

## 4. FARM BOUNDARY SURVEY AND STUDY BLOCK ESTABLISHMENT: A SET OF PRIOR ACTIVITIES FOR ACIAR/ASEM/053/2003 – TREE MEASUREMENT AND SOCIO-ECONOMIC SURVEY

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This paper discusses the method and process of conducting the perimeter survey of farms identified for the ACIAR Tree Farm project. There were two sets of information on existing tree farms used in identifying farms for the study – from the Department of Environment and Natural Resources (DENR) and Local Government Units (LGUs). Within a municipality, barangays with the greatest number of qualified tree farms were given priority for validation of farm area and number of trees. A courtesy appearance and discussion with LGU officers was always the first step to finding the tree farms. Being referred or accompanied by somebody, usually a barangay official, each qualified tree farmer was visited in their house. The decision to establish and number of tree blocks to consider in a farm was based on age of the plantation, area, species and species mixture, spacing, average size of trees, topography, slope, elevation, presence of vegetative cover particularly grasses and shrubs, soil characteristics, and evidence of silvicultural applications. Using a computer and the Mapsource program or Excel spreadsheet to create a sketch is quick and easy. However, the field team sometimes spent full weeks carrying out surveys, and tree farm sketches were needed for the socio-economic interviews and tree measurement in the same week. Sketches therefore were made manually either drawn to a scale or sometimes not. As soon as possible after the fieldwork, data from the GPS were downloaded to the Mapsource program on the computer. For every original set of data a revised version was created getting rid of the track logs<sup>1</sup> and leaving only the waypoints and routes to emphasize the farm and block boundaries. For future use, the original GPS data were retained.

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### INTRODUCTION

The ACIAR ASEM ASEM/2003/052, *Improving Financial Returns to Smallholder Tree Farmers in the Philippines*, has three major objectives. Two of these are to (1) assist DENR to overcome institutional constraints to tree registration and log transport currently restricting access to markets, and (2) assist smallholder tree growers to satisfy market requirements and improve productivity. The first objective was partly addressed through a socio-economic survey of smallholders, the second through the assessment of existing private trees farms. In order to conduct these activities, guide information was necessary. Boundary surveys of tree farms were conducted to provide information about the tree farm and other farming systems. The order of the socio-economic interviews was based on farms already surveyed. Sketches of the whole farm and study blocks were necessary during the interview of tree farmers to facilitate referral of blocks being considered. Location of plots in a block led the timber inventory team to the trees selected as samples for tree measurement.

This paper describes the methodology for conducting a perimeter survey of tree farms. The following sections highlight the method of tree farm identification and the process of GPS survey and data manipulation as well as creating the database of GPS information. Lastly, a discussion and recommendation are briefly presented.

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<sup>1</sup> The track log is a 'bread crumb' trail that is left behind as one's position changes on the map page of the GPS.

## IDENTIFYING AND FINDING THE FARMS

Two sets of information on existing tree farms were available for use in identifying farms for the study – from the DENR and LGUs. List of registered tree farms was secured from Community Environment and Natural Resources Offices (CENROs). Another list was gathered through Focus Group Discussions FGDs which were conducted in selected municipalities and attended by LGU officials, from both municipal and barangay levels. Lists were reorganized according to barangays and municipalities, taking those which met the selection criteria. The important criteria on the inclusion of farms for the study were that the farm had at least a block of trees with an area of at least 0.10 ha, and the number of trees within that particular block area was at least 100 (Monterola *et al.* 2007). Additionally, the tree blocks had to be able to accommodate sample circular plots with radius of 5 or 10 m without having the plots overlapped, thus for example 100 trees or more in two or three lines within a 0.10 ha would not qualify. Within a municipality, barangays with the most number of qualified tree farms were given priority for validation.

To facilitate the purpose of locating the farms, a heavy duty project motorbike was used to travel to places indicated in the list of qualified tree farms. A courtesy appearance and discussion with the LGU officers was always the first step to finding the sites. All qualified tree farmers were visited in their house after being referred or accompanied by somebody, usually a barangay official. Upon arrival, a short introduction was made and a letter from the country project leader written in vernacular was handed over to support the validity and formality of the request and purpose of the intended activities. Depending on the farmer's understanding or feeling towards the activities stated in the letter, the surveyor sometimes needed to express in more detail the impacts of having the farm sampled in the study including the farmer being automatically chosen as a respondent to a socio-economic interview. An intriguing inquiry by a farmer was whether or not he had an obligation to the project or could benefit from whatever information the project could get. A challenge to this end was to make the farmer not to think of any negative impacts of the study on him and his farm.

Usually after the discussion and once a farmer was truly convinced of the scientific intensions of the study, depending on the accessibility and distance to their farm, a reconnaissance survey of the farm was carried out, particularly to obtain an idea of the locations of his trees and the general orientation of their other farming systems. While on the farm a short explanation was provided of intended activities, always emphasizing the project activities would not harm or deprive the farmer's right to their farm and instead would be of assistance in the long run. As soon as everything was clear, a revisit of the farm for a boundary survey and establishment of study blocks was scheduled. There were instances, however, when an immediate survey of a farm could be undertaken, when there was enough time, permission was obtained immediately from the owner and if a guide person was available.

Depending on the size of the farm, the guide person was paid in a 'per farm' basis at PhP50 per farm, though this was increased to PhP100 or PhP150 when the survey of the farm took more than a half-day. The guide person had a dual function in that in a shrubby or grassy area they cleared a portion as a path for walking around the farm or block. Time spent for each survey was dependent on the size of the farm and site and weather conditions.

## THE PERIMETER SURVEY: MATERIAL, EQUIPMENT AND METHOD

Simple comparative perimeter survey exercises were conducted in a yemane (*Gmelina arborea*) plantation in May 2005. Two methods were tested to draw a comparison of the cost-effectiveness and efficiency of the activity. One method was through the use of Laser Ace<sup>®</sup> Hypsometer<sup>2</sup> and compass, and the other through GPS receiver unit (Garmin 76 2001). After the exercise, it was found that, in terms of time allotment and development of survey databases, the GPS survey was more efficient than a hypsometer and compass survey although there were slight difference in the calculated area of the farm. A GPS survey took less than half the time of a hypsometer and compass survey and downloading GPS data to a computer requires much less time than encoding the manual survey data. Therefore, for the general perimeter surveys of tree farms, GPS was used.

The equipment and material used in the survey were a GPS receiver unit, extra pairs of rechargeable AA batteries, data sheets, and a pencil and eraser.

For each farm, data sheets as presented in Appendix A were completed. Before the survey, code was written as a heading in each sheet (as described by Monterola *et al.* 2007) and the profile of the farmer was included on the farm sheet.

Prior to starting the survey of the farm, a short briefing was provided for the guide person on how the survey should be conducted. Only corners of the farm and tree blocks had to be GPS referenced so walking around the whole boundary was not necessary. Additionally, coordinates of important features within the farm (e.g. farm house, crop area) were recorded.

The establishment of tree blocks on a farm was based on the age of the plantation, plantation area, species and species mixture, spacing, average size of trees, topography, slope, elevation, presence of vegetative cover particularly grasses and shrubs, soil characteristics, and evidence of silvicultural operations.

The Laser Ace<sup>®</sup> Hypsometer<sup>2</sup> is a hand-held laser range finder that provides personal surveying capability – to measure distances, heights, slopes, diameters and volumes particularly of trees. It incorporates a pulse laser distance meter and an inclinometer.

### **Preparing the GPS for the Survey**

The initialization of the GPS 76 receiver unit was only needed the first time the unit was used, and during the actual surveys readying the unit for navigation could be done quickly unless there were obstructions of the signal (i.e. cloudy sky or heavy canopy cover). When on the farm, the unit was turned ON while at area site with a clear view (best if 360°) of the sky. Turning ON the unit at the farm corner where there was canopy cover would take the unit too long to acquire satellites. Under normal conditions the least accuracy level in taking GPS data was 10 m and 15 m for the worst conditions. The best accuracy level was 7 m, and measurements with accuracy beyond 15 m were never used. Bigger accuracy number is an indication of possible overlapping of boundaries and that future navigation of the sample plots may become difficult.

### **Creating Waypoints in the GPS and Writing the Information on the Data Sheets**

For an easy way of finding the saved waypoints in the GPS or in the computer through the Mapsource<sup>®</sup> program, assigning a code for every important location was necessary. Garmin 76 can accommodate at most 10 characters (capital letters, numbers or signs) in naming a waypoint. There was a slight difference in naming waypoints in the GPS from coding on the data sheets. Assigning codes in the GPS should not take long but must be understandable. For farm boundary corners, each code comprised the letter **F** followed by the farm number, which was expressed in three digits, then the letter **N** (Node to mean corner or vertex) and node number, which was expressed in two digits. For example the first corner of the first farm was coded as **F001N01**. A similar approach was used for coding corners of blocks, except that after the farm number followed the letter **B** then the block number, also expressed in two digits, before the node number. Therefore first corner of the first block of the first farm was coded as **F001B01N01**. Other important features of the whole farm and tree blocks were named in other ways but retaining the farm number.

GPS data – particularly coordinates and elevation of important locations – were written to the data sheet after marking each waypoint. As required on the sheet, additional information was supplied whenever applicable.

### **Creating a Route to Delineate a Farm or Block**

To directly make a polygon that represents a farm or block, lines should be drawn connecting one waypoint to another. Lines could not be created in the GPS but making a route would serve the purpose. Creating a route could be started while still doing the survey or immediately after the survey and a sketch could be directly seen on the GPS screen.

A route is a series of waypoints used for point-to-point navigation. At least two waypoints comprise a route, a start and finish. Garmin 76 can contain as many as 50 waypoints for every route and can store up to 50 routes. A route has to be created, and for the purpose of seeing the general form of a farm or block the first corner waypoint should also be the last waypoint. Thus the finish waypoint is a copy of the start waypoint. Routes were coded in almost the identical way to coding a farm or block corner waypoint, except that the node number was excluded.

Immediate delineation of the farm or block while in the field was necessary in order to make sure that the blocks were inside the farm, and sample plots inside the block, and the centroid plot was located more or less at the centre of the block. Data manipulation using a calculator or preferably a computer would give an accurate idea of the block centre. However, calculating would take time, and taking a laptop computer to the field was not practical. Additionally, even if the

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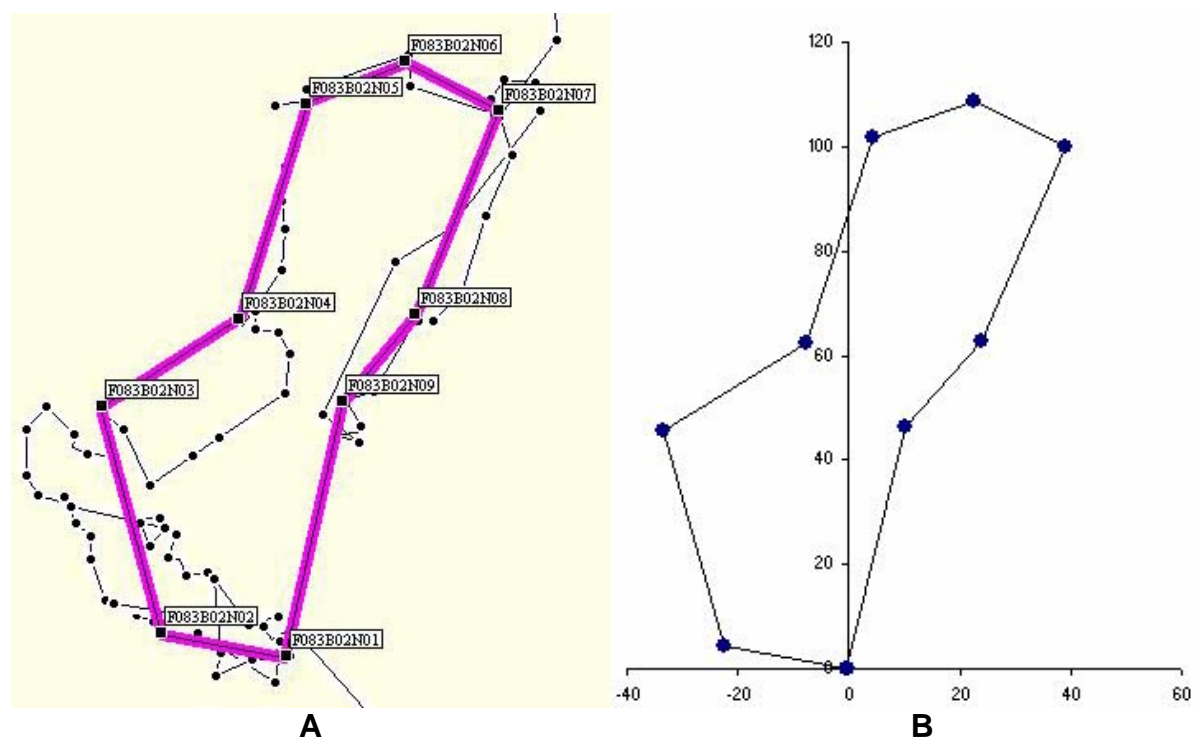
very centre was predetermined, it might not be considered due to the small number of trees that would qualify for tree measurement. The route gave a rough idea as to where the centroid should be located. In the GPS, only one route could be highlighted at a time.

Inevitably when viewing the routes on the GPS screen, there were a few cases when a small part of a block was outside the farm and the edge plot was outside the block. There were many factors that might have caused the inaccuracies. The intensity of the satellite signal had a strong effect to the overlapping of routes or leaving out plots from tree blocks. Wrong referral of the guide person to the farm corners during the farm survey, especially when the farm was large and the block was close to the boundary of the farm, might also have caused the overlapping of the farm and block boundaries. To resolve the inaccuracies, some waypoints were moved in accordance with their accuracy level, leaving the more accurate waypoints unadjusted. However, if the difference was more than 10 m from the line boundary of the farm or block then another GPS reading of the overlapping corners was taken.

**Making a Sketch of the Farm and Block**

Generally there are two ways to make a sketch from the GPS data collected, through computer and by manually plotting the coordinates. The first way of making a sketch could be through an Excel spreadsheet or with the Mapsource® program. The latter could be carefully done with a ruler and protractor to fairly plot the points according to a scale, or just directly plotting them without a scale but following the figure as displayed on a GPS.

Using the Mapsource® program to create a sketch is fast and easy because if the points are already put into series forming a route while on the GPS, when data are downloaded to the program the sketch can be readily seen or printed. However, the lines connecting waypoints are thick and could not be customized. Thus it is not well suited for viewing overall farm areas with multiple blocks because of the lack of detail. On the other hand, formatting the points to sketches on a chart in an Excel spreadsheet takes slightly more time than through the Mapsource® but lines and points can be customized. Figure 1 presents identical polygons formed through Mapsource® and an Excel spreadsheet. The left figure is derived from the raw data showing the route, waypoints and track log through the Mapsource®; at the left, using the same waypoints, the same polygon is formed when plotting the coordinates in excel spreadsheet. The farm or block area can be determined by either method.



**Figure 1.** The polygon formed after connecting waypoints - (A) on a Mapsource®, (B) on an Excel spreadsheet

Plotting with a computer produces a better map. However, surveys were done in periods of at least a week straight and the sketches were needed immediately for the socio-economic interviews and tree measurement, during the same week. Sketches therefore were made manually either drawn to a scale or not. For the purpose of socio-economic interviews, adding other important features on maps and particularly crop area was necessary.

### Creating the GPS Database

Every day after the fieldwork GPS data were downloaded to the Mapsource<sup>®</sup> program on the computer. Each download contained the map, tracks, routes and waypoints. When moving, GPS automatically creates a track log which, depending on the satellite signal, would create messy lines of points especially when slowing down the movement or stopping. Therefore, for every original set of data a revised version was created after removing the track logs and leaving only the waypoints and routes to emphasize the farm and block boundaries. Original GPS data were retained for future use particularly on seeing the track log profile to gain insights on the slope and elevation of each point on the track.

## DISCUSSION AND RECOMMENDATIONS

Carrying out perimeter surveys of farms using a GPS is a quick and resource-saving way of taking survey data and making sketches. Simple manual methods of surveying may well take little resources but appreciation of the polygon can only be realized after the coordinates are plotted on an Excel spreadsheet on the computer or drawn on paper. Having acquired the ability to use the GPS to its full capacities is very reassuring to the surveyor since the data once stored in the GPS will not be lost unless the memory is full and the previous data were replaced by the new data or the unit becomes badly damaged.

The use of a computer may not be new to most experts but using a program that facilitates the process of making analyses of survey data may be a privilege to just a few. Mapsource<sup>®</sup> serves as storage of GPS data and it also allows data updating and editing. The program has many functions that are useful in manipulating the data. GPS data can be transformed into other file types for higher use, particularly in creating a GIS database. Data can be overlaid to existing basemaps to indicate where tree farms exist and may be used to describe locations that produce higher timber yields. The Mapsource<sup>®</sup> program may be new to some users but using Excel in plotting survey data will serve the same purpose.

Perhaps it would be worthwhile to suggest to the DENR and LGUs to consider printed farm sketches from computers through GPS and GIS programs or through Excel as legal documents for some transactions. There may be also a need to train some DENR and LGU personnel on survey data manipulation at least through Excel spreadsheets; Mapsource<sup>®</sup> may be new and unavailable to these offices. To this end, developing guide modules in creating maps through Excel spreadsheets may be useful for training and dissemination to tree farm stakeholders.

## REFERENCES

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**Appendix A. Farm sheet of ACIAR/ASEM/2003/052 Project**

<b>1. Farm Sheet</b> - sketch plan of farm and blocks <b>FARM REF. NUMBER:</b> _____ <b>F</b> _____										<b>(NORTH)</b>
Node	East	West	Elev.	Remarks	Node	East	West	Elev.	Remarks	
1					11					
2					12					
3					13					
4					14					
5					15					
6					16					
7					17					
8					18					
9					19					
10					20					

Date : _____ Owner : _____ Home Address : _____ Tel/Mobile : _____ Phone No. : _____ Farm Address : _____	Zone: _____ GPS coordinates: E _____ W _____ Altitude (m): _____ Area (ha): _____ Perimeter (m): _____ No. of blocks: _____  Measurer/s: _____
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**Remarks:**

Appendix B. Block sheet of ACIAR/ASEM/2003/052 Project

<b>Block sheet</b> - sketch plan of block showing plot location: <b>BLOCK REF. NUMBER:</b> _____ F _____ -B _____										<b>(NORTH)</b>	
Node	East	West	Elevation	Remarks							
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
Plot	Zone	East	West	Elev.	Accl.	Plot	Zone	East	West	Elev.	Accl.
1						2					
Date: ..... <b>Main Species</b> ..... <b>Year planted</b> ..... <b>Spacing</b> ..... Slope ..... <b>Aspect</b> ..... <b>Land Cover (Number)</b> ..... <b>Cover type (short name)</b> ..... <b>Rock type</b> (encircle): Limestone/Basalt/Granite/Metamorphic/Sandstone/Other ..... <b>Situation</b> (encircle): In-situ/Colluvium/Alluvium/Aeolian/ Other ..... <b>Area code:</b> _____ <b>Area of Block (ha)</b> – actual if less than area of farm: _____, <b>Perimeter (m):</b> _____ <b>Block Area (ha)</b> – code for sec forest/open/single block farms: 0.5-1(1): 1-2 (2): 2-5 (3): 5-10 (4): 10-20 (5): 20-50 (6): 50-100 (7): 100-1000 (8): 1000 – 10 000 (9): > 10 000 (10). <b>Remarks (How uniform? Any unusual things? Etc.)</b> <b>Other species present:</b>											
Species code	Common name	Remarks									

*BlockSheet Revised December 27, 2005*