



Experiences in field missions to locate the 2005 NFA plots



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 States 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..

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Disclaimer

This report is designed to reflect the activities and progress related to the project GCP/GD/058/USAID “Strengthening National Forest Inventory and Satellite Forest Monitoring System in support of REDD+ in Bangladesh”. This report is not authoritative information sources – it does not reflect the official position of the supporting international agencies including USAID or FAO and should not be used for official purposes. Should readers find any errors in the document or would like to provide comments for improving its quality they are encouraged to contact one of above contacts.

Executive Summary

The Bangladesh Forest Department established 299 permanent sample plots (referred to as tracts) across the county in a systematic design in the 2005 National Forest and Resource Assessment. The objective of the inventory was to capture as much information about forest resources and land use with the limited financial resources available. To achieve this, a relatively low sampling intensity was compensated with large plots (4 x 250m x 20m rectangular sub plots per tract). While the methodology is statistically sound, efficiencies gained in the lower sampling intensity are not apparent at the plot level; smaller plots are generally easier and more efficient to measure than larger plots, if a high enough sampling intensity can be achieved.

In 2015, the Forest Department began the process of national forest inventory. A key consideration for the 2015 inventory was whether it is feasible to consider some or all of the 299 plots established in 2005.

Four attempts have been made to locate the 2005 plots but without any success. Major causes are:

- Absence of paper field form from the 2005 NFI compelled the relocation effort to be based solely on GPS coordinates with no explicit references to the marker point.
- The iron rods, placed ten years ago, might have been removed either maliciously or accidentally by the local community people.
- Local forest staff within the Forest Department transferred at routine intervals and very few of the current staff was actively involved in the previous NFI who can help in tracing the plot locations.

The FAO international consultants considered that:

- The process of relocating old plots is, in any case, very time consuming. This would affect logistic arrangement and time estimates for the collection of data in the new plots.
- The NFI will likely have many more clusters than the 299 of the old one, so the relocating effort would interest only a fraction of the new clusters.
- The very dynamic nature of the landscape makes it difficult to rely on features used as reference points 10 years ago.
- Some estimate of change (at regional / provincial level) can still be obtained even if data collection does not occur in the exact location as 2005.

Due to the reasons mentioned herein, the option to not consider the 2005 NFA may be an appropriate management decision based on the financial and accuracy/viability issues mentioned above.

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1. Introduction

In the context of a national forest inventory, the establishment of permanent sample plots and their subsequent, periodic re-measurement provides the temporal element to the forest monitoring process. This allows changes in forest and land cover dynamics to be observed over time and the information can be used to model and predict trends into the future. It is also key component of a measurement, reporting and verification for REDD+.

The Bangladesh Forest Department has extensive experience in forest inventory having implemented a number of methodologies for different purposes in different areas. In the 2005 National Forest and Resource Assessment, FD established 299 permanent sample plots (referred to as tracts) across the country in a systematic design. The objective of the inventory was to capture as much information about forest resources and land use with the limited financial resources available. To achieve this, a relatively low sampling intensity was compensated with large plots (4 x 250m x 20m rectangular sub plots per tract). While the methodology is statistically sound, efficiencies gained in the lower sampling intensity are not apparent at the plot level; smaller plots are generally easier and more efficient to measure than larger plot, if a high enough sampling intensity can be achieved.

In 2015, the Forest Department began the process of national forest inventory, building on lessons learned and equipped with significantly larger resources by way of USAID funding. A key consideration for the 2015 inventory is whether it is feasible to consider some or all of the 299 plots established in 2005.

The benefits of remeasurement are numerous and all reasonable efforts should be made to capture the temporal aspects provided through remeasurement. However, the remeasurement process is in many ways more difficult than the initial survey and questions related to GPS accuracy, adequate documentation of plots, access to the document archived and accurate data entry of the initial survey must be answered to ensure the process is feasibility.

This report outlines the initiatives taken to date to answer these questions and provides recommendations for FD to consider in their decision making process.

2. Methodology

Four attempts have been made to locate the 2005 plots. In the first three attempts the plot forms from the original survey had not been located leaving teams reliant on the data export alone. The plot forms were considered integral due to the additional illustrative information.

The first attempt was conducted with members of the NFMS team during the inventory design activity led by Olaf Kuegler. During this attempt, tracts 187 and 188 were visited. No plots were able to be located in tract 187. In tract 188, the team believed they had located the general area of one of the plots. The plot was defined by two small patches of trees along the 250m tract. No metal detector was available for the mission so the survey pin was not found.

Attempt two was conducted at Tract 180. A metal detector/radiometer was used in attempts to locate the plot marker however it could not be found.

The third attempt visited tract 179. A metal detector was brought by a consultant from FAO HQ. Members of the RIMS unit and the NFMS group searched for the four plots however none were located. The reasons provided for this failed attempts (as per the BTOR by FAO consultant Marco Piazza include:

- a) no filled-in paper field form from the 2005 NFI are available, thus forcing the relocation effort to be based solely on gps coordinates with no explicit references to the marker point;
- b) the iron rods, placed ten years ago, may have been removed (on purpose or accidentally) by the local population, particularly because, given the context of Bangladesh and its very high population density, it's very likely that the majority of the plots fell on settlement/village areas – this point also underlines the importance of always involving the local population by informing village chief about the NFI activities, in that way, chances of tampering would be reduced ;
- c) due to staff changes within the Forest Department, very few of the current staff was actively involved in the previous NFI.

The fourth attempt revisited tract 180. For this attempt the plot forms had been located which provided additional information of land use section. A plotted layout of trees was created for each plot using 'R' software (Figure 1). Members from SilvaCarbon and 14 FD participants from their QA/QC training and FAO joined the mission. At the end of the two days field exercise a brief informal meeting was held among the participants to collect feedback. Although the ultimate decision will have to come from the FD, the following feedback was gathered:

- The process of relocating old plots is, in any case, very time consuming. This would affect logistic arrangement and time estimates for the collection of data in the new plots.
- The NFI will likely have many more clusters than the 299 of the old one, so the relocating effort would interest only a fraction of the new clusters.
- The very dynamic nature of the landscape makes it difficult to rely on features used as reference points 10 years ago.
- Some estimate of change (at regional / provincial level) can still be obtained even if data collection does not occur in the exact location as 2005.

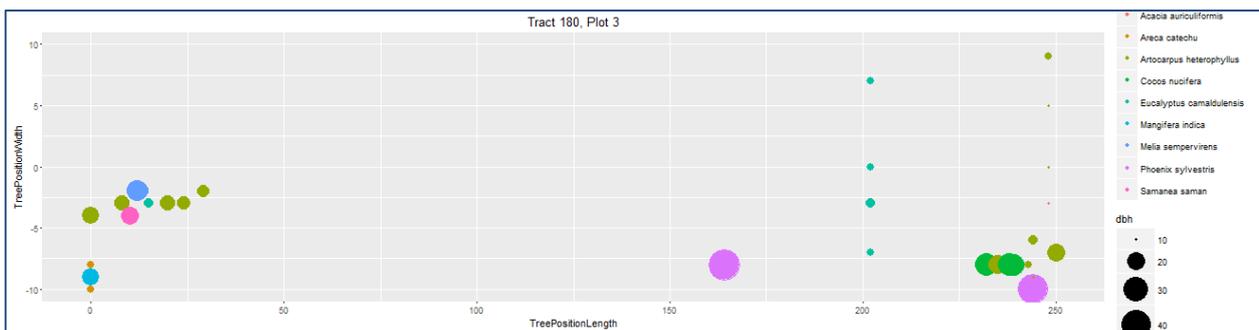


FIGURE 1: PLOTTED TREE LAYOUT PRODUCED IN R

No	Date	Location	Tract/Plot visited	Participation	Equipment
1	27-Jul-15	Srimongal	187 and 188	SilvaCarbon / FAO / NFMS group	GPS, Compass, database export, maps
2	27-Aug-15	Gazipur	180/3/4	FAO/FD	GPS, Compass, database export, maps, metal detector
3	6 -Nov-15	Gazipur	179	FAO	GPS, Compass, database export, maps , metal detector

4	7-Mar-16	Gazipur	180/1/3/4/	FD/FAO/SilvaCarbon	GPS, Compass, database export, maps, plotted layout of trees, metal detector, plot forms
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3. Discussion

Four attempts to relocate the 2005 plots have been carried out with limited success. In early attempts the failure was attributed to a lack of resources, most notably the plot forms and metal detector. The discovery of the plot forms in February 2016 was seen as a critical factor in the process. It was hoped that the forms would provide useful illustrations and additional descriptions they in fact provide limited additional information. Illustrations mostly related to a description of land use section, which is not at a scale to be useful for this purpose.

The closest attempts to find plots occurred when teams spoke with local land owners mentioned in the plot forms who often recalled FD members conducting the survey. However, in these occasions, the locations described by the locals were between 50m-100m away from the GPS point. Through these experiences it has become increasingly apparent that the GPS coordinates are highly unreliable.

In acknowledging the unreliability of the GPS coordinates, the remeasurement process is reliant on two factors: 1) the reference points and 2) the surveyed trees as references. However the former is dependent on the GPS point being useful in bringing crews close enough to the reference points, which based on experiences to date is no certainty, and the latter proves unreliable given the dynamic nature of land use in Bangladesh and the short rotation of trees outside of forests which account for the major proportion of the country's carbon stocks.

For example, in searching for Tract 180 in March, the team was confident they had located the general area of the plot based on reference point information. This was confirmed by local land owner Mr. Harun whose home was mentioned as a reference point. Mr. Harun recalled the crew from FD surveying his land some 10 years earlier. When Mr. Harun observed the tree list he confirmed that all trees listed on his property (approximately 15) had been sold. He also proudly produced the wooden bench that was formerly a *Eucalyptus camaldulensis* surveyed on his property. The absence of the trees meant the teams were unable to identify the line of plot centre which would be critical for remeasurement.

It is notable that the four attempts have been carried out in 'non-forest' areas. Each tract selected for remeasurement were chosen largely for logistical ease but also because they would seem logically to be the easiest to relocate due to their more distinct landscape pattern, compared to a more homogeneous forested plot. Given the results in the target areas, the implications for locating plots heavily forested plots in the Sundarbans or CHT is poor.

4. Conclusions and recommendations

It is well acknowledged that locating the 2005 plots will be a difficult process. However it must also be acknowledged that with increasing sophisticated technology and refined methodology, each of the four attempts were closer than the previous. In sum, the attempts carried out to date can not conclude that remeasurement is impossible. They do however provide some serious questions for FD to consider:

TIMING ON SITE AND COST IMPLICATIONS: Given the issues already mentioned, the relocation process will add a substantial time to the data collection process given the time taken to relocate the plot centre/start position at an adequate level of confidence. This has obvious implications for the cost of the inventory. While it should be acknowledged that a remeasurement process will always be more time consuming than a first round

survey, the added value of this process should be considered in the context of the likely accuracy that can be derived through the process.

ACCURACY: Based on findings to date, locating the plot marker may not be possible for a significant proportion of plots. This means that the plot centre will be estimated based on reference point and the accuracy of measured distances from the 2005 survey is not known. In such cases, every 1m of horizontal error from plot centre accounts for 2m of plot lost (1m on either side). If the centre is out by 5m, only 25% of the original plot area will be missed and 25% of new areas will be remeasured, accounting for a 50% variation from the original data. Based on the experience in remeasurement attempts to date, relocating the plot start to within 5m would be considered a good result.

RETURN ON INVESTMENT: In light of the above, the data may be less robust and of limited values in a reporting sense, in which case the return on investment may turn out to be marginal.

4.1 OPTIONS FOR REMEASUREMENT

1. Remeasure all plots as part of the current inventory

In this case further field missions are required to determine if an efficient methodology for relocation is possible. Given the time constraints and urgency to finalise the design, this would need to occur immediately. Aiming for a 5% sample of the original tracts (approximately 15) across different forest types may provide a more robust indication of the feasibility for remeasurement. Field teams would need to be mobilised immediately and the conclusion, based on current experience may likely be that it is indeed unfeasible. The cost implications would need to be considered factoring the additional time required to relocate the old plots.

2. Remeasure a partial sample as part of the current inventory

Remeasuring a subset of the plots may still provide useful data whilst limiting the overall time spent on the process. For this to occur, further field tests as mentioned in point one would need to occur. A statistical methodology would need to be defined also.

3. Conduct a close out survey as a separate, parallel process

So as not to delay the current NFI process, a parallel survey could be carried out for a subset of plots. This would require its own separate funding arrangement.

4. Collect only a partial section of the plot

To save time in the data collection process, a subsection of the 250m plot may be collected. This may be applied to options 1 to 3.

5. Not consider the 2005 NFA

Due to the reasons mentioned herein, the option to not consider the 2005 NFA may be an appropriate management decision based the financial and accuracy/viability issues mentioned above.

4.2 Next steps

In order to finalise the design for the current NFI a decision on re-measurement is necessary. To facilitate this decision, the NFMS group and members of the QA/QC field crews that participated in the recent field activity to tract 180, should discuss their experience with the higher forest department officials.

To ensure smooth delivery of the current NFI, a decision should be made by mid April 2016.

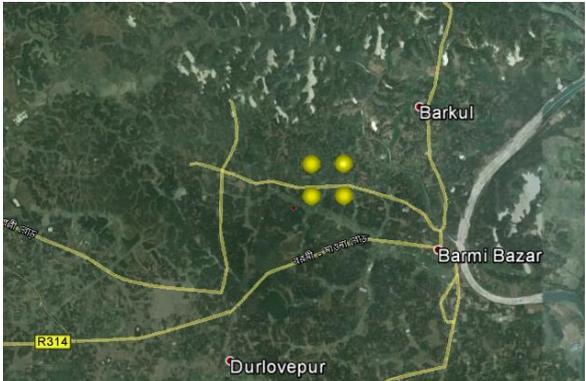
Appendix 1. Persons attended in the field trips for 5 tracts

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Appendix 2. Pictures

Tract 179 (6 th November 2015)	Google earth snap shots for the plots
 <p>A photograph showing four individuals in a rural field setting. One man in a white shirt is pointing at a map held by another man. A third man in a hat and backpack stands nearby, and a fourth man is partially visible on the left. They appear to be conducting a field survey or discussion.</p>	 <p>A satellite map showing a rural landscape with several yellow triangles marking specific locations. The terrain is a mix of green fields and brownish soil, with some white lines indicating boundaries or roads.</p>
Tract 180 (27 th August 2015)	
 <p>A photograph of a lush green field, likely a rice paddy, with several people standing in the distance. The background is filled with dense green trees and foliage.</p>	 <p>A satellite map of the Barkul area, showing a network of roads and a river. Yellow circles mark several locations. Labels include 'Barkul', 'Barmi Bazar', 'Durlovepur', and 'R314'.</p>
Tract 187 (27 th July 2015)	
 <p>A photograph of a tea plantation. A large, spreading tree with green leaves is the central focus. Several people are visible working in the tea bushes in the background.</p>	 <p>A satellite map of a village area with several yellow circles marking locations. Labels include 'Hajipur Sabarban Rd' and 'Sangpur Road'.</p>
Tract 188 (27 th July 2015)	

