Chapter 6
Resource mapping of mangroves

INTRODUCTION

This chapter provides COs, NGOs and other interested groups or individuals with information to assist POs in developing maps that can be used in ap-plying for Community-Based Forest Management Agreements (CBFMAs) and in managing CBFMA activities.

The process used is based on the mapping methods in the Coastal Resource Management Project's Participatory Coastal Resource Assessment (PCRA). The PCRA method broadly maps a variety of resource uses and issues that are important on the *barangay* and municipality levels. This book focuses that method on developing maps useful for managing CBFMAs. Most of the text was adapted from Walters et al. (1998).

Maps are among the most important tools used in planning and implementing CBFMA projects. Without maps, it would be difficult to understand the many variables involved in planning. With maps, the extent and condition of resources can be represented and analyzed, areas for various uses can be plotted out, infrastructure and other interventions can be spatially enhanced and the localities can be identified for possible problems, issues and conflicts.

This chapter explains how to develop maps by working with POs to transfer their knowledge onto a map by identifying the issues that are important and need to be depicted on the map, and by gathering the necessary technical information for a useful map. The next section explores why we need maps. The final section discusses what types of maps can be produced and how to produce them.

WHY DO WE NEED MAPS?

Maps are important visual information for the POs, allowing more effective communication between the stakeholders involved in developing and managing the CBFMA. Maps can help when verbal communication is constrained by differences in background, education and world view. Indeed, mapping is one of the most appreciated and successful strategies for eliciting information from local resource users. The members of the PO, therefore, must understand maps and their spatial value to best manage their CBFMA resources.

Maps are useful in the CBFMA process at a number of points. First, a map is needed to complete the Community Resource Management Framework and Annual Work Plan. Second, maps provide the PO with a tremendous capability to manage the resources under their control. For example, this chapter gives the PO a basis for planning resource use including lumber, fishing, fodder production and other activities, a baseline against which to judge progress and make changes as needed.

WHAT TYPES OF MAPS CAN WE PREPARE AND HOW DO WE PREPARE THEM?

Maps developed through the PCRA process can be divided into three basic types: sketch maps, base maps and field maps. Each has its own use. Typically, as a first step, a CO may ask a group of mappers to quickly draw a sketch map to help get an idea of the resources in a given area. Drawing over a base map that has been prepared will provide greater detail of familiar landmarks in the area and allow the group to develop a map that is already to scale. Field mapping is done to check the quality of the base map and to make certain that all the important information is captured. The box provides more discussion on each of these mapping activities.

Sketch maps ***are freehand drawings that can reveal much about the coastal areas in the maps and the people who draw them. They can be particularly useful in the early stages of developing the CBFMA map. Since sketch maps start as a blank piece of paper they provide the least biased view of how mappers perceive their surroundings, a glimpse of the mappers' "mental maps" of the coastal environment. Typically, these maps are only done when no base map is available.***

Base maps ***are maps that show features such as coastlines, rivers, roads and villages. They orient the cartographer to the area and provide a consistent scale to draw in additional features such as mangroves, seagrass beds, fishponds, wood cutting areas, nipa plantations and channels. Base maps are often produced by government geological or navigation agencies or may be*** **barangay** ***cadastral maps. If the precision and the scale are adequate, these maps serve as the best vehicle for accurately representing the CBFMA area.***

Field map ***verification is also known as groundtruthing. This method is used by individuals or small groups after at least some drawing over base maps has been accomplished. The basic idea of field mapping is to move around in the management area, either on foot or in vehicles, to verify and further refine maps from earlier exercises.***

The standardized mapping format shown in Table 6.1 can be used in all three map types. The approach divides the elements to be mapped (on one map) into several basic categories:

- Tree zones
- Average density and height of trees per hectare in the zone
- Resource uses
- Problems, issues and conflicts
- Other features

Tree zones are shown as shaded areas. *Resource uses* and *Problems, issues and conflicts* are depicted on maps where they are known to occur as numbers, letters and letter-number combinations. In preparing the map for presentation and distribution, letters and numerals can be replaced by symbols if that will make the map clearer. Table 6.2 shows tables of codes that should be used when identifying resource uses or issues. The last category, other features, can be depicted as shapes or lines depending on the nature of the feature to be

Table 6.1. Map format for Community-Based Forest Management Agreement map development.

Map element	Type of information	Presentation format
Tree zones	Identify the top three species of trees in major zones within the area.	Various colors to represent the major tree zones.
Average density and height of trees in the zone	Determine the average density and height of each species per hectare in each of the zones.	Two numbers within each zone representing the approximate number of trees and their average height for each of the three top species on a per hectare basis.
Resource uses	Determine the area's resource uses. Examples include fishpond, saltpond, nipa cutting, firewood cutting, woodcutting of other types, shell gathering, fry gathering, amatong and fishing.	Two-letter codes representing the identified resource uses in specific areas in the forest.
Problems, issues and conflicts	Determine issues of concern in the area. Examples include abandoned fishponds, illegal fishponds and illegal development of housing or other areas.	Two-letter codes representing the identified issues. A number from one to five can be added to indicate the severity of the issue.
Other features	Determine the location of channels, abandoned and operating fishponds, neap high and low tides, freshwater sources, etc.	Other features are typically drawn on the map using defined line styles.

Table 6.2. Map codes and colors.

Table 6.2a. Color codes used in Participatory Coastal Resource Assessment maps of Coastal Resource Management Project learning areas.

Habitats - color codes (12)

Mangrove	-	dark green
Seagrass	-	light green
Beach	-	yellow
Rocky shoreline	-	brown
Mudflats	-	black
Inshore flats	-	orange
Coral reef	-	red
Estuary	-	blue
Marine waters	-	light blue
Passes/channels/deep ocean	-	dark blue
Offshore sandbar	-	yellow green
Terrestrial area	-	light yellow

Table 6.2b. Suggested codes for traditional fishing methods, illegal activities, other traditional and subsistence fishing methods (T1-T100).

T1	Bagnets	T17	Fish corrals	T30	Purse seines
T2	Barricades	T18	Fish pots and crab pots	T31	Push nets
T3	Beach seines	T19	Fish shelters	T32	Rakes and dredges
T4	Blanket nets	T20	Hand instruments with curved blades, forks, hooks, etc.	T33	Reef seines
T5	Bottom set gill nets			T34	Ring nets
T6	Cast nets			T35	Round haul seines
T7	Cover nets	T21	Harpoons	T36	Scoop seines
T8	Cover pots	T22	Hook & lines/ handlines/droplines	T37	Scoops
T9	Crab lift nets			T38	Set longlines
T10	Dip nets	T23	Hoop nets	T39	Skimming nets
T11	Dredge nets	T24	Jiggers	T40	Snares
T12	Drift gill nets	T25	Lever nets	T41	Spears
T13	Drift longlines	T26	Lights	T42	Stop seines
T14	Drive-in nets	T27	Multiple hook and line	T43	Trammel nets
T15	Encircling gill nets	T28	Pole and lines	T44	Trap nets
T16	Filter nets	T29	Pull nets	T45	Troll lines

Table 6.2c. Illegal fishing/uses (IF1-IF50).

F1	Drive-in net with bamboo/tree trunk scare devices (*kayakas*)	IF12	Harvest of manta rays
		IF13	Harvest of marine turtles and eggs
IF2	Drive-in net with weighted scarelines (*muro-ami*)	IF14	Harvest of milkfish (60 cm and over)
		IF15	Harvest of triton shells (*tambuli*)
IF3	Electrofishing	IF16	Harvest of whale sharks
IF4	Explosives	IF17	Not honoring closed seasons
IF5	Fine mesh nets (less than 3 cm) for unexempted species	IF18	Other gears (banned by local legislation, like baby trawls, modified Danish seines, beach seines, compressors, etc.)
IF6	Fishing in closed areas (e.g., fish sanctuaries, limitation on baby trawls, etc.)		
IF7	Fishing without license	IF19	*Pantukos* (tuckseine) with torch and/or flammable substance
IF8	Harvest of dolphins		
IF9	Harvest of giant clams (*taklobo*)	IF20	Poisons/obnoxious substances
IF10	Harvest of helmet shells (*budyong*)	IF21	Superlights within municipal waters
IF11	Harvest of *kapis* (*Placuna placenta*) <80 mm using mechanical rakes, dredges and motorized boats	IF22	Unauthorized commercial fishing within municipal waters

Table 6.2d. Legal but controversial fishing methods (perceived as destructive/depletive) (C1-C10).

C1	Beach seines	C4	Modified Danish seines
C2	Compressors	C5	Other drag nets
C3	Drive-in nets with various scaring devices	C6	Trawls

Table 6.2e. Other uses and activities (A1-A50).

A1	Airports	A15	Lighthouses/beacons	A30	Public parks/plazas
A2	Anchorage	A16	Limestone quarries	A31	Research stations
A3	Banana plantations	A17	Mangrove plantations	A32	Resorts
A4	Breakwaters	A18	Mangrove timber cutting	A33	Rice paddies
A5	Coconut farms	A19	Military station/bases	A34	Roads, bridges
A6	Drainage canals	A20	Mineral extraction	A35	Salt beds
A7	Education reservations	A21	Navigation channels	A36	Sand and gravel extraction
A8	Fish cages	A22	*Nipa* harvesting	A37	Seawalls
A9	Fish landings	A23	*Nipa* plantations	A38	Seaweed culture
A10	Fish pens	A24	Oil refinery/depots	A39	Shellfish culture
A11	Fishponds/Shrimp ponds	A25	Orchards	A40	Waste dumps/outfalls/ efflluent discharges
A12	Historical sites	A26	Port/pier/wharf/marina	A41	Watchtowers/observation platforms
A13	Human settlements/ built-up areas	A27	Power stations		
A14	Industrial estates	A28	Protected areas (formal and informal)		
		A29	Public laundry areas		

Table 6.2f. Common coastal resource management issues and suggested codes (IS1-IS100).

IS1	Abandoned/unproductive fishponds	IS30	Lack of legislation
IS2	Beach/shoreline erosion	IS31	Lack of organization
IS3	Breakage of corals	IS32	Lack of security of tenure of land and/ or home lot
IS4	Closed access to sea	IS33	Lack of social services
IS5	Coliform pollution	IS34	Landslide
IS6	Coral bleaching	IS35	Loss of rare/endangered species
IS7	Coral extraction	IS36	Low awareness
IS8	Crown-of-thorns epidemic	IS37	Low prices of fishery products
IS9	Declining fish catch	IS38	Mangrove conversion
IS10	Decreased estuary circulation	IS39	Mangrove overharvesting
IS11	Defoliation/loss of vegetation	IS40	*Nipa* overharvesting
IS12	Destructive fishing	IS41	Oil spills
IS13	Deterioration of aesthetic quality	IS42	Overfishing
IS14	Diversion of fresh water	IS43	Pesticide pollution
IS15	Dredging	IS44	Piracy
IS16	Encroachment on the fishing ground by outsiders	IS45	Reclamation
IS17	Eutrophication	IS46	Red tide
IS18	Fish diseases	IS47	Salt water intrusion
IS19	Fish kills	IS48	Shellfish contamination
IS20	Fishing gear conflict	IS49	Siltation
IS21	Flooding	IS50	Smuggling
IS22	Heavy metal pollution	IS51	Theft of fishing gears and accessories
IS23	High cost of fishing inputs	IS52	Upland erosion
IS24	Hunting	IS53	Use conflicts
IS25	Illegal fishing	IS54	Use right conflicts
IS26	Illegal fishponds	IS55	Waste dumping
IS27	Increased estuary salinity	IS56	Water turbidity
IS28	Lack of alternative livelihood activities	IS57	Weak organization
IS29	Lack of law enforcement	IS58	Wildlife trade

Source of all tables: Walters et al. (1998)

mapped.

COs can conduct mapping activities with an individual or a group. (The group size usually ranges from three to twenty people.) The basic procedures are the same with individuals as with groups, except that group activities have group dynamics that can work either for or against (or both for *and* against) the success of the activities. At this stage, the local ways of referring to resources, places and habitats should be known to COs. The classification system in Table 6.1 can be used in all mapping exercises to minimize confusion and maximize local input.

WORKING WITH THE PO—THE MAP DEVELOPMENT PROCESS

Developing the map with the PO takes at least several days. It is important to brief the PO on the length of time it will take so that the members will not get discouraged.

The process involves four phases:

- Introductory
- Map development
- Field verification or groundtruthing
- Map finalization

Introductory phase—The introductory phase need not start at the very beginning. If the PO is already interested in a CBFMA and has a basic understanding of what is involved, discuss the importance of the map to the CBFMA and the PO planning activities as a starting point. In cases where the concept of CBFMA is introduced, however, it will be necessary to begin earlier in the organization process.

Spend some time with the group to determine what the members think of maps. Start by asking what they know about maps. Take a copy of the *barangay* cadastral map, or if one is not available, a provincial map, land classification map or nautical chart of the area, and ask them to identify some of its features.

Remember to link the need for a map to concrete things so that the PO can see the usefulness of mapping. Emphasize that a map is required by the DENR as part of the CBFMA application and that the information gathered from the mapping exercise will help the PO manage the forest better.

Depending on how well they do, discuss how to use and read a map. For example, if they can quickly point out the major landmarks of their *barangay*, then they are ready to move on to a discussion of map making. But if the map confuses the PO members, work with them until they can recognize major features of their *barangay*, and talk about making their own map. Explain what the scale is and ask them to point out how far it is between familiar places. Once they comprehend how to use a map, emphasize the importance of a map to the CBFMA application.

First, explain that without a map of the area, their application for the CBFMA will never be approved. Second, discuss that developing a map will help to understand what they have in terms of resources, where they might establish new mangrove plantations and what issues they might face within the community.

Inform the group that when the map is completed, they will know what types of trees are located in what areas. This information is useful in developing livelihood options and in determining where to establish new plantations. Issues can include people from another *barangay* who use the area for shell gathering or woodcutting, fishers who set nets just outside the area, illegal woodcutters and abandoned or illegal fishponds.

This phase usually takes 1 to 2 hours depending on the sophistication of the group. After the PO accepts the need to do a map, move on to the map development phase.

Map development phase—This phase is where the initial map is developed. The type of map made, sketch or base, depends on whether you have a map of appropriate scale. Borrow such a map from the Municipal Planning and Development Office and make copies to work from (blueprints are probably best).

Learn the historical use patterns of the mangrove forest by asking the PO members how far back they can remember people working (e.g., cutting wood) in the forest. Have the group determine (1) what were the top three mangrove species harvested in the past; and (2) what was the average volume of wood removed per day (or week or month). Inquire if they have the same information for each subsequent ten years. Write their answers on a white board or flip chart so all the people can see the trend of the resource. (This is known as trend diagramming.) This information will be useful when deciding which species to plant in particular areas.

Remember, a sketch map is drawn freehand without any model to copy from; it typically contains exaggerations of various features and an inaccurate scale.

A base map is traced from another map and left blank. It shows the outline of the coast, rivers and other natural geographic features, and sometimes roads. Because it is traced directly from another map, it has no exaggerations or problems with scale.

While members of the PO are collaborating on the map, see if everyone is participating. Often one person in the group will take over and tell the others what to draw. Should this happen, ask other members of the group if they agree with what is being said; if disagreement surfaces, it is important to control it. Plan on spending up to one day developing this initial map.

It is best to do the actual drawing of the map in a stepwise fashion. For example, after the area's boundary is agreed on, move on to what tree zones are present and what species are found in each zone. Next, determine the tree density (the number of trees per unit area) and estimate the average height for each of the top three species. Then focus on resource uses, issues and other features.

Field verification or groundtruthing phase—Field mapping should take place as soon after the development phase as possible. A subgroup of those who developed the sketch or base map should go into the field to verify the data on the map. Check facts as they are presented on the map and obtain additional data that the mappers did not know about. The amount of time this takes depends on the size of the area, how many people can work on it, and how many samples need to be taken. Plan on a minimum of one full day. (It could take as long as 5 days.)

Map finalization phase—Following the field verification phase, the field team presents its findings to the entire mapping group. Incorporate any changes and additions from the groundtruthing phase.

There are several ways to develop a final map. If geographic information systems (GIS) are available, submit the map to the GIS group and to develop a draft final map for PO review and validation. This copy should be done on a sheet at least 12 x 12 inches. If the map is drafted by hand, try to find a local artist or draftsman to render the map (the municipality may have such a resource).

Developing a Sketch Map

When a base map is unavailable, a sketch map is an adequate substitute and relatively easy to make. All that is required is a large, blank piece of tabloid (28 x 43 centimeters) or larger size paper, marking pens or pencils (with erasers and sharpeners) and a comfortable place to draw. Many people tend to start drawing at a scale that is too large for the size of the paper provided and quickly run out of room. To avoid this, draw a box on the paper with a light-colored pencil, leaving wide margins on all sides. Instruct the mapper to keep the drawing inside the box and use the margins only when necessary.

People drawing maps often find it easiest to draw first those features of the coastal area that are most familiar to them, e.g., the way from their home to the market or to their fishing grounds. Distinct geographical features such as bays, river mouths and islands are also good starting points. When prompted to draw these features, the mappers will usually draw the coastline first, then add other features like mangroves, rivers, seagrass beds, roads and settlements. To avoid confusion, use the local ways of referring to resources, places and habitats. Coastlines are best drawn in black ink using other colors (e.g., red, green, brown) to represent other aspects of the map. Figure 6.1 is an example sketch map for a mangrove area.

Sketch maps are most useful in locations or cases where base maps and aerial photos are unavailable and where there is a lack of knowledge or understanding of the local perspective on habitats and resource uses. Sketch maps also offer an insight on those elements that are most important to the local communities participating in the sketch mapping exercise. Once the sketch map is complete, the PO can use it as a planning tool for managing its resources.

Developing a Map Using Base Maps

The best way to produce a base map is to use a GIS to draw a large-scale map that reflects the CBFMA area. See if such maps are available from the DENR or the Provincial Planning and Development Office (PPDO). Alternatively, you can use a *barangay* cadastral map or a map produced by the National Mapping and Resource Information Agency (NAMRIA) as a guide. Prepare the base map in advance of the mapping activity, ideally on tracing paper the same size as the base map. It is extremely important that you identify a minimum of two latitudes and longitudes from the map. If you use a GIS system to produce your map, this information is needed to accurately depict your map. The basic goal is to produce a spatial guide to the area, leaving out those features that can be easily filled in by the mappers. A base map with pre-drawn black lines representing coastlines, rivers and roads and general bathymetry (water depth) is generally sufficient to orient the mapper.

The size of the area to be mapped determines the most appropriate map scale. For mapping areas for CBFMA, the best maps to trace have scales that range from 1:2,000 to 1:10,000. If a GIS-produced map is not available, the best source for a CBFMA base map is the *barangay* cadastral map on file in the municipality. If one is not available, it may be necessary to use a navigation chart of the area. These charts are produced by NAMRIA. Every effort should be made to locate a chart with a scale lower than 1:20,000 since this allows a good level of detail for the maps, allowing the community to relate more easily to the map's depictions.

Most maps (including the cadastral maps), from which base maps can be traced, show more detail than those required by the CBFMA. Details such as locations

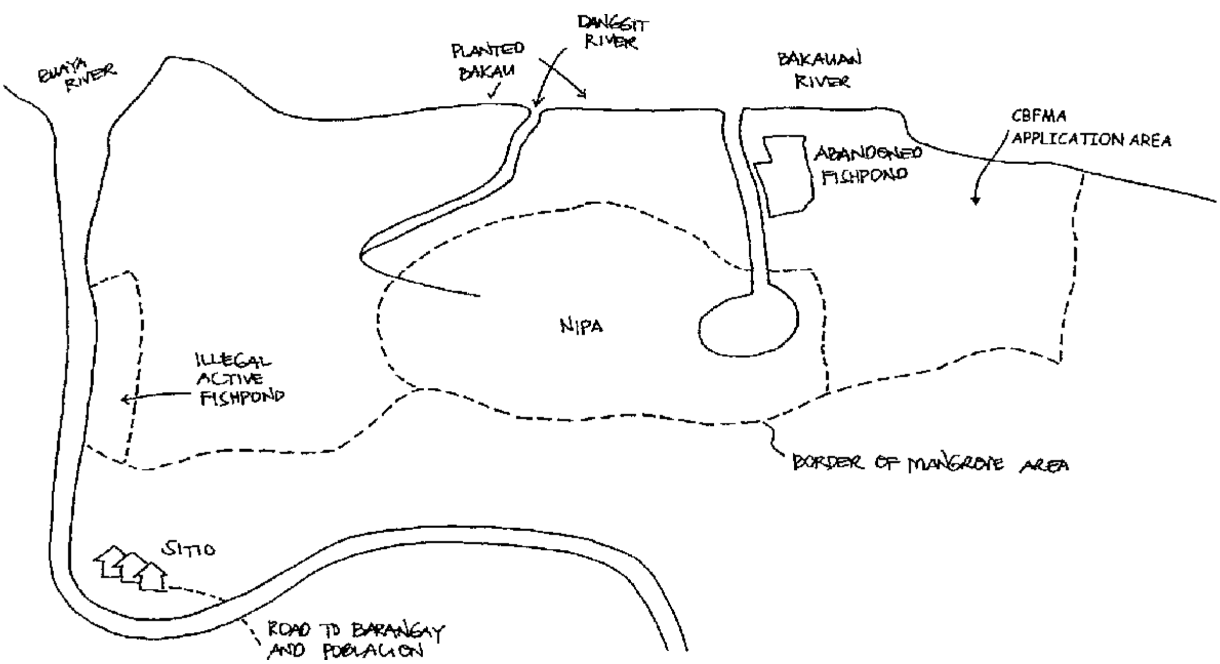

Figure 6.1. A sketch map.

Hint

It is wise to agree on a set color scheme and codes that all participants will use for all the features mapped. Recall the necessity of choosing features to be mapped that arise from previously determined classification systems for tree zones, resources and other factors (see Table 6.1). When drawing the maps, use colors to differentiate the zones. Using colors can help differentiate mangroves with significant remaining old growth from those having mostly secondary growth. Following the standardized mapping format previously discussed, numbers, letters and symbols can be used to indicate locations associated with various resources, uses and issues.

of mangroves and seagrass beds, for example, should not be traced onto the base map, since that will defeat the purpose of the mapping activity. The goal is to record what local mappers know about the area, not what is reported by professional mapping agencies. The maps drawn by the mappers can be compared later with those done by professional cartographers. After completing the base map, make several photocopies (or blueprints) that can be drawn over by participating fishers.

Next, introduce the mapping process to the PO members developing the map (Figure 6.2). Orient the participants before the mapping begins, explaining that they are now going to improve on their sketch map. The map you are showing them was traced from another map of the *barangay* (or from whatever source you used). Point out some of the landmarks you copied on the map, then ask the group to identify some. Most mappers quickly understand the exercise, but mapping the coastline, especially mangroves, can be confusing.

After discussing the map, tape it to a table and cover it with mylar tracing paper in preparation for mapping the elements in Table 6.1. Begin with mapping the boundary of the total extent of the mangroves in the CBFMA application area. There may be several different opinions about parts of the country. It is important for two reasons. One, every person's opinion must be shown to have value to ensure the exercise is not perceived as under the control of a small elite. Two, an agreement begins to shape the ethic of people working together

A Word About the Mapping Process

Mapping is best handled as a group exercise. Peer consultation leads to better understanding of the terminology and more accurate location of map elements.

To begin, place the base map on a table. Take away all chairs to provide as much open space as possible. This allows the mappers to move freely around the map as they perform the mapping exercise. Before mapping each category, review the list of all elements within the category. For example, for habitats, list all types of habitats and assign a color code to each type. Be sure that no two types have the same color code and that colors are distinct to avoid confusion later. When the list is completed, map the elements one at a time, preferably in the order they appear in the list. In cases where few resource users are involved, mapping by smaller groups (one-on-one, for example) may be appropriate.

toward a common goal. It will prove very important to the effective development and completion of the map.

Once agreement on the boundary has been reached, it is necessary to determine how many tree zones are in the area.

- Explain to the group that we need to know what types of trees are located in what areas.
- Tell them this is likely to be the most difficult part of the mapping process.
- Ask them to think about the areas within the forest where they know specific types of trees are found. For example, ask if anyone knows where there is a lot of *tangal, malatangal* and *busain*.

Table 6.3 gives some examples of what the group might produce in terms of zones of trees; Figure 6.3 shows how it might be depicted on a map.

At this stage, it will probably be impossible to determine the exact boundaries of these zones. Explain that the last step of the process, groundtruthing, will help to finalize the boundaries. Ask the mappers to

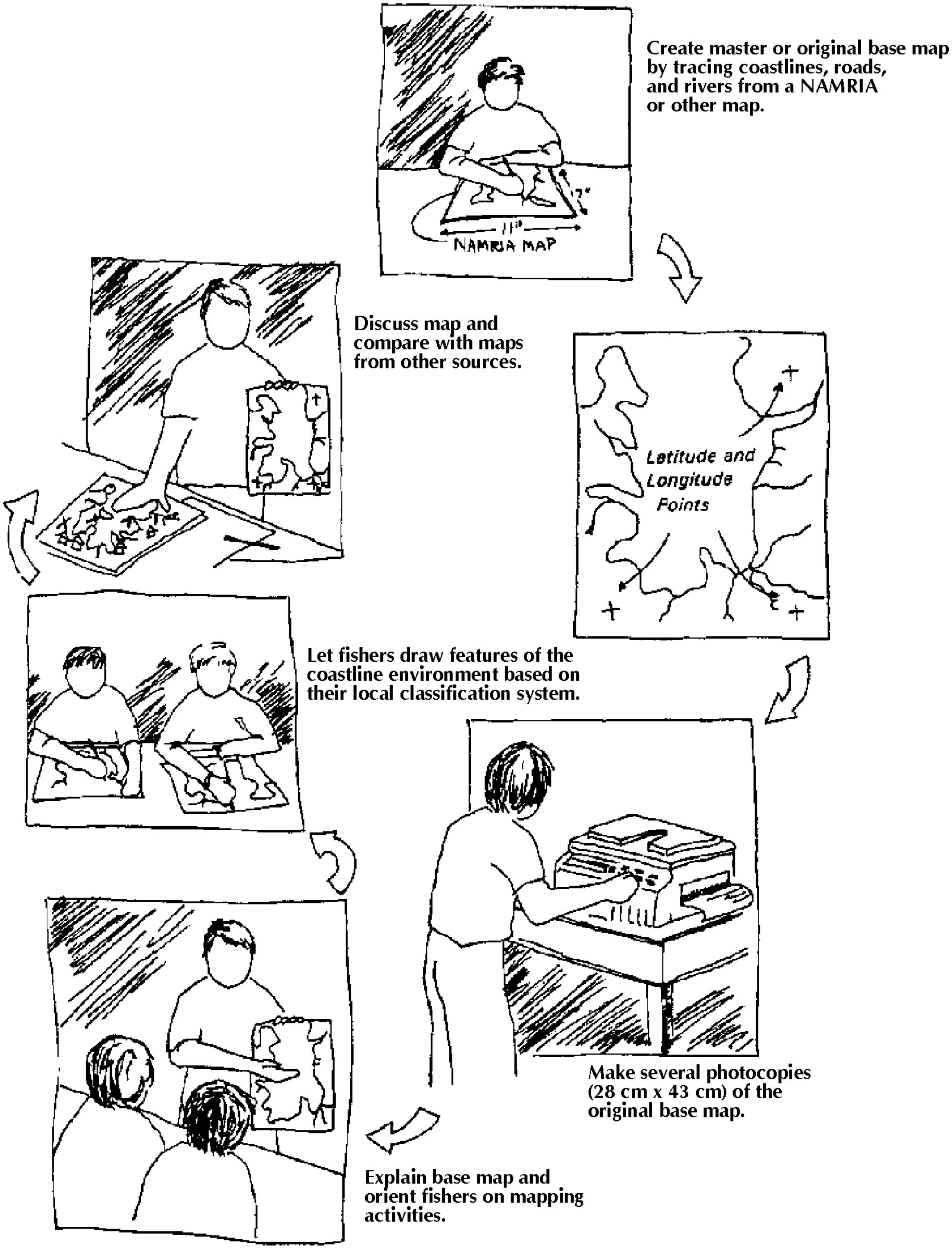

Figure 6.2. Base map procedures.

Table 6.3. Examples of tree zones.

Zone	Description
Api-api, piapi, pagatpat	In all cases, the first species represents the species that is most often found in the area.
Bakauan lalaki, bakauan babae, piapi	
Tangal, malatangal, busain	There may be several more than the species listed but they make up more than 75% of the total.
Tabigi, busain	
Nipa, api-api, pagatpat	The last category should be seldom used.
Mixed	

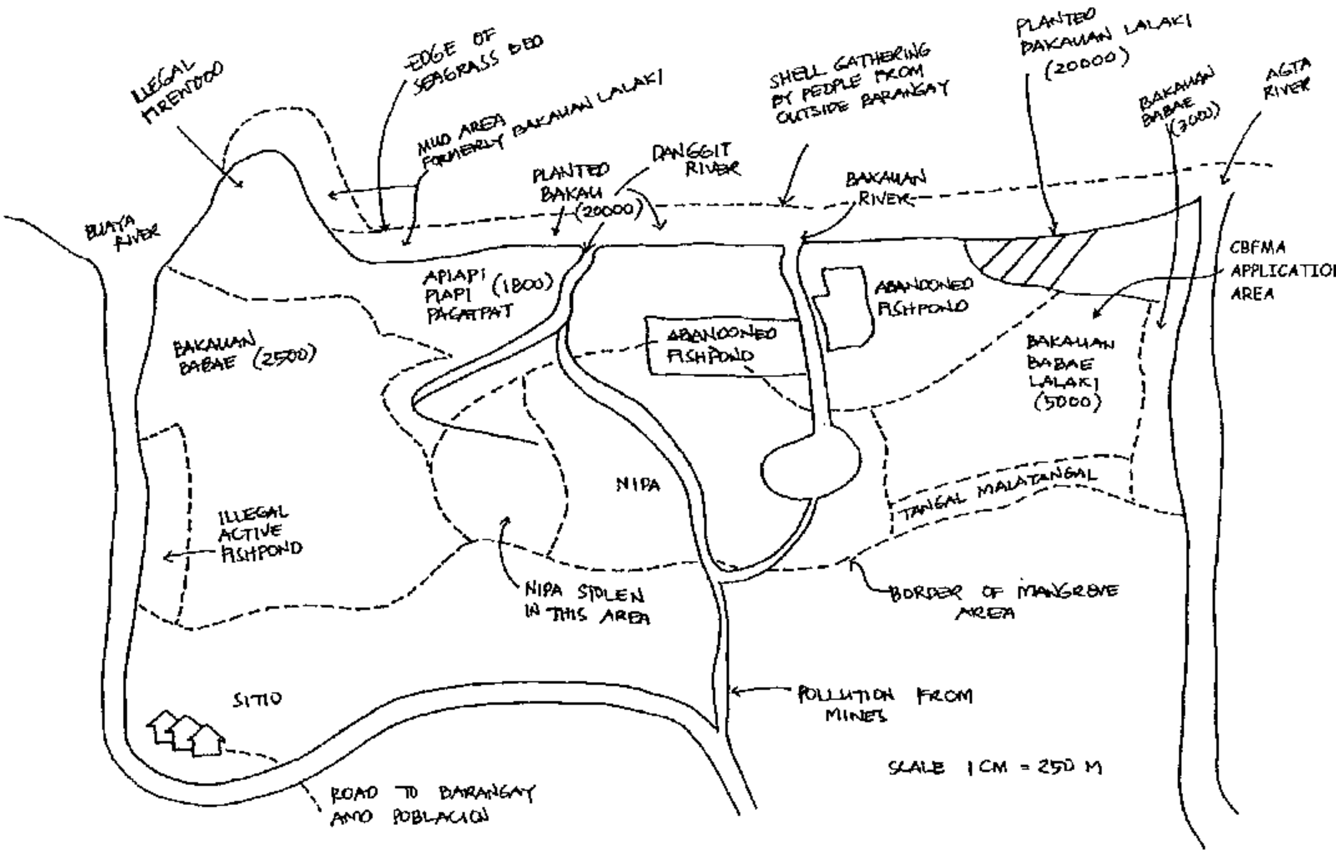

Figure 6.3. Land use map.

estimate the total number of trees per 100 square meters (show them what an area of 10 x 10 meters looks like).

Next, ask them to estimate the average height of each species.

Tree zone information should also be transferred to the map. For each species, create a small box with the name of the tree, estimated number and average height;

Bakauan	*bato* 40	7	meters
Bakauan	*lalaki* 25	4.5	meters
Piapi	5	6	meters

draw the box within the zone or next to it with an arrow pointing to the zone. It should look like the following box:

The first column is the name of the tree; the second, the number in the area; and the third, the estimated average height.

The group should now have a map that looks similar to Figure 6.3. While this is a good start, it is not complete. Ask the group to identify all of the current uses, resources and issues within the forest. Uses include not only the cutting of trees or harvesting of *nipa* but also such CBFMA area activities as fry gathering, shell gathering, fishing, fishponds (legal, illegal and abandoned), etc.

Part of the mapping exercise is to make certain that the PO has identified all the legitimate resource users. This includes part-time users from within the* barangay *and outside it. All have a right to a livelihood.

Be sure to ask the participants if the people practicing these livelihoods are members of the PO. If they are not, it is extremely important that the PO attempts to include them. Even people who are outside of the current organization have a right to continue their livelihoods.

Problems, issues and conflicts are mapped next because they logically follow the mapping of resources and uses, and because they are the most abstract of the mapping elements. The capital letters "IS" followed by a number may be used to represent the issues as shown in Table 6.2f. The reason that the codes are not sequential is that the table is based on one from the *PCRA Handbook* and unnecessary issues (such as dynamite fishing) have been removed.

The "other features" may be entered as people determine what they are. Once again, the majority of the group must agree on these features and their location. Other features can be extremely important to the overall success of the CBFMA. For example, it is important to be able to locate any channels (large or small) in the forest since they may allow for several forms of mariculture. Also, the location of the average and highest high tides and low tides is crucial to planning additional planting activities. Other types of features may be more or less important depending on the area in question. Sometimes it will be necessary to locate other features in the field. The section on *Field Mapping/Groundtruthing* gives details on how this is done. Figure 6.3 also shows a finished map showing all of the information discussed above.

Once the mappers incorporate all features on the base maps, show participants the details from existing printed information sources (such as the NAMRIA maps) and compare them to the maps just drawn. Comparing the maps developed by the PO to the NAMRIA maps is usually a positive experience as the group sees the strong similarity between their maps and the maps produced by experts.

While these similarities are often striking, much can be gained from examining the differences between the local and expert maps. As with PCRA results, look for new or different information on spatial details (e.g., small fishponds), details on features that vary over space (e.g., old growth vs. previously logged mangrove), and features that vary over time (e.g., locations of seasonal fishing activities in the mangrove forest).

After group members examine expert maps in comparison to their own, they often wish to amend their maps based on those features more accurately depicted on the expert maps. This should be encouraged provided the original maps are retained for reference. What usually results from the verification and correction process is a composite map of expert and local perceptions, often more accurate and useful than either map considered separately. Expert maps can provide exact scales, overall distributions and consistent locations. Locally drawn maps can add critical details and locally significant and relevant features that make them useful for CBFMA planning purposes.

Developing a Field Map—Groundtruthing the Base or Sketch Map

Field mapping, also known as groundtruthing, is used to check the accuracy of the PO map. This involves walking through the area to compare the reality of what is seen in the walk to what is on the map. This is usually accomplished with only a few of the people who worked on the base map. Figure 6.4 is an example of a completed field verification map.

Signboard maps can be prepared after the base map. Box 6.1 presents information on how to prepare sign board maps.

Groundtruthing involves determining if the PO's map reflects what is actually in the forest. There are varying levels of effort the PO can use to perform this. The activity with the least effort is a walk-through of each of the forest areas identified in the map to see if they possess the characteristics of the map. The activity with the most effort involves sampling anywhere from 1% to 5% of the total forest area to identify tree species, size and height.

For a CBFMA, the first approach is appropriate because the application does not require any details about the composition or characteristics of the forest. However, in a few months when the PO begins to write the Community Resource Management Framework, the Annual Work Plan and the Resource Use Plan, a much higher level of forest characterization will be needed.

Low-intensity groundtruthing—This involves locating the tree zones identified in the PO map to

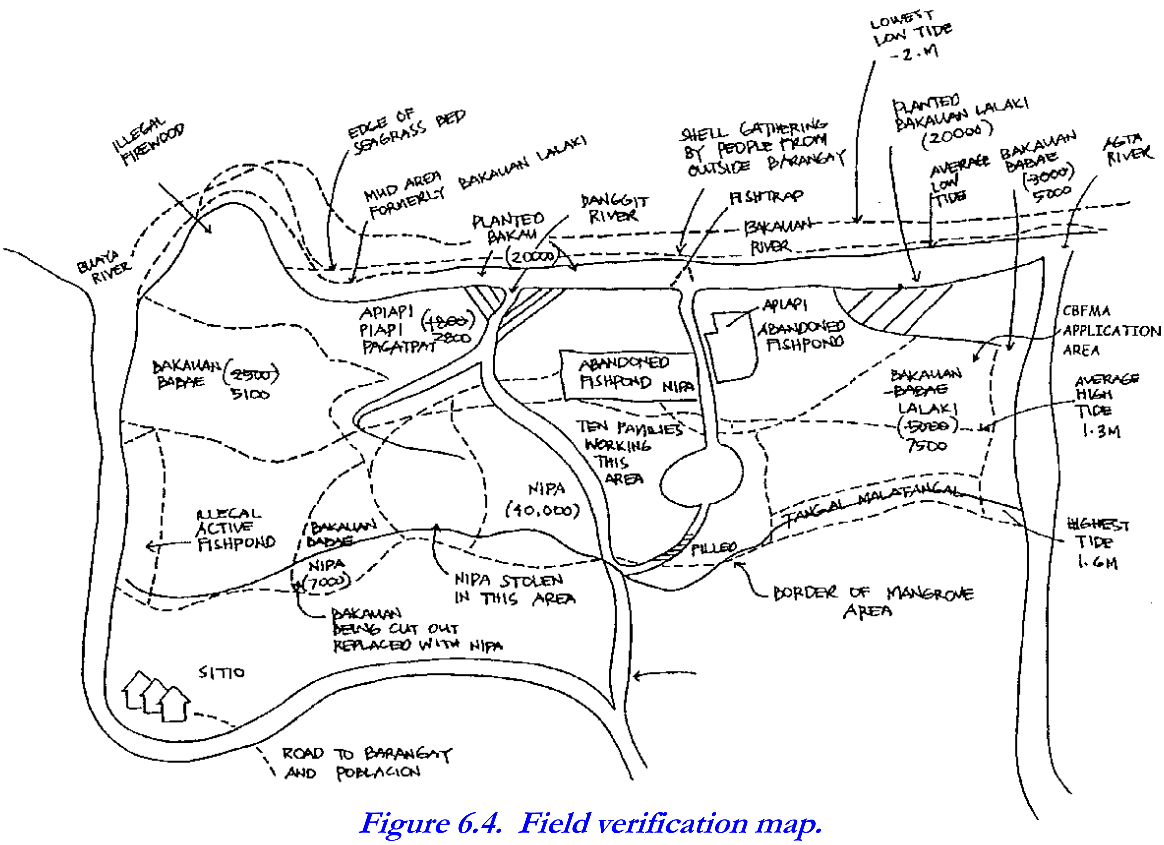

Figure 6.4. Field verification map.

Box 6.1 Making a map for display.

For planning and education it is often useful to produce a large map of the management area on a signboard or poster. Signboard maps are produced in a group setting after fishers have finished drawing over the tabloid-size base maps. The exercise is similar to that of drawing over base maps, except that the base map used is much larger and usually prepared in a different way. Signboard maps should be at least 120 cm x 120 cm and are best made of marine plywood with a 2.54 cm (1 inch) or larger border around the edges to give it strength and durability. It is best to hire a professional signboard artist to prepare the signboard base map, but a resourceful CO or community member can also handle the job. Since it is impossible to trace through a signboard, the lines of the map must be transferred from a reference map using a scaling or grid technique. Follow these steps:

1. On a tabloid-size (28 cm x 43 cm) sheet of paper, prepare a base map showing coastlines and a few other features, such as rivers and roads, to help orient the mappers.

2. Draw a grid of squares on the map so that each square measures no more than 2.54 cm x 2.54 cm (1 square inch).

3. Calculate a multiplication factor by dividing the length of the longest side of the base map into the length of the longest side of the area in which the map is to be drawn on the signboard (leave space on all the edges of the signboard for a border).

4. Multiply the size of the squares on the paper base map by the multiplication factor to calculate the corresponding size of the squares to be drawn on the signboard. For transferring a tabloid-size base map onto a 120 cm x 120 cm signboard, one can draw a grid of 2.54 cm x 2.54 cm squares on the base map and a corresponding grid of 6.4 cm x 6.4 cm squares on the signboard. (120 cm divided by 43 cm is 2.8, which can be rounded down to 2.5 to leave room for a border; 2.5 multiplied by 2.54 cm equals 6.4 cm).

5. Draw the square grid on the signboard using the size of the squares just calculated (e.g. 6.4 cm x 6.4 cm).

6. Going square by square, copy the lines on the base map into the squares on the signboard using the lines of the squares as guides to the placement of the map features.

After the basic lines have been drawn on the signboard, paint of various colors can be used to fill in the map (for example, light green for seagrass and green for mangroves).

Fishers can then begin painting the features they mapped on their paper base maps. (The job is easier if the fishers tape their maps on a corner of the signboard base map, so they can glance from one map to the other as they paint.) Fishers are typically good painters and should have little trouble transferring the features of one map to another. Enamel paints, available from most hardware stores, are best for the job.

determine how close the composition of the zone reflects the information on the map. To do this, a small group from the PO goes to the forest and visits each of the zones identified on the map.

A single group of three to four people should be identified for this task (in case it cannot be accomplished in a single day those with experience can return to the task later). It should be composed of the people who frequent the forest on a regular basis. Good candidates include firewood gatherers, *nipa* harvesters and shell gatherers.

Once a group is assembled, develop a plan on how to do the work. As a group, determine:

- When to begin (day and time)
- The number of areas to visit
- The order of visitation
- How long it will take to complete the activity
- The need for a *banca* or pumpboat
- Who will record the information
- Who will check the information against the map
- Who will present the findings to the PO group

Next, decide how to record the groundtruthing information. A helpful form is provided in Table 6.4.

Table 6.4 Data record form.

Example data sheet (adapted from IIRR 1998).

MANGROVE ASSESSMENT DATA

SITE/PO NAME

DATE__________________ **TEAM MEMBERS**______________________________

ZONE NUMBER	SUBSTRATE TYPE	MATURE TREE DENSITY	AVERAGE HEIGHT	OBSERVATIONS
		S1/DENSITY S2/DENSITY S3/DENSITY	S1/HEIGHT S2/HEIGHT S3/HEIGHT	

Upon completion of the groundtruthing process, compare the group's findings to those placed on the map. Any necessary changes should be discussed with the PO in a general meeting. Then the map can be redrafted for submission in the CBFMA application package.

Determining the average and highest high and low tides and their depths—Knowing the range of the tide in your CBFMA area is important because:

- It helps to determine if there are additional areas for plantation.
- It helps to determine which species might succeed in a particular area.

To determine where tides reach in your CBFMA area, observe the heights of the tides over several tidal cycles. Box 6.2 provides a detailed discussion of how to measure tides.

It will be necessary to perform these activities more than once to get accurate tidal information for the map.

Using tidal information from calendars—To determine the approximate height of the tide and when the average low tide will be reached, use a calendar that lists tides. These are commonly available in fishing supply stores and it is likely that someone in the PO will have one.

Box 6.2. How to determine tides.

Using Tide Tables

What are tide tables?

Tide tables are written predictions of when high and low tides will occur each day, along with a prediction of how high or how low the water will be at the time. In the Philippines, most people are familiar with and can get calendars that have the time of high tides and time of low tides listed by date. There are many things you need to understand before you can properly use these tide tables to map your area.

Kinds of tides

Daily and semidaily: At most places and at most times there are two high and two low tides each day. The time of high tide and low tide is determined by the position of the sun and moon; their gravitational attraction causes tides. In some locations, there may be several days each month when there is only one high tide and one low tide. In other places, this occurs every day. However, most of the Philippines experiences two high tides and two low tides every day.

Unequal tides: Usually when there are two high and two low tides, they will not be the same. For example, it is normal for one high tide to be higher than the other high tide. The higher of the two is known as the Higher High Water, or HHW; the lower low tide is called Lower Low Water, or LLW.

Daily tides

On average, the low and high tides occur about 50 minutes later from one day to the next. (The moon rises about 50 minutes later each day as well.) However, this is just a rule of thumb and tides are very complicated. Use this estimate to determine when the tides will occur next day, but do not count on an exact 50-minute change. Instead, look at the tide tables carefully when using the tides to map.

Monthly tides

Each month there will be one or two periods of several days during which the HHW is very high, and the LLW is very low. These periods usually fall around full moon and new moon periods because at those times the sun and moon are working together to pull the tide higher. Most people who live along the coast know this from watching the tides and moon every day.

Seasonal tides

Tides also change during the course of a year due to the ever-shifting angle of the sun. There are usually two periods when the tides are higher than the rest of the year. In the Philippines, the period of highest tides occurs around the end of June or early July. The annual highest high tides are called spring tides. The opposite, a low tidal period, are known as neap tides. Spring tides and neap tides occur in different months.

What do the numbers on the tide tables mean?

The number next to the time in tide tables is the expected height of the tide in meters (level is often used in place of height). If the table reads +2.4 (or just 2.4), for example, the water will be 2.4 meters higher than it will be on a low tide that is 0.0 meter. The 0.0 level is defined as the Mean Lowest Low Water (MLLW), or the average LLW as defined above. In other words, 0.0 is a standard level that corresponds to a typical lowest low tide of a typical day during the year. If people go out to the seashore on the day that a 0.0 tide is where the tide is at its lowest point on the shore, they would be standing at a level of 0.0. If they stood there as the tide came in, the tide would rise on them to the level predicted on the tide table. For example, if the tide table predicted that the high tide would be +2.5, the depth of the water would be very close to 2.5 meters.

Tide table locations

In the Philippines, exact tide tables are available only for areas near major cities like Cebu or Manila. Tides vary from location to location; even the shoreline can affect the tide. To say the tides vary means that the times may be different (the high and low tides may be earlier or later than at Cebu or Manila, and the levels the tides rise to or fall to also might be slightly different). However, using the tide tables for the city nearest to you should be good enough for CBFMA mapping purposes.

Estimating differences from tide tables

To estimate the difference between the tide tables and a specific location, go out and observe

continued

Box 6.2. continued.

high tides or low tides by watching the water rise or fall on the shoreline or on a piling or stake. When the tide reaches high or low, note the time and see how much earlier or later the tide is than the tide table predicts. Then add or subtract the difference to determine high or low tide for the area. Often the time differences will vary slightly for high and low tides. For example, in a certain place the high tide might be 40 minutes later than the table predicts, but the low tide only 10 minutes later. People who live and work along the coast or shore are generally aware of the time difference. To actually learn the differences, measure several times for the high and low tides when it is not windy or stormy.

Weather

Be advised that weather can greatly change the times predicted on the tide tables. Storms and winds can push water against or blow it away from the shoreline. The same kinds of winds and storms can also delay the tide from coming in or going out, thus change the time when the tide is highest or lowest. When using tide tables to map or to adjust the tables locally, do so only during calm, clear weather.

Currents and time lags in rivers/streams/bays

Incoming and outgoing tides are very different from high or low tides. This is because some rivers, streams or bays are not filled up to the level of the sea when the tide starts to recede at the river mouth and sea. The sea can still be higher than the river for many minutes after the tide has started to fall. Because the sea is higher, the water continues to flow into the river and move inland, even though the time of high tide has passed. In that kind of situation, the high tide in the river, stream or bay is later than the time listed in the table. Similarly, the low tide will be different. For areas quite a distance from the sea, it is important to determine the correct tidal time for better mapping.

Mapping Mangrove Areas

One of the most important things to know and to map in a mangrove area is the elevation or the depth of water at high tide. Both mean the same thing when they are measured accurately. By understanding tides as described above, you can use them to accurately map an area.

Tide lines

Simple and useful map features are the lines indicating where the water is at low tide and high tide. Since one low tide can be lower or higher than another and one high tide can be higher or lower than others, standards are needed.

Standards

The standard for low tide is Mean Lowest Low Water (MLLW), the place the tide falls to when the low tide is 0.0. Mean Highest High Water (MHHW) elevation determination is not as easy. Because mangroves can grow even in places where the tide reaches only on the highest tides of the year, it is important to know where that line is on the map. At the same time, some mangrove species cannot grow well unless the tide reaches them almost every day; at least two standards are needed for high tide. Look at the tide tables and see what high levels are reached each month. Select a high tide number like 3.0 or 2.8 (about the highest tide that occurs every month). This is the high tide. It is important to record what elevation that refers to high tide.

Determining the MLLW line

Low tide, ideal case: The simplest way to determine the MLLW line is for several participants to go out on a day when the low tide is predicted to fall to 0.0. If the weather is calm, watch the water fall and record the low tide for mapping. For example, along a shallow shoreline the tide might fall until the water is 100 meters away from the mangroves at low tide (0.0). Along another stretch of shoreline where the water is deeper closer to shore the tide might only be 10 meters out from the mangroves at 0.0 low tide. It is important to have many people doing this at the same time because if you try to do it alone, the tide would come up before you could walk to other areas. Be sure to mark where the water's edge was for any land that was exposed during low tide, including sand or mud bars.

Low tide, practical case: There are very few low tides that fall to exactly 0.0. Those that do may be during the night or stormy weather (remember not to measure tide levels on windy days). Use the following technique to map the MLLW (0.0) line when the tide falls below (less than) 0.0. Go out at low tide

continued

Box 6.2. continued.

when the tide is predicted to fall to -0.5, for example. Watch the water recede and at its lowest put a stake into the mud at the water's edge. Use a ruler or measuring stick to make a mark on the stake exactly 0.5 meter up from the mud. Wait and watch the tide come in until it reaches the 0.5 mark; now the water's edge is back up to 0.0. Then do the same things as above, as if the low tide had only fallen to 0.0 meter. Record where the water is on the shoreline at 0.0 (when the ruler is covered up to the 0.5-meter mark).

Highest tide detailed map

The only way to accurately map the highest high tide line in detail is to actually be there when the tide is high. Again, many individuals will have to help, because so much area is involved. In fact, this may require a larger number of people and more days if there is an "island" within the area that the tide never covers. It is especially important to know where the high tide line is along all rivers and tributaries. This is a difficult task, and it may take several years to complete accurately because the highest tides only occur a few days each year.

The technique is simple. Place participants in select areas with some overlap. For example, if mapping how far the tide moves into a stretch of mangroves along a shore, walk through the mangroves, following the water's edge for about 15 minutes before and after high tide. When one person finishes at 15 minutes after high tide, he/she should reach about where someone else started 15 minutes before the high tide. This ensures that all of the shoreline is mapped without any gaps. Similarly, different people will have to walk along each side of any river, tributary or other areas where water extends into the forest.

Highest tide, approximation

Measuring the highest tide line takes a lot of work and time. It is something that should be done, but in the mean time, this information can be approximated. In most cases, there are people who spend a lot of time in the mangrove areas and know from memory where the highest tide line is. They can transfer this memory onto the community-based map. This could and should be incorporated into the process from the outset. Where there are gaps in knowledge/memory, it is possible to estimate the HHW line by walking through the forest along the interior of shorelines and observing the soil and floating debris that indicates where tides have reached.

High tide, approximation

There is no apparent way to determine a high tide line without detailed measurements. Careful examination of mangrove forests on Bohol did not reveal any indicators, as sometimes occur in other wetlands (e.g., waterlines or periphyton lines on trunks). Therefore, the high tide line must be determined using the technique used to determine the low tide (MLLW) line.

High tide measurement and mapping

Once the standard high tide elevation (e.g., 3.0) has been selected (see above), the high tide line for this standard can be measured any time when the tide is at or above this level. Just like for the low tide measurement, things would be simplest if the tide was exactly equal to the standard (3.0, in this example) on the day the measurements are made. However, as in the case of low tide, the tide will not be exactly 3.0 on many days. Therefore, measurements can be made on any day the tide is 3.0 or higher, using a reference stake(s) as for the MLLW measurements.

In this case, go to the mangrove areas to be mapped a little before the time of predicted high tide and wait until the tide reaches its highest point. (The predicted level for that tide is already known; we'll use 3.5 in this example.) When the tide is at its highest, walk into water that is more than 0.5 meter deep and insert a stake. Measure down 0.5 meter with a measuring stick and make a mark on the stake at that point (one method is to use a *bolo* to cut a line into the stake 0.5 meter down from the water surface). Then watch the stake as the water falls. When the water level goes down until it is level with the mark, the water is now at 3.0, because it is 0.5 meter lower than what it was (3.5 meters in this example). However, if the person at that site waits until the water has fallen to the mark, he or she will be able to note where the water line is but will only see where the water is at 3.0 (or a little lower as the tide continues to fall). Therefore, the observer should not wait until the water falls to the exact mark on the stake. Instead, start the survey when the water is still about 0.2 meter (2 centimeters) above the mark. This gives the observer about 15 minutes to walk while the water is still within a few centimeters of

continued

Box 6.2. continued.

being at an elevation of 3.0.

Other tidal level mapping

The procedure described above can be used to map other critical elevations. For example, the optimal elevation for planting *apiculata* may be between 0.5 and 1.0 meter. The techniques described above can be used to map out areas between these elevations. Mark a stake at a known low tide, such that marks at 0.5 meter and 1.0 meter are placed on the stake. The marks would be located relative to the predicted low tide. For example, if the tide is predicted to be -0.1 meter, then a stake would be placed at a location slightly below the low tide line. The mapper measures up 0.6 meter from the water line at low tide, and makes one mark at 0.5 meter (-0.1 + 0.6 = 0.5). A second mark would be made at 1.1 meters, and when the tide reaches that mark, the tide would be at an elevation of 1.0 meter. Then, when the water reaches the lower mark, the area is surveyed and possibly marked out with stakes. When the water reaches the second mark, the area is similarly surveyed and marked to indicate the upper extent of the area between 0.5 and 1.0 meter.

Reverse tidal mapping

Another important way that tides and water level can be used to map areas involves determining the elevations at which certain mangrove species grow. For example, certain species grow well in a specific elevation range. If that species is to be planted in the CBFMA area, it is best to plant at elevations where it is known to grow well. To determine the elevation, the same elevation mapping techniques described above can be used. When the location is far from the low tide line (e.g., a clump of mangroves several hundred meters in from the open water), a reference point is established at high tide by marking a stake located in the middle of the clump. Then mappers measure the distance from the water surface to the sediments next to selected trees. Do this by attaching a measuring tape to a piece of bamboo or some other stick.

The following example demonstrates this technique. At high tide predicted to be 3.1 meters, a mark is made at the water surface on a stake. Using a measuring stick (marked in 0.1 increments or having a measuring tape attached to it) the distance from the water surface to the soil next to a tree is measured to be 1.6 meters. Thus, the elevation of the sediments by that tree is 1.5 meters (3.1 - 1.6 = 1.5). This can be repeated at other trees in the clump. After a few minutes, the tide will have fallen. The distance from the mark on the stake to the water can now be measured. For example, the distance from the mark is 0.3 meter, because the tide has fallen. This means that the water surface is now at an elevation of about 2.8 meters (3.1 - 0.3 = 2.8). If the depth of water next to a tree is measured at 1.1 meters, then the elevation of the soil surface there is 1.7 meters. In other words, the sediment had been at 0.0 and the tide was at 2.8, then the measuring stick would show 2.8 meters of water over the soil. Since the measuring stick showed only 1.1 m of water over the soil, the soil surface had to be at 1.7 meters to make up for the difference between 0.0 and 2.8. This method can be confusing; be sure you understand it completely before using it.

Knowing the range of the average tidal height and the points where the lowest and highest tides reach allows your group to determine if there are potential plantation areas outside the mangrove forest. Be sure to include these areas in the CBFMA application.

These calendars generally predict the tides for nearby large cities and will not tell you the precise time or exact range of local tides. But they will provide a good understanding of the general trend of tides in your area. The box shows typical tidal information found on a calendar.

Above the date are the day's expected high tides;

below, the day's low tides. The numbers after each time are the expected height of the tide. For example, reading the information in the box tells us that on the 1st day of the month the first high tide will be at 7:30 a.m. and will

7:30 a.m. 1.0 m	1	6:37 p.m. 0.9 m
12:20 p.m. 0.3 m		1:24 a.m. 0.0 m

be 1 meter above the average low tide for the area. Note the day's second low tide height is 0.0 meters, or average low tide.

Determining the height of the water and extent of low tide—This activity is done during the neap tide period. Since every place has a slightly different tide time and height it will not be possible to use the exact times and heights to predict tides. Use the calendar to determine the approximate time and height of local tides. Simply look at the heights of the low tides during the first and last quarter of the moon. These are the neap tides.

Go out to the CBFMA area with several people about an hour before the neap low tide is predicted on the calendar. Watch the level of the water fall until it falls no longer. Note the time this happens so you know how far off the calendar is from your location. Put

The average low tide is also known as Mean Lowest Low Water (MLLW). As the tide goes out, the shore is uncovered. The average low tide represents the typical point at which the low tide exposes the tidal flat. This point is the reference for all other tide heights. Low tide can be a positive number, negative or zero. Experience in the Philippines suggests that it is safest to extend plantations only to the lowest tide lines of the year, or neap tide line, because the survival of trees planted below the neap tide line decreases significantly (due to the long amount of time spent wet).

bamboo or *bakauan* poles along the edge of the water at approximately every 50 to 100 meters. The poles should be about 3 meters long. Push each stake into the bottom approximately 0.5 to 1 meter. This line of stakes will mark the neap low tide for your area.

Return to the site the following day to compare the height of the low tide on the stake with the calendar information. For example, if the calendar says low tide is 0.1 meter and the stake is covered by 30 centimeters (0.3 meter) of water, local tides are slightly higher than the place where the calendar was printed. You can safely add this difference to the calendar tides and predict low tides for your area.

Determining the tide line and depth of high tide—This too should be done during a neap tide period. Use the established low tide information to determine the high tide by observing when high tide goes back to the poles that were placed on the low tide line and recording how much of the stake is covered at high tide. If, at high tide, the pole is in 1.2 meters of water, that is the high tide. Notice the time difference between the calendar and the tide for your area to predict future high tides.

It takes a group of people to obtain this information. About one-half hour before high tide, put one person at the poles and then have people form a landward line at a spacing of about every 100 meters to the far edge of the CBFMA area. When the tide reaches its highest point, the person at the low tide line calls out that fact, then each person in the line determines the depth of water at their location. The individual farthest away may be on dry land. He or she should walk back to the point where the water ends and note the location. This represents the furthest point landward that mangroves should be planted.

How do we use this information?—The information gathered on tides helps to better plan the development of plantations; for example, determining which species can be planted in a particular area. This is discussed in more detail in Chapter 3. For a complete discussion on tides, see Box 6.2.

Identifying other important physical features such as fishponds, streams, depressions—As part of their activities, the sampling team should observe the general surroundings. Does there appear to be recent woodcutting to indicate illegal cutting or the beginning of clearing for a fishpond? Is *amatong* present? If so, does the group know to whom they belong? If *nipa* is present, does the group know who harvests it; and are they in the PO? Are there any streams, or active illegal or abandoned fishponds (evidenced by old dikes or water control structures)? All this information should be noted as the team walks along the transect. Reference the location of each feature so they can be added to the map. For fishponds, streams, etc., make sure to include size and shape.

How to use a global positioning system (GPS) as part of sampling activities—GPS is rapidly becoming more common in the Philippines as an important development tool. One may be available from the municipality, the CENRO, or the PPDO. If so, make every effort to use it as part of the PO's mapping activities.

Using satellite technology, a GPS can pinpoint exact locations in the CBFMA area, providing several advantages for the field team. First, it easily identifies latitude and longitude for each sampling point and each feature. Second, it acts as a compass. Third, it informs the group how far it has moved from one point to the next, e.g., the distance traveled along the transect. All these features are valuable, especially the ability to note latitude and longitude (generally referred to as lat. and long.), a vital component when developing a high-quality map.

There are different types of GPS available in the Philippines so it is impossible to explain how to operate a GPS. The best chance for the PO is to either get help from the group from whom the GPS is being borrowed or for the PO to read the directions and get instructions from the users.

GPS systems are not difficult to operate; simply turning it on activates the system. Soon it acquires (finds) the satellites and tells the user where he or she is located by displaying the latitude and longitude. Every time a sample is taken or a feature noted, the GPS operator must tell the group the latitude and longitude, and someone must record the information.

The GPS can also be used to help develop the boundaries of an area. This is done in a fairly straightforward manner. After turning on the GPS and letting it determine the current location, simply walk or take a *banca* along the edge of the area the PO intends to claim. Every 100 meters or so write down the latitude and longitude, as well as every time there is a distinct change in direction.

Figure 6.5 shows examples of the points to note the latitudes and longitudes. Circles represent every 100 meters; squares represent distinct locations that would not have been recorded otherwise, e.g., a distinct change in border direction that does not occur at a 100-meter point.

After collecting a list of latitudes and longitudes, see if there is access to a GIS group who can prepare the area boundary map from the list. Alternatively, give the data to a draftsman and he or she can transfer it to a map by hand. This will increase the quality of the map and make it less open to challenge.

Figure 6.6 shows what a final map drawn using GIS looks like. It provides all the information captured during both the community-based mapping and field verification activities.

A finished map is useful for a number of purposes, including:

- Preparing the map for submission with the CBFMA application.
- Understanding the resources available within the area.
- Planning how to manage the area.

Each is important in the quest to obtain a CBFMA for a mangrove forest. By following the map development process in this guidebook, a beneficial, thorough map can be created with little trouble.

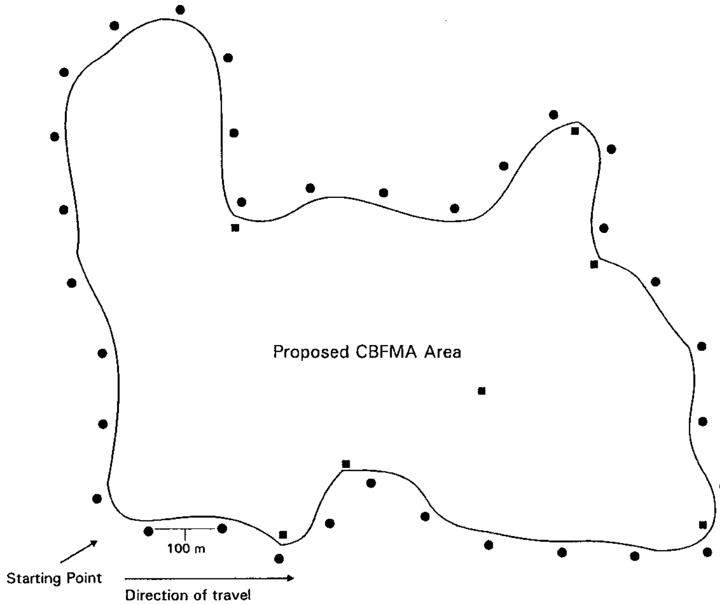

Figure 6.5. Examples of latitude and longitude points to note a boundary area. (Note the square points. They are extra latitude and longitude points that are taken to mark a landmark.)

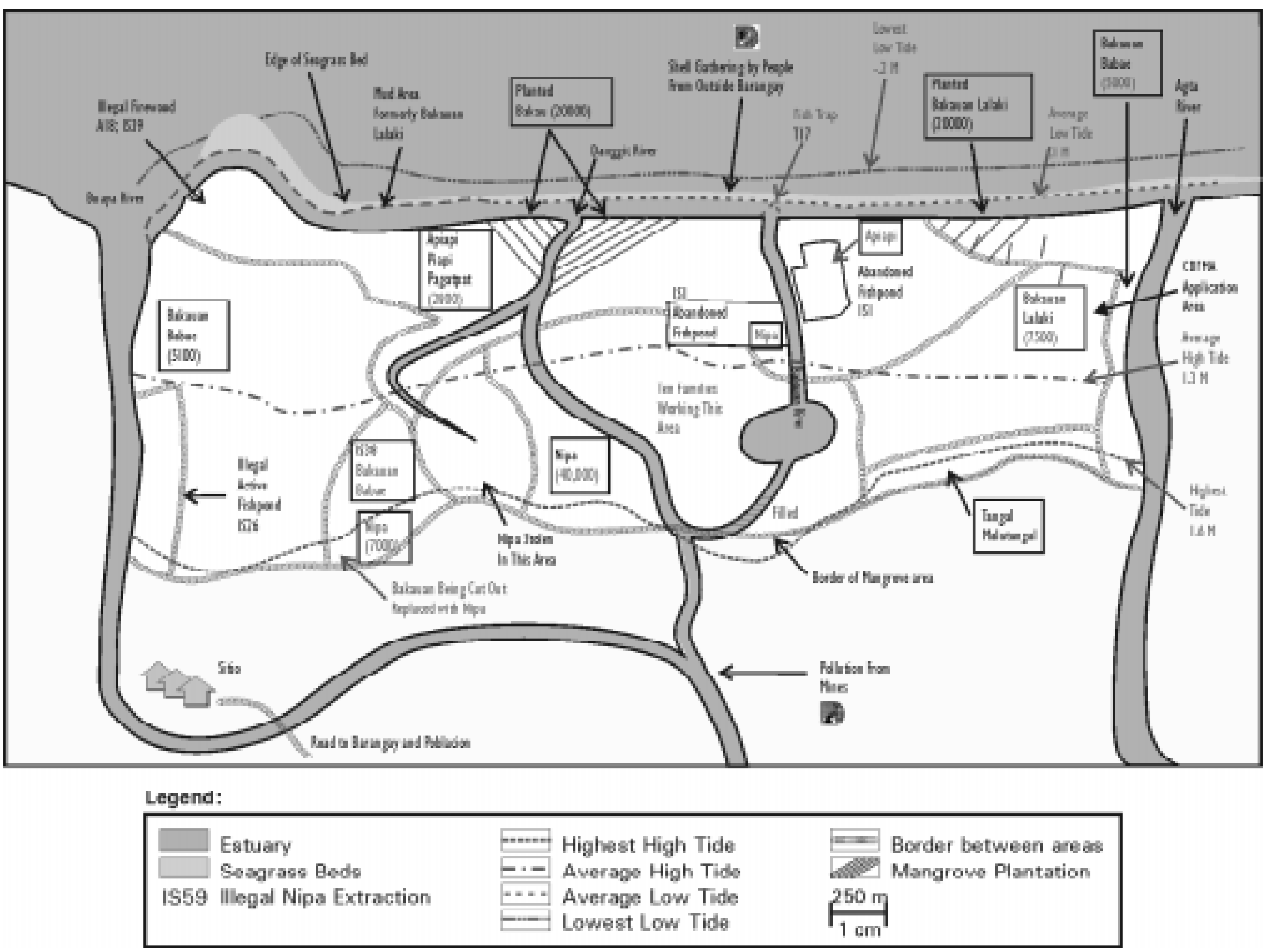

Figure 6.6. Final GIS-drawn map.