold checked and 39 were hot checked. All 12 field teams were checked. Team 10 got highest number (12) of cold checks and Team 3 got highest number of hot checks (7). Team 1 stands with no hot check and same situation for team 6 with no cold check. In the case of total check plots team 9 is in the highest position, they have 17 plots checked and team 6 have only one plot checked.

Table 1: field team wise check distribution

Field team no.	Cold check	Hot check	Total checks
Team 1	4	0	4
Team 2	2	4	6
Team 3	7	7	14
Team 4	1	4	5
Team 6	0	1	1
Team 7	6	1	7
Team 8	2	2	4
Team 9	11	6	17
Team 10	12	4	16
Team 11	1	3	4
Team 12	5	4	9
Team 13	3	3	6
Grand Total	**54**	**39**	**93**

4 QA/QC team-wise cold check and hot check distribution

QA/QC team 1 did not do any cold check. Field team 2 leader Anisur Rahman (QA-AR) and field team 12 leader Touhidor Rahaman (QA-TR) were involved with cold check at the final stage of final work. So, seven QA/QC teams were involved with hot checks and cold checks. QA/QC team 5 did the highest number of checks of 27 plots.

Table 2:QA/QC team wise plots checked

QA/QC team	Cold check	Hot check	Total
QA-T-1	0	12	12
QA-T-2	10	2	12
QA-T-3	8	8	16
QA-T-4	1	5	6
QA-T-5	17	10	27
QA-TR	6	0	6
QA-AR	12	0	12
FAO[2]	0	2	2
Grand Total	**54**	**39**	**93**

5 Zone-wise cold check and hot check distribution

All cold check and hot check plots are distributed into all 5 BFI zone. Hill zone has the highest number (37 plots) of checks.

Table 3: Zone wise plot distribution

Zone	Cold check	Hot check	Total
Coastal	6	5	11
Hill	22	15	37
Sal	10	4	14
Sundarban	10	2	12
Villages	6	13	19
Grand Total	**54**	**39**	**93**

6 Results from cold checks

For this report, seven attributes were considered. Soil sampling was not checked due to budget and time limitations in collecting this information separately.

---

[2] FAO team performed two separate hot checks while participated in several of the QA/QC field activities

Table 4:Attributes level wise field team performance

Field team	Plot level Sat.%	Unsat. %	LF level Sat.%	Unsat. %	SP level Sat.%	Unsat. %	DWM level Sat.%	Unsat. %	Soil level Sat.%	Unsat. %	Tree sapling level Sat.%	Unsat. %	Bamboo level Sat.%	Unsat. %
1	100	0	100	0	50	50	100	0	0	100	0	100	100	0
2	100	0	100	0	50	50	100	0	100	0	50	50	100	0
3	100	0	85.71	14.29	85.71	14.29	100	0	100	0	85.71	14.29	85.71	14.29
4	100	0	0	100	100	0	100	0	0	100	100	0	100	0
7	100	0	100	0	33.33	66.67	100	0	100	0	83.33	16.67	100	0
8	100	0	100	0	50	50	100	0	100	0	100	0	100	0
9	90.91	9.09	100	0	90.91	9.09	100	0	0	10	72.73	27.27	100	0
10	91.67	8.33	66.67	33.33	91.67	8.33	91.67	8.33	100	0	75	25	66.67	33.33
11	100	0	0	100	100	0	100	0	100	0	100	0	100	0
12	100	0	100	0	100	0	100	0	80	20	100	0	100	0
13	66.67	33.33	66.67	33.33	0	100	66.67	33.33	100	0	66.67	33.33	100	0
Total	**94.44**	**5.56**	**85.19**	**14.81**	**74.07**	**25.93**	**96.30**	**3.70**	**68.52**	**31.48**	**74.07**	**25.93**	**90.74**	**9.26**

Sat. - Satisfactory, Unsat. -Unsatisfactory, LF – Land Feature, SP – Subplot,
DWM – Down woody debris

6.1 Cold check comments section

For every section of attributes measurement there are spaces for writing comments/notes. The QA/QC teams write their observation and perceptions on that specific space.

Major comments for seven different sections are compiled below-

6.1.1 Comments for plot section

In plot level nearly **50%** of the observations regarded errors with the **Reference Point (RP).** RP is a very crucial object for the plot relocation and identification. Other major findings were- **Plot access sketch map**, **missing administrative information**, **Plot accessibility status** and **Time on plot**. Some examples of plot related comments-

Table 5:comments for plots

Heading	Comments
Accessibility	The plot falls on a pond. In the dry season it will be accessible. But in the rainy season it will different to find the center in future.
RP issues	RP bearing was recorded from the center of center subplot
Time on plot	613: Arriving from "another plot/ Other"- It is written in report. At the time of departure 06:49, departure from another plot is not possible.
Access sketch map	Sketch map should indicate more description and clear image of the way. The plot is located very near to Kolajura Eidgagh Bazar. From the main road of Moulavibazar-Borolekha, turn to Kolajura Eidgagh Baar via Dokhshinvagh Bazar of Borolekha.
Admin info	The Forest Range of this plot is Nolchira but mistakenly recorded as Oskhali.

6.1.2 Comments for Land Feature (LF) Section

Land feature describes the about the circumstance, ecosystem and components where plot located. Proper LF identification and description is a major component of BFI. According to the information provided the land class will be assigned and verified. Among LF related comments, 32% regarded **LF object missing,** 25% regarded **inaccurate land class identification,** and 21% regarded **management related issues.** Other major observations were - **LF object cover percentage**, **LF photos**, **Crown cover** etc. Some examples of LF related comments-

Table 6: Comments for Land feature

Heading	Comments
Inaccurate Land class	Two LF Containing same name.
LF Object missing	Tree should include as LF Object.
Management	lf_id 1 and lf_object_id 1 management is mistaken. Field team written "Village Common Forest" instead of Homestead Forest
Object cover percentage	OBJECT % OF COVER (725): In LF-1, Object-1 the Tree cover may be 50-60. NON-VEG % COVER: LF-1, Object-2 the Non-vegetated object Building /Structure % may be 30-40.

LF photos	only three photos per LF
Inaccurate Land class	NLCL misidentified: LF 1 should be "Rural Settlement" and LF 2 should be "Pond
Crown cover	MIN CROWN COVER and MAX CROWN COVER: This should not be more than 20-30%.
LF proportioning	Land Feature proportioning picture is not clear, and proportioning was done only for three subplots.

6.1.3   Sub-plot section observations

In sub-pot relates comments, **36%** regarded missing or inconsistent **tree tagging of witness object**, and other observations were- **Witness object issues (19%), wrong species identification (20%), inaccurate measurement of tree attributes**, **sub-plot accessibility status**, **wrong measurement of slope** and **leaf cover**, **incomplete LF proportioning** etc. Some examples of sub-plot related comments-

Table 7: Comments for sub-plot section

Heading	Comments
Tree tagging	Tree Tag was missing for two WO in 3rd Subplot
Tree measurement	Subplot 5 & WO 1 bearing should be 5 (but they took back bearing).
LF proportioning	lf proportion for subplot 4 and LF 1 is not correct
Accessibility status	subplot 1 status will be "Completely sampled
WO issues	WO were identified as "Albizia lebbeck" instead of "Samanea saman
Species identification	In subplot 1, WO 3 is Trema orientalis but recorded as Glycosmis pentaphylla.
Leaf cover	Subplot 3 leaf cover should be 60%
Slope	Subplot 5 max slope is 45%;

6.1.4   Down woody materials observation

Down wood material (DWM) amount differs with time, that's why the amount of FWD and CWD may differ between field team observation and QA/QC team observation. For DWM the QA/QC team accepted that in maximum cases the amount changes are okay due to time interval. In few cases their opinion regarding DWM varied from the field team opinion and suspected that field team might have missed some DWM.

6.1.5   Soil Notes

In QA/QC cold check the aspects of checking soil things are limited. Among the observations the most identical issues frequently done by field teams are- **litter not collected**, **missing soil photos**, **Information lacking missing LF id for soil samples** etc. But in some cases, for soil humus layer QA/QC team wrote in the comments- **"Field team recorded the humus layer as 99 cm, but it seems very high"**. It is a **confusion of QA/QC teams** because, **99 is a code** not centimeter and used for "**unknown- cannot determine**". Some examples of soil related comments-

Table 8: Comments for soil and litter

Heading	Comments
Litter Collection issues	Litter supposed to be collected as there were many trees
Soil photos	Subplot 2 and subplot 3 soil picture seemed taken from same pit.
Soil Humus layer	They recorded all the humus layer as 99 cm, but it seems very high.
Missing LF id	They did not record land feature ID.
Information lacking	Insufficient information of litter and soil in returned form.

6.1.6 Tree seedlings observations

Measurement of tree, sapling and seedlings are most important activity of a plot measurements. The volume, biomass, growing stock, stem density, carbon stock calculation and so on are largely depend on tree measurements. Moreover, by recording tree, sampling and seedling the regeneration status of a forest and the future status of forest can be predicted.

Among the QA/QC tree and seedlings related comments, the most frequents are- **misidentification of species (39%)**, **inaccurate tree attributes (length, diameter, bearing, distance) measurement (20%)**, **trees within plots missed to be recorded in the tree list (16%), seedings were missed to be counted**, **sapling related error**, **data missing** etc. Some examples of tree and seedling measurement related comments-

Table 9: Comments on tree, seedling and sapling

Heading	Comments
Seedling count	Serious Miscount of seedling
Sapling error	2 saplings were missing in 3rd Subplot.
Tree missed to record	WO-1 and WO-2 of subplot 2 missed in the tree list
Species identification	9 Samanea saman is misidentified as "Albizia lebbeck" and Two Bombax ceiba tree is misidentified as "Gossypium arboreum
Tree measurement	Tree's height observed 15.8 where field team found it 20.32
Tree measurement	In Subplot 1, Tree No 2, the Diameter was recorded 13 but we found 23.9cm.
Data missing	Bearing of some stump was not recorded

6.1.7 Bamboo measurements comments

Bamboo is not common in most plots and therefore was usually observed by QA/QC teams. In maximus plots having bamboo, QA/QC team mentioned that, Data looks fine" and in a few plots (3 plots) QA/QC team found bamboo that was not recorded by the field team.

7 Results from hot checks

A total 39 plots were hot checked. Field team performances are assessed by the QA/QC team into two categories. Categories are-

- ➢ Performance in plot attributes measurements
- ➢ Performance in use and maintenance of the equipment

Those are separately mentioned in the hot checks report. Preference are ranked into below categories-

1= Needs improvement: Further dedicated training required

2= Needs monitoring: Mostly adequate but data should be thoroughly reviewed. Further training may be considered.

3= Competent: Sound understanding of the topic area, and

0= Not observed

In the hot check form, code "0" was not there but in some cases QA/QC teams mentioned "0" when they required to indicate not observed for any attributes. That's why it is included in this reporting.

7.1 Performance in plot attributes measurements

Field team performance in plot attributes measurements are presented in table-11. The main observations of the table are-

- ✓ For plot details and RP attributes measurements, land feature (LF) details, LF objective details, proportioning, WO details, Seedlings recording, FWD and soil measurement field team's competency is more than 60 percent.
- ✓ But in case of Sapling, CWD, Tree details and Bamboo measurement attributes the percentage of competency are less than 60%.
- ✓ Most crucially in case of Tree details attributes measurement, the competency of field teams is lowest. It is only 48.72%.

7.2 Hot check observations

QA/QC teams use to visit the plot with the field teams and observe their activities in plot measurements. If they found any problem with the field team like- error in measurement, lack of clear idea, incorrect planning, incorrect use of instruments etc. they used to make things correct in the field. So, that the idea, concept and technical soundness of field team were improved by the hot checks. That was the main concept of conducting hot checks, it helped a lot to improve the field team performance.

Hot checking procedure includes two main segments-

A. Plot attributes measurements
B. Field team performances in equipment use and handling

7.2.1 Hot check measurements for plot attributes

QC/QC team checks the overall field team activity but in case of plot attributes measurement, they mainly consider-

Table 10: List of plot attributes hot checked

Serial	Attribute
1	Plot /RP details
2	LF details
3	LF object
4	Subplot (SP)
5	SP LF proportioning
6	Wo details
7	Seedling details
8	Sapling details
9	CWD
10	FWD
11	Soil measurements
12	Tree details
13	Bamboo details

Field team performance in plot attributes measurements are presented two table 11a and 11b below-

Table 11a: Field team performance in plot attributes measurements by hot check

	PLOT /RP DETAILS		LF DETAILS		LF OBJECT		SUBPLOT (SP)		SP LF PROPORTIONING		WO DETAILS			SEEDLING DETAILS	
Team	2 (%)	3 (%)	2 (%)	3 (%)	2 (%)	3 (%)	2 (%)	3 (%)	2 (%)	3 (%)	0 (%)	2 (%)	3 (%)	0 (%)	3 (%)
2	0	100	25	75	0	100	25	75	0	100	0	0	100	0	100
3	42.86	57.14	28.57	71.43	14.29	85.71	28.57	71.43	14.29	85.71	0	14.29	85.71	0	100
4	25	75	0	100	0	100	0	100	0	100	0	0	100	25	75
6	0	100	0	100	0	100	0	100	0	100	0	0	100	100	0
7	0	100	0	100	0	100	0	100	0	100	0	0	100	0	100
8	0	100	0	100	0	100	0	100	0	100	0	0	100	100	0
9	66.67	33.33	50	50	50	50	66.67	33.33	100	0	0	83.33	16.67	0	100
10	0	100	0	100	0	100	0	100	0	100	25	0	75	75	25
11	100	0	100	0	100	0	100	0	100	0	0	100	0	100	0
12	0	100	0	100	0	100	0	100	0	100	0	0	100	0	100
13	66.67	33.33	66.67	33.33	66.67	33.33	66.67	33.33	100	0	0	66.67	33.33	0	100
Total	33.33	66.67	28.21	71.79	23.08	76.92	30.77	69.23	33.33	66.67	2.56	28.21	69.23	25.64	74.36

*Codes:

1= Needs improvement: Further dedicated training required

2= Needs monitoring: Mostly adequate but data should be thoroughly reviewed. Further training may be considered.

3= Competent: Sound understanding of the topic area, and

0= Not observed

Table 121b: Field team performance in plot attributes measurements by hot check

Team	SAPLING DETAILS			CWD			FWD			SOIL MEASUREMENTS			TREE DETAILS			BAMBOO DETAILS		
	0 (%)	2 (%)	3 (%)	0 (%)	2 (%)	3 (%)	0 (%)	2 (%)	3 (%)	1 (%)	2 (%)	3 (%)	0 (%)	2 (%)	3 (%)	0 (%)	2 (%)	3 (%)
2	0	0	100	0	0	100	0	0	100	0	25	75	0	0	100	25	0	75
3	0	0	100	0	0	100	0	0	100	0	14.29	85.71	0	0	100	28.57	14.29	57.14
4	75	0	25	0	0	100	0	0	100	0	0	100	0	100	0	50	0	50
6	100	0	0	100	0	0	100	0	0	0	0	100	0	100	0	100	0	0
7	0	0	100	0	0	100	0	0	100	0	0	100	0	100	0	100	0	0
8	50	0	50	10	0	0	50	0	50	0	0	100	0	100	0	50	0	50
9	0	66.67	33.33	0	66.67	33.33	0	66.67	33.33	16.67	66.67	16.67	0	50	50	83.33	0	16.67
10	100	0%	0	100	0	0	75	0	25	0	0	100	50	50	0	100	0	0
11	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	100	0	0
12	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100
13	0	66.67	33.33	0	66.67	33.33	0	66.67	33.33	0	66.67	33.33	0	66.67	33.33	66.67	0	33.33
Total	23.08	23.08	53.85	17.95	23.08	58.97	12.82	23.08	64.10	2.56	28.21	69.23	5.13	46.15	48.72	56.41	2.56	41.03

*Codes:

1= Needs improvement: Further dedicated training required

2= Needs monitoring: Mostly adequate but data should be thoroughly reviewed. Further training may be considered.

3= Competent: Sound understanding of the topic area, and

0= Not observed

* Table 11a- and Table- 11b are two parts of a single table

7.2.2 Field team performances in equipment use and handling

Under this section of observation QA/QC team mainly checked out the skill and competence of field team members in using and maintain the equipment used in the field. This is the first time in Bangladesh, Forest inventory data is collected using tablet and using real time data collection method. So, it is very crucial to know the competency of field team with the latest technology they are using. Besides the work distribution and team composition to direct the successful plot measurement were also evaluated. If distortions of field teams identified, then QA/QC team guided field crews to the appropriate way. The main components observed under this section-

Table 12: Equipment use and handling performance

Serial	Checked attributes
1	Use of Tablets
2	Use of Laser
3	Use of GPS
4	Use of Compass
5	Use of Sunnto
6	Use of Densitometer
7	Team work/Team composition
8	Equipment maintenance
9	Cleanness maintained

Table 133: Field team performances in equipment use and handling

	Tablet		Laser		GPS		Compass			SUUNTO	Densitometer		Team work		Equipment maintenance		Cleanness	
Team	2	3	2	3	2	3	0	2	3	3	2	3	2	3	2	3	2	3
2	0	100	0	100	0	100	0	0	100	100	0	100	0	100	0	100	0.	100
3	0	100	28.57	71.43	0	100	0	0	100	100	28.57	71.43	0	100	42.86	57.14	28.57	71.43
4	0	100	0	100	0	100	0	0	100	100	0	100	0	100	0	100	0	100
6	0	100	0	100	0	100	0	0	100	100	0	100	0	100	0	100	0	100
7	0	100	0	100	0	100	0	0	100	100	0	100	0	100	0	100	0	100
8	0	100	0	100	0	100	0	0	100	100	0	100	0	100	0	100	0	100
9	50	50	0	100	50	50	50	16.67	33.33	100	50	50	16.67	83.33	50	50	0	100
10	0	100	0	100	0	100	0	0	100	100	0	100	0	100	0	100	0	100
11	100	0	0	100	100	0	100	0	0	100	100	0	100	0	100	0	0	100
12	0	100	0	100	0	100	0	0	100	100	0	100	0	100	0	100	0	100
13	66.67	33.33	0	100	66.67	33.33	66.67	0	33.33	100	66.67	33.33	0	100	66.67	33.33	0	100
Total	20.51	79.49	5.13	94.87	20.51	79.49	20.51	2.56	76.92	100.00	25.64	74.36	10.26	89.74	28.21	71.79	5.13	94.87

7.3   Major observations from Hot checks

Usually Hot check is done to make things correct. From the observations in Hot checks the major recommendations are-

- ✓ Lacking clear concept in different section of measurement such as- Land Feature description, separating land feature and land feature object, percentage of object cover, identification of tree status, management status, rotation etc.
- ✓ Problems of data recording in open foris using tablet; this problem seen most in the early stage of measurement.
- ✓ Random problems created by open foris in data recording.
- ✓ Don't collect soil appropriately
- ✓ Field team don't read the manual properly and follow the instructions mentioned
- ✓ Problems of using equipment properly
- ✓ Do not calibrate the equipment before using, it gives erroneous reding
- ✓ Lack of carefulness in case of taking measurement such as- height, DBH, Distance, Bearing measurement, seedling and sapling measurement.
- ✓ Problem of species identification
- ✓ Identification of appropriate RP and WO

8   Conclusion

From hot check and cold check reports; field teams' performances are satisfactory in most parameters. But for some parameter's improvement is needed such as- land feature description, soil sampling and tree, sapling attributes measurements. In field measurements, less than 50% competency was achieved by field teams in tree attributes measurement, which is a very crucial finding and needs attention in the next inventory cycle. QA/QC teams suggest further training and intensive monitoring to the field team will improve their performances significantly. Additionally, a higher number of cold checks and hot checks should be performed. A feedback system of quality checking should be developed, whereby after completing a certain number of checks (such as 10 or 15) the findings should be compiled and reported field teams so they can make adjustments. These initiatives, and experiences will be helpful to increase robustness of data in the future cycles of Bangladesh Forest Inventory.

9 Citation

1. BFD (2016). The Bangladesh Forest Inventory Design. Dhaka, Bangladesh
2. BFD (2016). Quality assurance and quality control for the Bangladesh Forest Inventory. Bangladesh Forest Department and Food and Agricultural Organization of the United Nations, Dhaka, Bangladesh. ISBN: 978-984-34-2713-7
3. USDA. (2012). Quality assurance plan for the annual forest inventory in the South. Retrieved from
4. Asrat, Z., Tesfaye, Y. (2013). Training manual on: Forest Inventory and Management in the context of SFM and REDD+. Hawassa University and Wondo Gent College of Forestry and Natural Resources, Wondo Gent, Ethiopia.
5. BFD (2016)
6. . Manual for Soil Measurements for the Bangladesh Forest Inventory. Bangladesh Forest Department, Food and Agricultural Organization of the United Nations, Dhaka, Bangladesh. ISBN 978-984-34-2714-4
7. Kumar, F. M. and Henry, M. (2016). Proceedings of the Training of Trainers for the Bangladesh forest inventory, 02-08 October 2016. Organized by Bangladesh Forest Department, Food and Agricultural Organization of the United Nations, Dhaka, Bangladesh.

10 List of Tables