FD Volume III: CF Management
III-3:Group Consolidation
(reference sheet)

Why Group Consolidation?

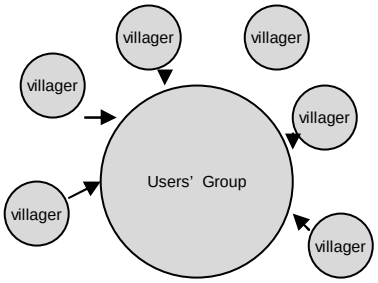
- **Villagers as individual are very weak when considering as a stakeholder for mangrove management.**
- **They have little experience of mangrove management.**
- **They have limited opportunities of sharing experience.**

POWER OF CONSOLIDATION

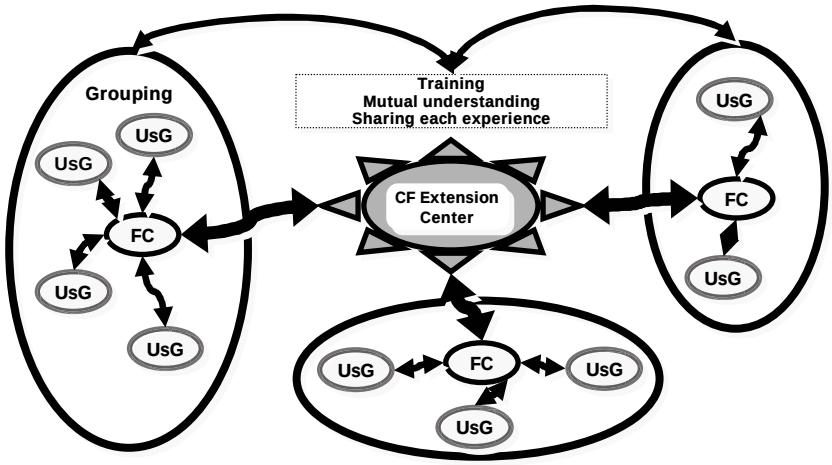
- **If local people are consolidated into groups, they share their power, experience and skills and become more powerful for mangrove management.**

METHOD FOR EFFECTIVE GROUP CONSOLIDATION

- **People organize user group for mangrove management.**
- **FD staffs periodically communicates with villagers.**
- **Local network will be constructed among UsG in the Ayeyawady Delta to share the experience and information, and among UsG, FD staffs, and other concerned people/organizations**



Network of UsG and FD staffs



FD Volume III: CF Management
III-3:Group Consolidation
(reference sheet)

Why Group Consolidation?

Subject: Local people as individual are very weak when considering as a stakeholder for mangrove management.

Teaching method: Discuss with trainees (villagers) following matters and confirm.

- **They are relatively poor and pressed by livelihood activities, and frequently without any help from supporters and donors.**
- **They have neither organized technical know-how nor management skills. They need to be informed such for better mangrove management.**
- **They have little experience of mangrove management. They have to share the experience of other villages and FD.**
- **However, they have limited opportunities of sharing experience.**

POWER OF CONSOLIDATION

Subject: If local people are consolidated into groups, they become more powerful.

Teaching method: Discuss with trainees (villagers) using examples and confirm the followings.

- **If they are consolidated, they enjoy mutual help. They can assist each other in a form of cooperation work.**
- **If people share their knowledge, experience and skills among group members, they can be more powerful than each person working individually (learning each other).**
- **If they help each other, they can manage mangrove rehabilitation more effectively (consolidation will create multiplier effect).**
- **They exchange understandings and expertise with FD staffs (interaction of stakeholders).**

METHOD FOR EFFECTIVE GROUP CONSOLIDATION

Subject: Villager will be involved in multiple network of stakeholders for mangrove management.

Teaching method: make trainees (villagers) understand the role of UsG, relation with FD staffs and the network of UsG.

- **People organize users group (UsG) for mangrove management.**
- **FD staffs periodically communicate with villagers.**
- **Local network will be constructed among UsG in the Ayeyawady Delta to share the experience and information, and among UsG, FD staffs, and other concerned people/organizations.**

What is monitoring?

Key points

- **Enable sustainable community forestry activities based on findings from periodical monitoring (such as weekly, monthly, annually progress check through site check and/or working records for the CF activities).**
- **Self monitoring by user groups and overall monitoring by CF task force of FD**
- **Developed mutual understanding of community forestry between user groups and FD through a series of monitoring activities**

Why/what monitoring for management?

- **To grasp the progress of community forest activities in accordance with management plans (activity areas, survival rate, achievements of each activities etc.)**
- **To explore needs for assistance for user groups**
- **To identify constraints/issues (insufficient techniques for planting operation, livelihood problems, encroachment issues, etc.)**
- **To feed back next plan/implementation of community forest activities with findings and lessons learned from step by step monitoring.**

Monitoring Type

1. **User group activity recording (self monitoring by user groups and basis for progress and growth monitoring)**
2. **Monitoring of community of forestry activities (e.g., planting, patrolling, harvesting, preparation of annual plan, monthly meeting etc.)**
3. **Growth monitoring for confirmation of growth condition and survival rate of plantation, identification of constraints and difficulties, and consideration of countermeasures.**

Type	Contents	frequency	Source of information
Activity monitoring	-name of activities -period of activities -mandate for each activities -achievements of each activities -copy of working record etc. -list of user group members and their achievements	Monthly by entire user group Biweekly by sub-group, FD staff	working record of each member, minutes of meeting of periodical meeting of user group shall be prepared and kept by management committee of user group.
Growth monitoring	-species of planted seedlings, -number of survived seedlings, -survival rate by species etc.	Annually or Semiannually,	Management plan for plantation, field survey, interview of user group members

Monitoring procedure

Step1: Support UsG with preparation of monitoring forms and user group activity record formats
Step2: Support UsG with preparation of a monitoring plan by user groups
Step3: Organize workshops and/or periodical meetings for information sharing about monitoring activities to target user groups/members
Step4: Implementation of the monitoring with stakeholders (such as MC members, subgroup leaders, related user group members as owner of target monitoring area
Step5: Recording results to monitoring forms
Step6: Report the result of monitoring with evaluation to CF task force and township office
Step7: Feed back the evaluation result to user groups
Step8: Support UsG with countermeasures toward effective and sustainable implementation of community forestry activities by user groups

1. Preparation of activity monitoring form

- **Contents of the form shall be in accordance with the component of concerned management plans of user groups**
- **User groups should keep work/ activity records as data source of progress monitoring**

Activity monitoring form (sample)

No	Prototypes/ Component	Location	Area (acre)		Activities	Duration	People-day			Work Quantity			
							Male	Female	Total	plan	achievement	%	remaining
1	Plantation	subgroup 6	10	1	preparatory work	20-23 May	4	2	6	10 acres	10	100	0
				2	seedling transportation	25 -27 May	11	2	13	2000 sdling	1300	65	700
				3	staking	1- 5 Jun	3	15	18	10 acres	5	50	5
				4	brushing	1- 5 Jun	8	4	12	8	8	100	0
				5	planting								
				6	tending								
				7	replanting								
				8									
2	Nursery operation	Village nursery	1	1	preparatory work								
				2	material procurement								

2. Preparation of growth monitoring form

Growth monitoring form (sample)

UG Member	Prototypes/ Component	Total CF area (acre)	Species	Planted date	Inspection date	Target Area	Avg. diameter/girth at breast height (in/cm)	Avg. height (ft/m)	Tree planted (no)	Tree survived (no)	Survival rate (%)
1. U aaa	Plantation		xxx								
			yyyy								
			zzzzz								
2. Daw bbb	NFIO patching		xxx								
			yyyy								
			zzzzz								
3. U ccc	Plantation		xxx								
			yyyy								
			tttt								
4. school PTA	Plantation		aaaaa								
			xxx								
			zzzzz								

3. Field measurement

Procedures

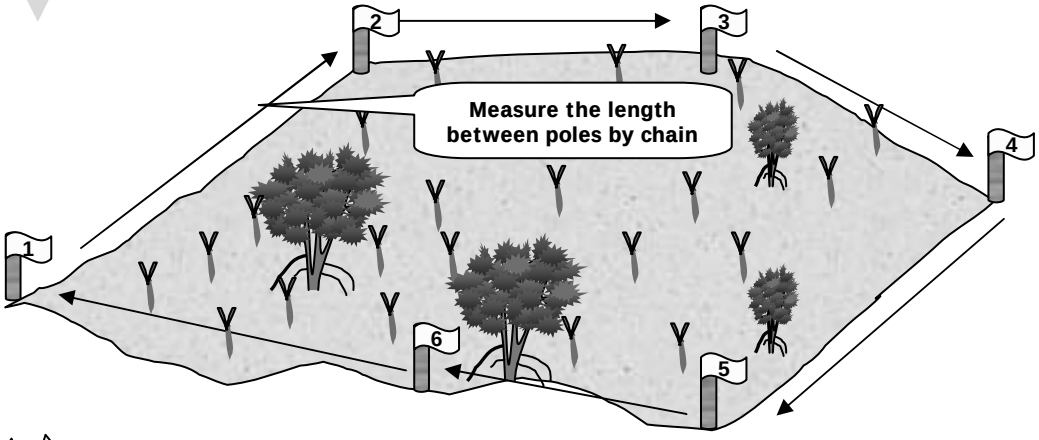
- **Activities for field measurement shall be based on the content of work records / monitoring forms in accordance with CF management plans**
- **User group should keep work/ activity record as data source of progress monitoring**

Example> Plantation area

1: Decide a starting corner of area for community forest activity

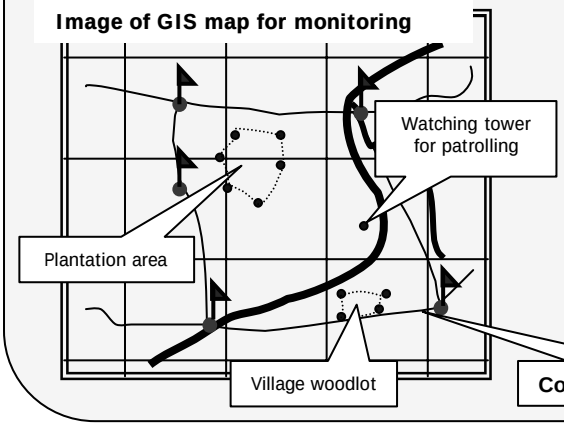
2: Install poles with paint all corner as landmark and record the length between poles

3: Count the planted seedlings within delineated area and record in monitoring form



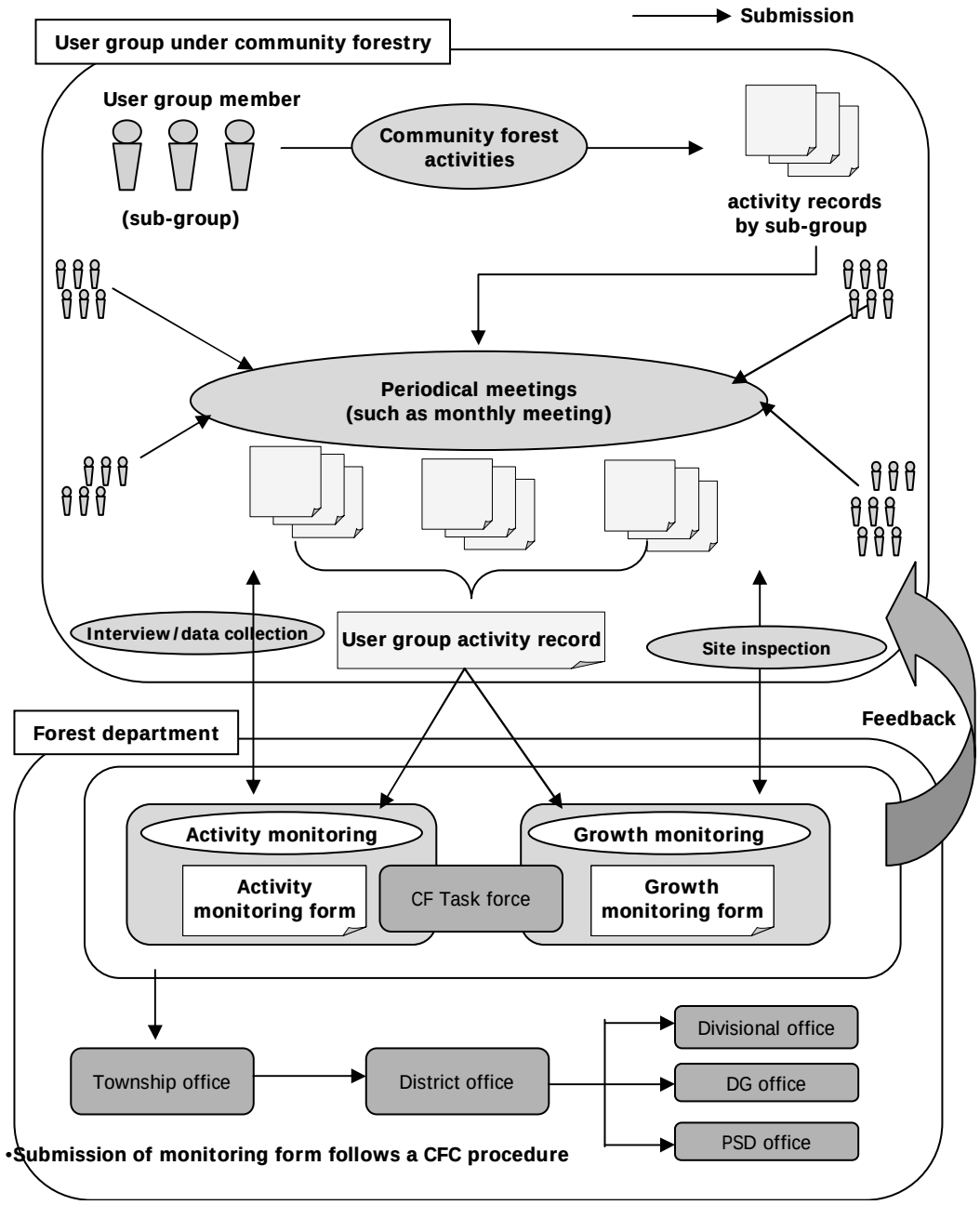
- **If GPS is available for monitoring, confirmation of area under community forestry activities shall be located on the topographic map with higher accuracy.**

Image of GIS map for monitoring



In GPS survey for monitoring, necessary to
- **procure batteries for GPS receiver,**
- **train to operate the GPS,**
- **train to record GPS data, and**
- **establish of submission process from sites to offices which installed computer and GIS technology with experts.**

Procedure of reporting of monitoring result

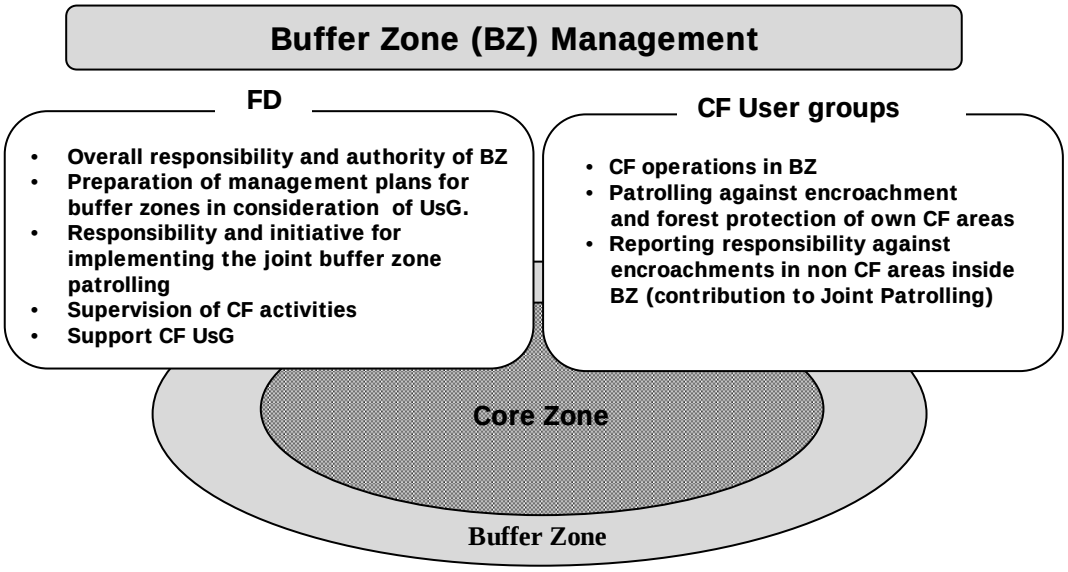


Management Concept:

Buffer Zone as "Social Fence" against encroachment from outside and "Natural Barrier" for core areas with remaining mangrove vegetations

Key points

- **Buffer zones are focal areas inside reserved forests for creating public awareness of mangrove degradation and rehabilitation**
- **Villages and settlements inside buffer zones are the priority targets for implementing and CF and formulating UsG**
- **Tight collaboration between FD and CF user groups for buffer zone management and operations**
- **In addition to the regular patrol system, establishment of joint buffer zone patrolling system (including fire protection) between FD and user groups, in collaboration with local authorities**
- **Utilization of CF products by user groups**
- **FD to provide basic equipment, materials and technical guidance to CF UsG**



FD shall supervise and support CF User groups for effective BZ management!!

FD Volume III: CF Management
III-6: CF River Bank Management

Management Concept: Integrated River Bank Management to protect national land and its production capacity

Current Conditions of Land of the Delta:

- **Exposed land to very salty wind, wave, water flow, sunshine, etc. without protection by natural vegetation**
- **Erosion of river banks and coast lines are common phenomenon in the delta**
- **The country's land is decreasing because of a luck of proper protection/ rehabilitation measures**
- **Moreover, the livelihood of residents and regional economy are affected by damage to settlements, paddy fields and other infrastructures**

Bank erosion and damage to paddy field

Bank erosion and damage to housings

Key Points

- **Introduce appropriate counter measures against erosion/degradation observed along coastal and river banks**
- **Countermeasures for critical areas and banks outside of reserved forests shall be conducted by local authorities and concerned ministries**
- **Inside reserved forests, FD needs to take the initiative for riverbank protection/ rehabilitation in collaboration with local authorities**
- **For core zone area, riverbank protection/rehabilitation to be conducted under FD direct operations.**
- **For buffer and multiple-use zones, riverbank protection/rehabilitation to be conducted as one type of CF prototypes**
- **CF river bank management is to protect the national land resources and production/living areas of user groups.**
- **Integrated river bank management is to be promoted in association with public awareness for mangrove resource protection**

River bank management / rehabilitation to be under CF in the reserved forests
- CF River Bank 100 Feet Woodlot -

Methodology:

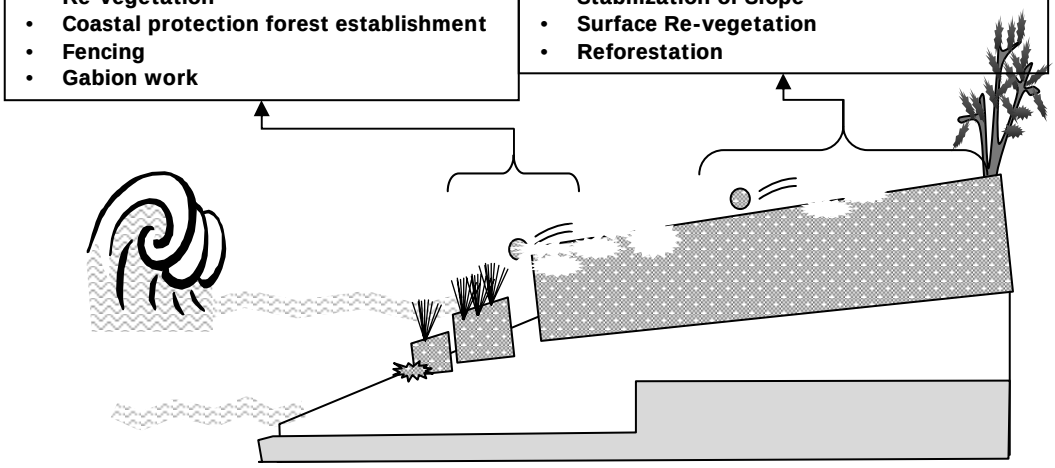
- **Civil engineering works are more effective, but locally appropriate technology and materials should be used for river bank stabilization**
- **Reforestation and surface re-vegetation are feasible methods of river bank stabilization**
- **Fencing and gabion work by locally procured materials (phoenix poles) can be applied in areas where immediate stabilization is required**
- **Organize a river bank management subgroup under the CF user group**
- **Avoid unnecessary conflicts with fishery activities; therefore, coordination with the fishery department is required by FD before implementation of any works.**

Water Edge (CF River Side Woodlot / CF Paddy Woodlot, CF Village):

- **Prevention of landslide & landfall**
- **Re-vegetation**
- **Coastal protection forest establishment**
- **Fencing**
- **Gabion work**

High Ground Level (CF River Side Plantation / CF Paddy woodlot / CF public Woodlot):

- **Prevention of soil erosion**
- **Stabilization of Slope**
- **Surface Re-vegetation**
- **Reforestation**

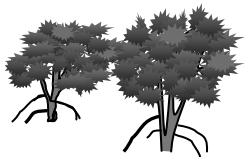


Mid Ground Level (CF River Side Plantation / CF Paddy woodlot):

- **Prevention of top soil erosion**
- **Surface re-vegetation**
- **Reforestation**

Low Ground Level (CF Nipa Plantation / CF Rive Side Woodlot):

- **Protection from waves action**
- **Coastal protection forest establishment**
- **Gabion Work**



FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance
Summary of Activities for Mangrove Forestry Operation

	FD Operation	CF Operation
1. Natural Forest Operation:		
a. Protection and Conservation	- Preservation of critical areas - Wildlife/ecosystem conservation - Patrolling to prevent illegal activities & fires - Monitoring & evaluation	-
b. Forest Regeneration Operation (Forest Stand Improvement: FSI)	- Climber cutting & clearing - Pruning - Thinning - Regeneration treatments (seed tree, coppice, assisted natural regeneration, enrichment planting) - NFTP extraction - Forest Protection	-
c. Forest Improvement Operation: (Regeneration Improvement Felling: RIF) (Natural Forest Improvement Operation: NFIO) (Timber Stand Improvement: TSI)	- Improvement felling (cutting, clearing, thinning, pruning) - Regeneration treatments (clear felling on alternative strip, selection, seed tree, coppice, assisted natural regeneration, enrichment planting) - NFTP extraction - Forest Protection	- Improvement felling (cutting, clearing, thinning, pruning) - Regeneration treatments (selection, seed tree, coppice, assisted natural regeneration, enrichment planting) - Harvesting - Forest Protection
2. Plantation Operation:		
	- Plantation establishment - Weeding - Thinning - Pruning - Controlled harvesting - Patching & replanting - Forest protection	- Plantation establishment - Weeding - Thinning - Pruning - Harvesting - Patching & replanting - Forest protection
a. Mangrove Species Plantation	- Potted seedling for mid/high ground - Bare root seedling & propagule for low/mid ground	- Potted seedling for mid/high ground - Bare root seedling, propagule, sowing for low/mid ground
b. Non-mangrove Species Plantation	- Assisted natural regeneration (nurse/shade tree at high ground)	- Multiple-use tree establishment at high ground
3. Riverbank stabilization		
a. Vegetation activities	- High ground reforestation - Re-vegetation for surface erosion - Low ground/ wave action stabilization	- High ground reforestation - Re-vegetation for surface erosion - Low ground/ wave action stabilization
b. Bank protection work	- River embankment	- River embankment
4. Forest Protection		
	- Pest & disease prevention control, - Fire protection & control, - Patrolling & monitoring against illegal cutting & encroachment - Monitoring & evaluation	- Pest & disease prevention control, - Fire protection & control, - Patrolling & monitoring against illegal cutting & encroachment - Monitoring & evaluation
5. Seedling Production		
	- Seed/ propagule/ wildling collection - Seed orchard operation - Seedling production (bare-root & potted seedling)	- Seed/ propagule / wildling collection - Village nursery operation

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance

Desirable & Preferable Species by Ground Level for Forestry Operations

Key points

• Desirable species are based on site-species matching, suitability and profitability (financial and economic returns and environmental soundness)

• Preferable species are based on availability of abundant seed sources, ease in collection and raising seedlings, or already established planting methods, and often selected by FD/villagers

• Fast growing non-mangrove species shall be introduced in high ground and extremely high ground areas where growing of mangrove species are not favorable due to less tidal inundation

Ground Level		Desirable Sps.		Preferable sps.	
High (equinoctial tides & rainy seasons)	Plantation	***Albizzia lebbek***		***Avicennia officinalis***	Thame
		Melaleuca spp.		***Sonneratia apetala***	Kanbala
		Acacia mangium			
		(spp proved in trial plantaion)			
		Amoora cucullata	Pandaka		
		Excoecaria agallocha	Thayaw		
	Natural Forest	***Phoenix padulosa***	Thinbaung	Spp. existing in natural conditions	
		Heritiera fomes	Kanazo	***Excoecaria agallocha***	Thayaw
				Amoora cucullata	Pandaka
Medium (normal high tides or spring high tides)	Plantation	***Avicennia officinalis***	Thame	***Bruguiera spp***	Byu
		Ceriops spp	Madama	***Avicennia officinalis***	Thame
		Sonneratia apetala	Kanbala	***Sonneratia apetala***	Kanbala
	Natural Forest	spp. existing in natural conditions		spp. existing in natural conditions	
Low (all high tides)	Plantation	***Rhizophora apiculata***	Byuchidauk	***Sonneratia apetala***	Kanbala
				Avicennia. marina	Thame-phyu
				Avicennia. alba	
	Natural Forest	Spp. existing in natural conditions		Spp. existing in natural conditions	

Securing Seed/Propagule Sources

Key points

- **Securing sufficient supply of better quality seeds/propagules are prerequisite for mangrove reforestation**
- **Understanding seed collection and availability situations are essential to support regeneration and planting for mangrove rehabilitation**
- **Consider seed/propagule availability for both FD direct operations and CF operations**

Methodology

- **Identify locations of seed/propagule sources**
- **Accumulate information of seed/propagule sources (fruiting time, seed collection time & method, available quantity)**
- **Establish seed production areas for desirable species as seed/propagule sources**
- **Accumulate information of seed/propagule (maturity, selection, storage, pretreatment)**

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance
Seed Collection and Seedling Production

Seed Collection

- **Notice fruit bearing and ripening time because collecting seed/propagule at the right timing is critical. (refer source book for approximate period of fruiting/seed collection for major species)**
- **Mangrove seeds/propagules to be collected shall be 1)average to superior size, 2) free from defects and infestation,3) matured 4) fresh without developed roots**.

General characteristics of mature seed/propagule:	
Color: dark green, or dark brown, or yellow.	Texture: soft and sticky peel.
(Size: a bit bigger)	(Taste: a bit sour)

- **Seed/propagule collection can be done by plucking matured fruits and/or by picking up windfalls during Yethe (Low-rise) tide days.**
- **If required, consider and method of sorting, packaging (keep moisture and avoid direct sun light), transportation and storage of seed/propagule:**

- When collecting propagules of Rhizophoraceae family, it is advisable to pluck them and plant at once though the matured fruits can be stored for a while.

Seedling Production

- Types of seedling for production

1) **Direct sowing species (ready for planting)**
Rhizophora apiculata, R. mucronata, Bruguiera gumnorhizza, Kandelia candle Ceriops decandra, Avicennia spp., (Aegiceras corniculutum, Aegialitis rotundifolia, Xylocarpus moluccensis)

2) Bare-root seedling (need to germinate in ridge or germination bed)
Excoecaria agallocha, Heritiera formes, Sonneratia apetala, S. caseolaris, S. griffithii, Cynometra ramiflora, Xylocarpus granatum, (Agiceras corniculutum, Avicennia spp)

3) Potted seedling (above two types can be produce as potted seedling)
following species can be sown directly to pot: *Avicenniaceae, Cynometra ramiflora, Heritiera formes, Xylocarpus moluccensis, Rhizpphoraceae*

4) Wildering: wilderings are required when seeds/propagules and seedlings are not available. Relatively, lower survival compare to other types of seedlings therefore more care is necessary.

- Sowing and seed germination

First Step: Processing seeds before nursing

The seeds of mangrove species are not to be left long before sowing. It is suggestible to sow them directly at once as soon as the seeds are collected. Some species need certain pretreatment before sowing.

-*Sonneratia* fruits are to be immersed in water for two, three days and stirred off and on to separate the flesh and the seed. Then, take out the seeds and wash them again in water. After drying under the shade, put seeds in bags and store in a cool dry place.

Second Step: Sowing seeds

Two ways of sowing:

1. Sowing seeds in ridges/ germination beds first and then transplanting seedlings into plastic bags or nursery beds
2. Sowing seeds directly in the plastic bags.

Take care that the seeds are not carried along by the tide. It is therefore advisable to sow only on Yethe (low-rise) days and seeds to get rooted before high tide

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance
Seed Collection and Seedling Production

Seedling Production and Maintenance

• Preparation for potting

- **For production of potted seedlings, pot filling materials (soil, manure) and plastic bags are required prior to transplanting**
- **Especially for some high ground mangrove species and non-mangrove species, should avoid clay and salt, and use sand for potting to avoid salt accumulation in soils of potted seedlings, which cause dehydration and damage seedlings.**
- **pot filling materials shall be mixed thoroughly, either by manually or by machine.**
- **Plastic bags shall be filled with filling materials and filled pots shall be laid in nursery beds to be ready for transplanting and maintenance**

•Transplanting

- **Germinated seedlings to be transplanted to plastic bags or nursing beds in time for further activities.**
- **Transplanting is done by pricking germinant using a flattened stake to minimize damages to root. Avoid pricking by hand.**

Nursing of Seedlings (Tending activities)

watering: For non-mangrove species water daily if not exposed to rain. For mangrove species, secure daily water flows into bed, either freshwater or brackish water

shading: Shade newly germinated/potted seedlings to avoid direct sunlight

weeding: Conduct regularly to prevent competition with weeds

pest& disease control: Conduct regular inspection. If any pest or disease are found conduct necessary counter measures (isolation, removal, burning, pesticide)

recording: For monitoring of growth performance and survival of seedlings in nursery and planting sites

hardening: Preconditioning seedlings to acclimatize planting environment (sunlight increase, watering reduction, if necessary)

seedling transport: grade and sort seedlings based on seedling criteria, before packaging and transportation

Example of Seedling Critera

⇒ Root and stem ratio of 1:1 or 1:2;
⇒ Tough and strong collar and stem;
⇒ Proportionate growth of leaves;
⇒ Compact growth of roots;
⇒ Strong leaves with dark green color (without yellow /withered leaves)

Seedlings to be removed for planting

Stem	Root
⇒ Deformation	⇒ Having less hair roots
⇒ Having small stem	⇒ Have less lateral roots
⇒ Having less leaves	⇒ Having root disease
⇒ Having too many branches	⇒ Having wrinkled or curled up roots
⇒ Dry at the top	
⇒ Leaves are yellowish / pale	
⇒ Having tiny leaves	
⇒ Having too big stem	

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance

Mangrove Nursery Establishment

1. Site selection

Consider following items upon selection of mangrove nursery sites:

- **Select the site near the river/ creek, preferably in medium ground level.**
- **Tidal influence is needed the whole year round. However avoid site selection where there is tidal waves.**
- **If tidal influence is not available, dig ditches up to the depth level where tidal influence is available.**
- **Embankment type nurseries require less earthwork and preferred for small scale nurseries such as for village nursery, Excavation type nurseries require more earthworks but preferred for mass production since such nurseries are easier for quality control of seedlings.**
- **Choose the site where there is convenient transportation.**
- **Some mangrove species need the fresh water at nursing time. Others are able to live salinity water. So that, nursery site shall be at brackish water area.**
- **Even for a same species, consider difference of water salinity level from locations to locations and adjust bed levels which is appropriate for the concerned location**

2. Establishment of Nursery Facility

Nursery shall have enough area and facilities to fulfill annual production requirement of the said nursery. Consider following facilities for establishing mangrove nurseries:

Water outlet:
Outlets to control water flow in and out nursery
Nursery beds/ridges:
At least 3 ft. wide and fairly long beds/ridges at the site where there is tidal influence. At least 2 feet wide passage shall be constructed between two ridges for easier operation.
Germination beds:
Similar structure with nursery beds but smaller in size. For non-mangrove species, Build a rack at a minimum of 3 ft high above to avoid tidal inundation, or establish bed floors above spring tide level. Use local products such as bamboo and *Phoenix* poles.
Shed/shade:
Erect bamboo or *Phoenix* poles. Tie the poles to the bamboo slats. Use bamboo screen, coconut frond, Nypa or grass for roofing. Nypa thatch can be used for shading material of nursery beds.
Fence:
Erect fence around nursery for protection against animal browsing and prevent washing away of seed/propagule. Bamboo or P*hoenix* poles can be used.

Also, based on necessity, following facilities shall be introduced in nursery
Potting ground: potting ground with a shed for potting activities
Stock piles for potting materials: stock pile grounds with shed for large-scale nursery.
Compost bed: Necessary if compost(manure) are used for pot filling material
Landing points (Jetty): for transportation of seedlings and nursery materials
Well: for securing fresh water
Fresh Water Reservoir: also for securing fresh water during dry seasons

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance

Plantation Operation

1. Identify Plantation Objectives:

- **Necessary to have well-defined management objectives reflecting objectives and intentions of implementation bodies (FD, UsG and etc.)**
- **For successful results, actual operation and management activities must be based on objectives of plantation**
- **What is Plantation Objective?**

Production: Is it for timber, firewood/ charcoal, post/poles, thatching materials, or other non timber forest products (NTFP)

Protection: Is it for re-vegetation, riverbank/coastline stabilization, sediment trapping, habitat creation or other purposes?

- **Once, a plantation objective is identified, planning and design of plantation (sites, species, planting methods), shall be determined**

2. Planning and Design

Site/ Species selection is the key factor for the successful plantation !

Site Identification and Selection

Factors to be considered for site identification/selection:

Ground level & tidal inundation regime : To understand physical site conditions, identify ground levels (low, medium, high) and tidal regimes of proposed site based on ground surveys and interviews. Determining the height of the average and highest/lowest tides are useful to understand tidal inundation regimes.

Existing vegetation (species): To determine possible plantation species, identify common/dominant species growing or existed at proposed sites based on ground surveys and interviews.

Current and past land use pattern: Though, lands under RFs belong to FD, there are dwellers and traditional users of mangrove forest areas. Identify such land uses and users in/adjacent to proposed sites and consider such influences in plantation operations

Available Areas: Identify actual sites in terms of area, location and topography to incorporate such information in planning and design.

Constraints: Identify potential disasters, pest & diseases, and other constraints which may influence plantation.

Species Selection

Based on biophysical conditions of proposed sites, and plantation objectives, planting species shall be selected. Normally species which are historically found in the area are biophysically adapted to the area, promising success of plantations

(also refer "Volume I-2 species-site matching" and "Volume IV-1 desirable species & preferable species" for potential species for selection)

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance
Plantation Operation

2. Planning and Design

Planning

Planting Area: Identify and determine location/ size of planting blocks, planting excluding areas, access routes, and other information necessary for implementation.

Schedule: Operation planning & design shall be aware of critical timing such as seed collecting, nursing, and planting periods. Also, all of activities must be arranged in time for planting.

Planting Density: Spacing shall be determined based on plantation objectives and species characteristics.

In delta, 1.8 x 1.8 m (6 x6 ft) is widely used, however: 1) Closer spacing ,less than 1 x 1 m (3 x 3 ft), shall be introduced for the purpose of bank/wave impact protection, straight pole production, and fuelwood production; 2) Wider spacing more than 2x 2 m shall be introduced for timber production as well as bigger trees are need.

Selection of spacing will allow to determine total amount of seedlings to be procured for planting.

Planting Method: Determine following factors based on objectives, species characteristics, and availability of seedlings and technologies

planting type: direct sowing, bare-root seedling planting, potted seedling planting

planting pattern: planting in lines, cluster planting, strip planting

species: single spp planting, mixed spp planting

structure: single story plantation, multi stories

3. Establishment Techniques

Land Preparation

• Operations to be covered depends on existing conditions of plantation sites

• Clearing/felling of existing vegetation, dead trees and debris which inhibit further planting operations and growth of planted seedlings shall be considered

• Clear felling, partial felling (in strips or spots) shall be selected based on shade tolerance of planting species, labor intensity, and conditions of remaining vegetation need for clearing/felling

• Felling with burning shall be avoided in mangrove areas. Especially in high ground areas, the soil becomes dry and cracked in the dry months which cause the mortality of planted seedlings.

•For site preparation in mangrove area, partial felling, remaining 40-50% shades without burning has proved to be the appropriate approach from past experiences.

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance
Plantation Operation

3. Establishment Techniques

Planting:

• The planting method to be applied depend on type and availability of seedling stocks, and species introduced.

1) Direct seed/propagule sowing:

- Easiest and the least inexpensive method

- Not more than one-third of propagules shall be buried to hard substrate to avoid suffocation of propagules.

2) Bare-root planting

- Suitable in areas where tides come regularly without prolonged inundation

- Practical because it is easier for survival and lower in nursery and establishment cost

- However, survival of bare-root seedlings are critical influenced by the timing for planting. Try to plant during the beginning of rainy seasons for survival and acclimatization to planting sites

3) Potted seedling planting

- Reliable with higher survival percentage, therefore adapted for planting on high ground level and unstable substrates where low survival of seedlings are expected.

- Labor and cost intensive in terms of transportation when using large-size pots.

- When planting, do not forget to remove plastic bags from seedlings.

4) Wildering planting:

- Use wilderings when seeds/propagules and seedlings are not available by other methods. Care shall be taken not to damage roots when uprooting/collecting wilderings.

•Staking, hole digging, and planting

1) Establish a baseline, and then lines perpendicular and parallel to the baseline, in accordance with planted spacing. Put stakes at intersection of lines

2) Dig planting holes at stakes: remove soil of a hole with twice to thrice the size of pot. Refill cultivated and pulverized top soil to hole up to ground surface.

3) Distribute seedlings to each planting hole and dig holes with the size same as that of pot or propgagule. Plant seedling without plastic bag. Root collar should be at the same level with the ground surface.

4) Remain stakes near planting holes to indicate seedlings have been planted.

- Planting shall be conducted during low tide (of neap tide) for easiness and prevent wash away of seedling immediately after planting

- If available, use (plastic) containers for seedling transportation. Using containers will reduce seedling damages during transportation and improve transportation efficiency

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance

Plantation Operation

Care and Maintenance of Established Plantations

Activities in Initial stage (first 2~3 years):
- **Regular patrol**: to check and monitor any changes/problems in plantation
- **Weeding**: to avoid competitions with undesirable plants and to expose more light to planted trees. Frequency varies among sites but at least twice per year is preferred
- **Removal of debris, insect, and pest and necessary countermeasure**: if detected by patrol
- **Removal of sick or dead trees**: if detected by patrol
- **Replanting**: if large extent of area has poor survival.

Activities in intermediate stage (up to e first thinning):
- Regular patrol: to check and monitor any changes/problems in plantation
- Removal of debris, insect, and pest and necessary countermeasure: if detected by patrol
- Removal/replacement of sick or dead trees: if detected by patrol

Activities in Subsequent stage (first thinning ~, around 5th year):
- **Regular patrol**: to check and monitor plantation in certain intervals
- **Countermeasures against pests and damages**: same as previous stage
- **Thinning**: To reduce competitions among planted trees to improve the quality of plantation. Timing and intensity of thinning depend on the expected age at harvest for the plantation. Trees with malformed shall be thinned. Avoid high intensity thinning in environmental protection forests
- **Pruning**: Cutting of unnecessary and mal-form branches/stems to: promote diameter/ height growth of remained trees; improve the tree form and wood quality. Initial pruning shall be conducted a year or two after the initial thinning. Avoid pruning of more than 30% of the live crown over in 1 to 2 year period to prevent sudden decrease in growth.

Harvesting

Firewood: Firewood can be harvested from the first thinning. In plantations, removals from subsequent thinning and pruning are also utilized for firewood. In the latter stage, removals/products from thinning, topping, and harvesting can be utilized. Firewood can be also harvested from plantations for poles, posts and timber production

Poles, post, timber: thinning and pruning not only generate firewood, the operations allow to increase diameter and height growth of remaining trees. Selective harvesting of poles are possible during the thinning operation.

Non-Mangrove Species Plantation

In extreme high ground and high ground level, and where growth performance of mangrove species are not optimum due to dryness, fast growing non-mangrove species shall be introduced, *Albizia lebbeck (*Kokko), *Melaleuca spp. (*Malarluca), *Casuarina sps,* and *Acacia mangium* are considered to be adapted species.

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance

Natural Forest Operation

1. Principle of Mangrove Natural Forest Management

Identify management objectives based on the principle:

• Sustained Yield Management: Forest resource is managed at 20 to 40 year cutting cycle to provide sustainable harvest with economic returns and at the same time poses naturally regenerating capacity or with minimal assistance.

•Multiple-Use Management: Management and utilization of various renewable forest resources, contributing to local and national socioeconomic development. Resource includes not only wood products but also, non timber forest products and fishery products. Furthermore, functions for environmental protection such as coastal/riverbank protection shall be considered as part of multiple-use management.

•Ecosystem/Bio-diversity Management: Management of mangrove forest for biodiversity and ecosystem conservation purposes. Creating various forest stands in terms of ages, structures, and species compositions to provide diversified niches and habitats

•Social Equity: Opening the opportunity to local habitants to benefit and create livelihood activities, and at the same time protecting/rehabilitating mangrove forests

The ideal multi-layer/function forest management system in the delta can be described as three tiers silvicultural management consists of the following:

(1) "The Protection Tier" normally in the upper canopy to provide: forest physiognomy, seed production; and protection and partial shade for lower layers and forest floor.

(2) "The Production Tier" normally in the middle layer to provide: firewood's, poles and timber and other wood products; growing space for regenerated seedlings and saplings through cutting and harvesting operations.

(3) "The Regeneration Tier" normally in the lower layer and forest floor to provide: favorable regeneration of seedlings; and constant renewal of seedlings.

Protection-production-regeneration functions can be provided through protection-harvesting-regeneration operations conducted simultaneously in mangrove forests. The three tiers silvicultural management can be applied to both natural forests and plantations. Such can be attained through regular forest operations which will be conducted in the proposed mangrove management system under the IMMP. Moreover, monitoring compliance is quite easy as it only requires confirming the continued presence of the upper canopy trees and of adequate regeneration.

In natural forests, the tiered silviculture can be done in following operations: 1) selection and marking of mother trees (including potential trees); 2) assisted natural regeneration or enrichment planting if there are no sufficient regeneration; 3) intermediate harvest (selective cutting) and/or thinning of non-marked trees for domestic or commercial use; 4) final harvest of mature trees; and 5) natural regeneration or artificial regeneration by coppicing and/or planting in the area where harvest operation had been done.

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance

Natural Forest Operation

2. Forest Regeneration Operation

Key points

•For protection and improvement of existing mangrove forests, forest regeneration operations shall be introduced.

•Natural regeneration includes activities such as
- protection of degraded forests
- coppice raising by cutting malformed trees for regeneration of good forests.
- Pruning, vine cutting/clearing, thinning and planting activities

Application

Adaptable sites/locations for Forest Regeneration Operation:

• Areas where regular tide reach at least 10 to 12 days per month twice daily

• Regeneration are usually plentiful in the tidal inundated areas of mangrove forest.

• Low to medium ground level areas.
- if lacking sufficient regeneration, assisted natural regeneration with/without enrichment planting shall be introduced

Operations

- **Climber(vine) cutting & clearing** : to release valuable/desirable species from suppression and damages from climbers and other species
- **Thinning**: To reduce competitions among existing trees to improve the quality of The stand, particularity of the valuable/desirable species.Trees with malformed and less valuable trees be thinned. Avoid high intensity thinning in environmental protection forests
- **Pruning**: Cutting of unnecessary and mal-form branches/stems to: promote diameter/ height growth of valuable/ desirable trees; improve the tree form and wood quality.
- **Regeneration treatments**: cutting & clearing, thinning activities are expected to release under-story regeneration. However, assisted natural regeneration including enrichment planting shall be introduced, if in case under-stocked regeneration is observed in terms of species and quantity.
- **NTFP (non timber forest products) extraction**: For protection, purpose, harvesting shall be limited to NTFP with minimum negative impacts on forest stands

Assisted Natural Regeneration

• Assisted natural regeneration is a process of rehabilitating/regenerating forest lands by taking advantages of trees already growing or planted as a nurse tree in the area.

• Operations normally include, releasing indigenous/ desirable species, planting, tending, and protection activities

• Especially, gap plantings and other plantings will be applied to secure abundant regeneration

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance
Natural Forest Operation

3. Forest Improvement Operation

Key Points

•For improvement of degraded mangrove forests, forest improvement operations shall be introduced.

•Forest improvement operation includes improvement cutting/felling, thinning, regeneration treatments (particularly assisted natural regeneration, enrichment planting)

• Combination of improvement cutting and regeneration operations. More known as "Regeneration Improvement Felling (RIF)", "Natural Forest Improvement Operation (NFIO)", or "timber stand improvement".

Application

Adaptable sites/locations/conditions for Forest Improvement Operation:

- Majority of mangrove species can tolerate shades in early age and survive but the growth will be very slow if overhead cover is not removed.
- Effective for low ground level areas where regular tides reach intermittently to ensure sufficient moisture retention in the soil and induce natural regeneration.
- On high grounds beyond the reach of tidal inundation, it is advisable to perform RIF with planting operations for species tolerate to high ground conditions.

Operations

- **Improvement Felling**: Systematic cutting and felling activity of shaded trees and vines above selected tree specie where natural regeneration of small and valuable trees is highly possible. Regeneration improvement felling is considered as an improvement felling activity and should be done with heavy cutting and felling in the area
- **Thinning**: To reduce competitions among existing trees to improve the quality of the stand, particularity of the valuable/desirable species.Trees with malformed and less valuable trees be thinned. Avoid high intensity thinning in environmental protection forests
- **Pruning**: Cutting of unnecessary and mal-form branches/stems to: promote diameter/ height growth of valuable/ desirable trees; improve the tree form and wood quality.
- **Regeneration treatments**: cutting & clearing, thinning activities are expected to release under-story regeneration. However, assisted natural regeneration including enrichment planting shall be introduced, if in case under-stocked regeneration is observed in terms of species and quantity.
- **NTFP extraction**: For protection, purpose, harvesting shall be limited to non timber forest products with minimum negative impacts on forest stands.

FD Volume IV: Technical Guidance
IV-1:Forestry Technical Guidance
Forest Protection

Key points

- All of forestry operations require regular forest protection and patrolling activities.
- Forest protection is necessary to monitor and maintain forest conditions in good shape
- For forest protection activities in core zones for mangrove protection shall be directly managed and operated by FD
- Forest protection activities buffer zones for mangrove protection shall be jointly managed and operated by FD and UsG members
- Fire protection especially during the dry season and encroachment prevention shall be also regarded as part of forest protection in association with public awareness of mangrove resources

Application

Operations

- Regular forest patrolling: (checking growth/ survival)
- Pest and disease prevention & control: apply countermeasures when detected
- Fire protection & control: establishment of firebreaks and regular patrol especially in dry seasons
- Patrolling & monitoring against illegal cutting/encroachment
- Monitoring & evaluation:

FD's role

- Providing FD camps for base camp for forest protection activities
- Supervise and give legal for forest protection and patrolling activities conducted by UsG members
- Providing basic equipment/materials and technical guidance for countermeasures against fire protection, pest & disease control.

Agroforestry -1: CF Agroforestry along with Creek

Key points

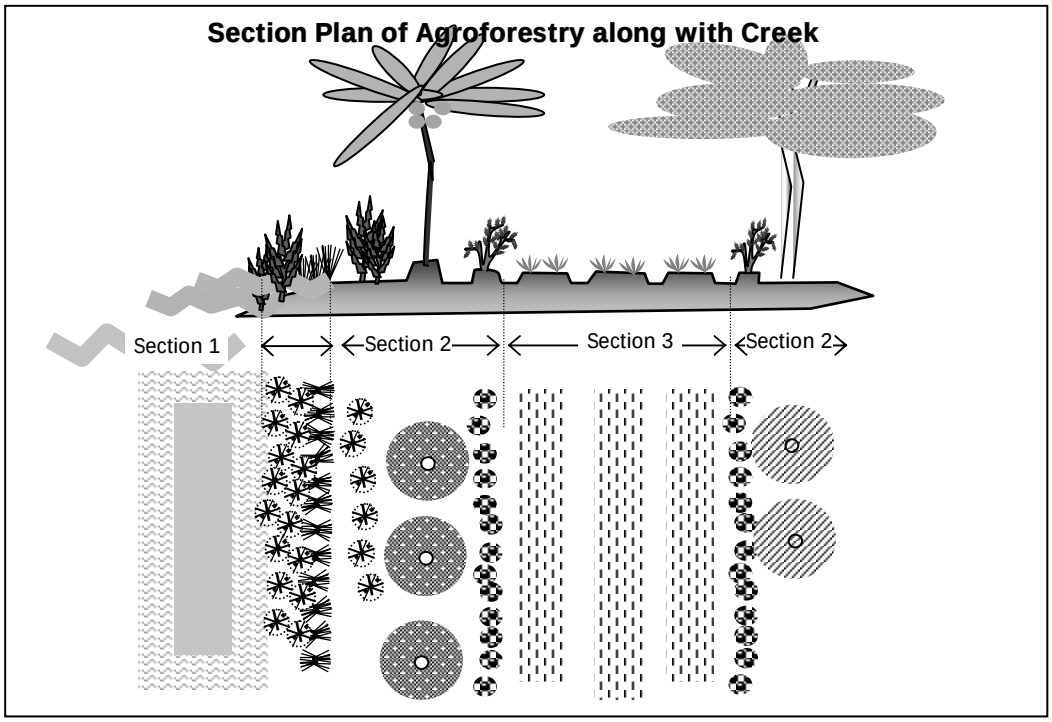
- **FD should promote CF agroforestry to the lands along with creeks for protection the national land from the land erosion**
- **Lands along creeks should be protected through bank protection vegetation by combination of low land vegetations such as reed and low ground mangrove species i.e. nipa, Rizophora, Avicenia, etc.**
- **Behind lands of the bank protection vegetation, low land agroforestry can be promoted by mixed land use methods of fruits trees and vegetables**
- **The CF agroforestry along with creek is designed along with creeks**
- **FD should lead UsG for formulation of sub CF UsG agroforestry**
- **FD have to lead sub CF UsG agroforestry for practicing high ridge cultivation and applying composts**
- **High ridge must be higher than the high tide level**
- **Targeted to promote all CF UsG members**

Methodology

- **Section 1 for River Bank Vegetation with; Avicenna, nipa, reed, and staking**
- **Section 2 for Fruits and Legume; Coconuts Palm, *Sesbania grandiphora***
- **Section 3 for Vegetables, legumes, Flowers; Green gram, Okra, Chile, Aster**

Rule

- **FD should lead the sub UsG for developing vegetation at section 1 against to land erosion**
- **FD should lead the sub UsG for developing fruits trees covering vegetation at section 2 and 3**
- **FD should support sub CF UsG for processing of products and marketing**



Agroforestry-2: Low Yield/Wasted Paddy CF Agroforestry

Key points

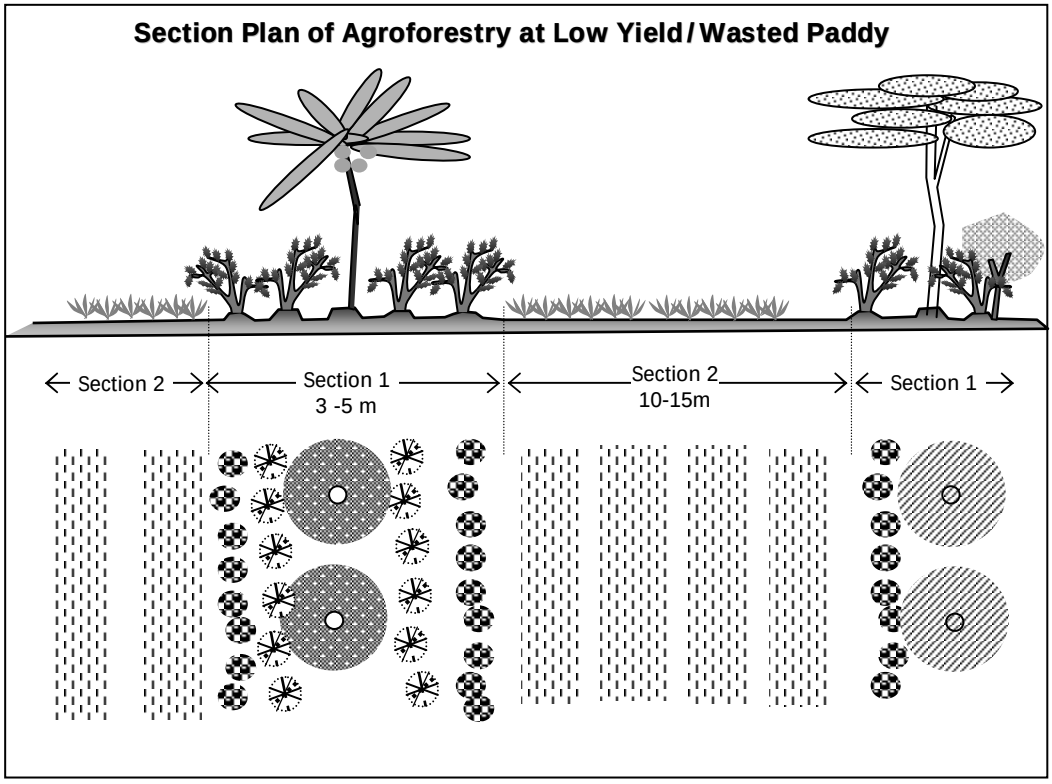
- **FD should promote CF agroforestry to the low yield paddy/bare lands for obtaining agricultural production through improvement of soil fertility**
- **The CF agroforestry can be promoted to low yield/wasted paddy for fruit and vegetable production**
- **The CF agroforestry can be designed along with creeks and foot paths**
- **FD should lead UsG for formulation of sub CF UsG agroforestry**
- **FD have to lead sub CF UsG agroforestry for practicing high ridge cultivation and applying composts**
- **High ridge must be higher than the high tide level**
- **Target sub CF UsG is farmers/land owners**

Methodology

- **Section 1 for Fruits Trees and Legume; Coconuts Palm, Banana, *Sesbania grandiphora***
- **Section 2 for Paddy in accordance with improvement of soil fertility**
- **Use Sesbania leaves and branches for fodder and paddy composting**

Rule

- **FD should lead the sub CF UsG for developing permanent vegetation of fruits trees at section 1**
- **FD should support Sub CF UsG for processing of products and marketing**
- **FD and sub CF UsG should consider about "one village one product" to create specialized production to the village**



CF Border / Windbreak Plantation

Key points

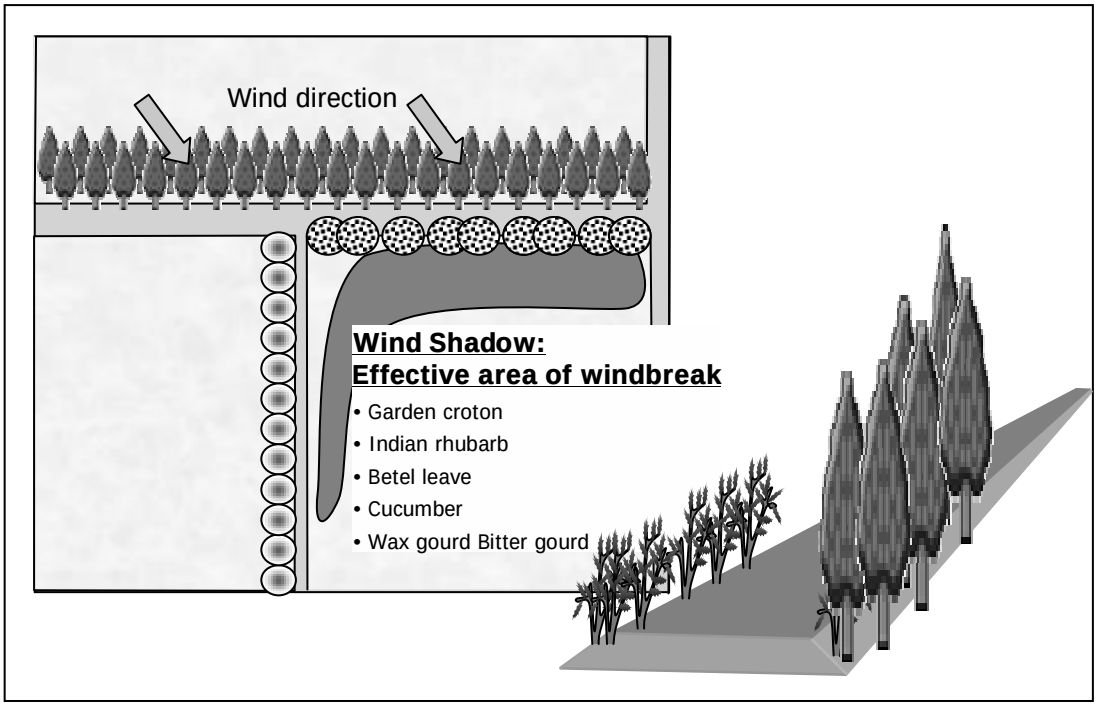
- **Required CF border / windbreak plantation for protecting paddy or land from dry and salty wind**
- **CF border / windbreak plantation can support sustainable paddy use and maintain yield of paddy**
- **CF border / windbreak plantation can support double cropping (after paddy , upland crops such as leguminous species) during summer by utilization of wind shadows**
- **FD should lead UsG for formulation of sub CF UsG for CF border / wind break plantation**
- **Target of CF border / windbreak plantation is whole paddy areas**
- **Target sub CF UsG member is farmers / land owners**

Methodology

- **FD can lead UsG for promotion of the tree planting as first step, then promote whole farmers**
- **FD can supply seedling of *Sesbania grandiphora* for the planting**
- **FD should promote utilization of *Sesbania* leaves and branches for fodder and paddy composts**
- **Utilization of wind shadow for cultivation during summer**

Rule

- **FD should lead the UsG for developing border / windbreak planting as permanent vegetation without logging**
- **FD should arrange technology support of Myanma Agriculture Service (MAS) for the sub CF UsG**
- **Bylaw of UsG have to include components for developing border / windbreak planting**



Layout of CF border / wind break Plantation

CF Aqua-Agroforestry -1

Key points

- **CF aqua-agroforestry is one of the countermeasures for illegal land use inside reserved forests**
- **FD promotes CF aqua-agroforestry as one of CF activities without change in land use as forest**
- **CF Aqua-agroforestry aims 4 benefits; 1) tree, 2) fruits, 3) vegetable and 4)aquatic resources**
- **CF Aqua-agroforestry is an intensive land use method by combination of; 1)forestry, 2)agriculture and 3)fish culture**
- **FD should lead UsG for formulation of sub CF UsG for practicing CF aqua-agroforestry**
- **CF aqua-agroforestry must be extensive fish culture with no purchased seed of fish/crab/ shrimp supply, no chemical application, and no purchased feeding**

Methodology

- **FD should supply both mangrove and none mangrove seedlings to the sub CF UsG**
- **Agroforestry seedlings for the CF aqua-agroforestry shall be self supply by the sub UsG**
- **Section 1 is for tree production: Avicenna, nipa,**
- **Section 2 land area is for fruit and vegetable production**
- **Section 2 water body is for aquatic resource production**

Rule

- **FD has to lead the sub CF UsG for following definitions of the forest law**
- **Water bodies of the CF aqua-agroforestry shall be less than 1,250 square feet which is the minimum water surface area in the fishery law about fish culture ponds**
- **Rules and regulations of the sub CF UsG have to be developed for construction, O&M and selling and keeping consistency with the fishery law**
- **FD should arrange technology supports of the fishery department for the sub CF UsG**

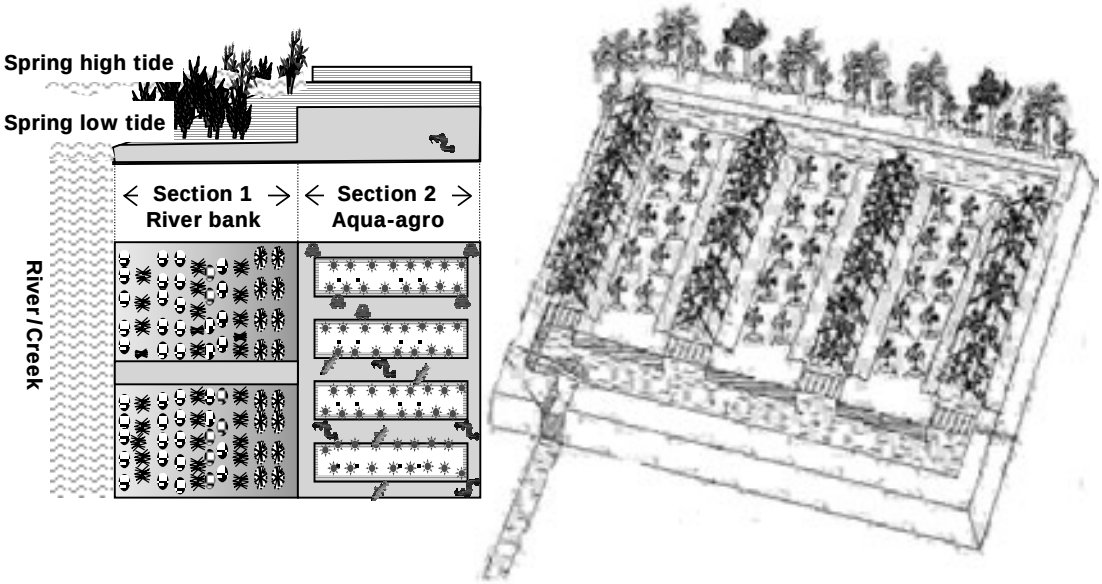


Image of CF aqua-agroforestry

CF Aqua-Agroforestry -2

Construction

- **Dimension of a pond: water surface under 1,250 square feet, depth: 4-5 feet, width: less than 10 feet**
- **Layout: CF aqua-agroforestry land shall be located under tree/fruit tree canopy**
- **Drainage: Pipes for drainage should be set at the bottom of the ponds and connect to channels to creeks or rivers.**

Utilization methods

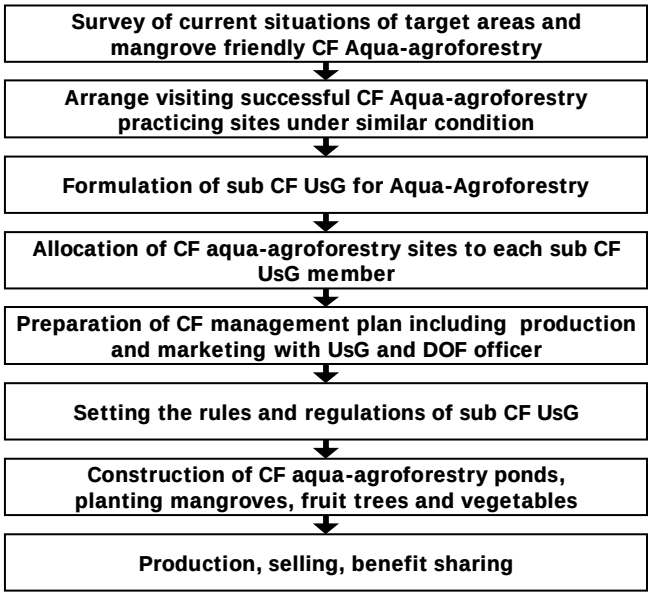
- **Species (Saline Area)**
  - **March to December: Giant tiger shrimp (*Penaeus monodon*)**
  - **January to March: Barramundi (*Lates calcalifer*)**
- **Freshwater Area**
  - **All year round: freshwater prawn (*microbranchium rosembergii)***
- **Feeding: Not necessary**

Maintenance

- **Dikes and sluice gates**
  - **Check the whole dike in order to avoid cracks or holes at least of once a week**
  - **If cracks and holes are found, then fix them as soon as possible, within a week**
  - **Clean fragment sticks around the mesh of sluice every day**
- **Feeding is not recommendable utilization of the water body**

Rules

- **Cannot expand the water area more than 1,250 square feet**



Flow for Promotion and Practice of the CF aqua-agroforestry

CF Agroforestry Nursery

Key points

- **CF agroforestry is the important CF activity in forest lands for supporting livelihood of CF user groups**
- **Agroforestry nursery is to be the center of the sustainable CF agroforestry activity**
- **CF agroforestry nurseries aim self seedling supply for CF agroforestry and selling surplus seedlings to outsiders**
- **The CF agroforestry aims self supply of agroforestry seedlings such as fruits, stocks, scions, vegetable stocks, vegetable seeds, etc**
- **FD should support for starting the agroforestry nursery as an activity of sub CF UsG for agroforestry**

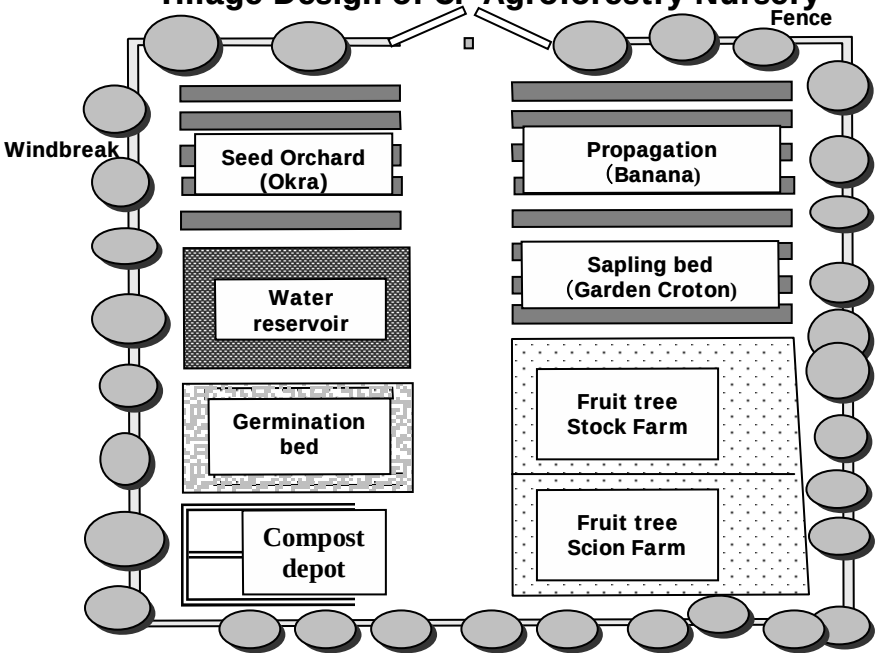
Methodology

- **FD in collaboration with MAS should supply technology for operation and management of the agroforestry nursery**
- **FD should supply stocks and scions for production of agroforestry seedlings**
- **Grafted fruit seedling production: Mango, Jack fruit, etc**
- **Layering seedling production: Citrus species such as Lemon, Lime, etc**
- **Propagation: Banana, etc**
- **Sapling production: chrysanthemum, Garden Croton, etc**
- **Seed production: Okra (lady finger), Cucumber, etc**

Rule

- **FD has to lead the sub CF UsG for following definition of the forest law**
- **Embankment type water reservoir should be a center of the CF agroforestry nursery for a supply of freshwater for watering**
- **FD should arrange technology support of MAS for the sub CF UsG**

Image Design of CF Agroforestry Nursery



FD Volume IV: Technical Guidance
IV-2: CF Prototype - CF Public Woodlot -

Key points

- **CF user groups and FD can share responsibility for management of reserved forests**
- **CF public woodlot is the one of the CF application method**
- **CF public woodlot shall promote for protection of the national land and CF areas**
- **CF public woodlot can promote for improvement of economic activities**
- **CF public woodlot can support weak/poverty families who can not practice in individual CF activities**
- **CF public woodlot can be promoted to all village area**

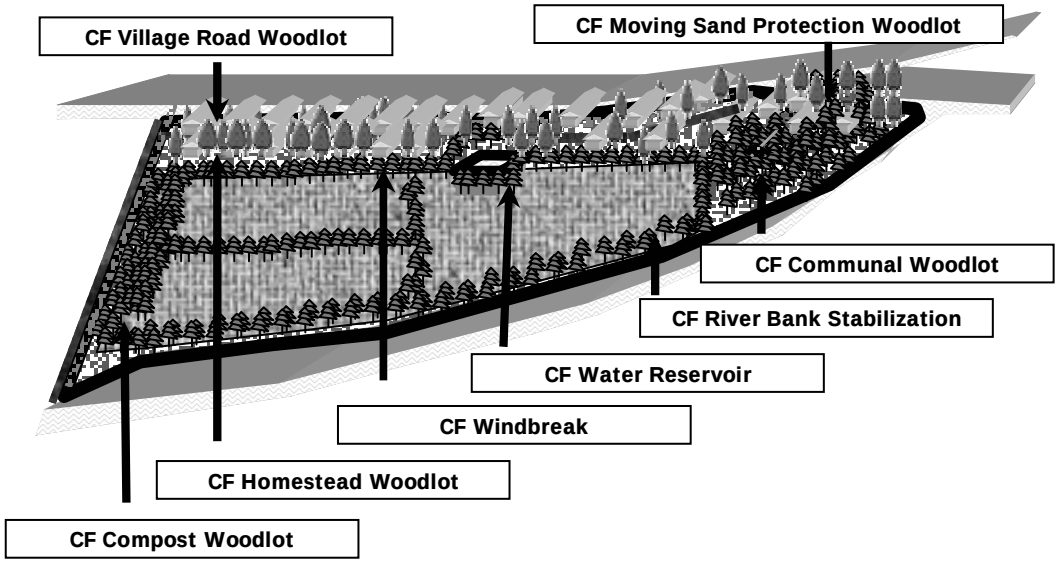
Methodology

- **FD shall obtain understanding about CF public woodlot of CF user groups by showing menus of CF public woodlots**
- **FD shall support CF user groups for application of CF public woodlot based on their intentions**
- **FD shall allocate CF public woodlot areas based on UsG's intentions**
- **FD shall support CF user groups for delineation, mapping and planning of CF public woodlots**
- **FD shall support formulation of sub CF user groups for each type of CF public woodlot**
- **Tree seedlings and technology for practicing CF public woodlots shall be supplied by FD**
- **FD shall support harvesting and utilization of production of CF public woodlots, based on rules and regulations for each type of CF public woodlot**

Rule

- **FD shall support CF user groups for implementation of CF activities based on the management plan**
- **FD shall register new members or drop out members of CF public woodlot UsGs**
- **FD shall lead CF public woodlot user groups for updating the management plan/map: updating of CF user group members, updating of CF areas, etc**

Sample of CF Public Woodlot



Key points

- **CF school woodlots, monastery woodlots, church woodlots, VPDC woodlots, etc shall be established based on collaboration with such groups or authorities**
- **Approaches to such group activities, facilities or authorities are important CF promotion activities**
- **Those groups, facilities or authorities are pipes for connection between FD and people**
- **Those CF activities are objected to establish environmental forest that contribute to national and public benefits such as environment conservation, education, recreation, etc.**
- **Those CF activities are also objected to earn budgets for activities i.e. school or monastery building renovation, bridge maintenance, etc.**
- **Those CF activities are promoted to all reserved forest areas where people settled**

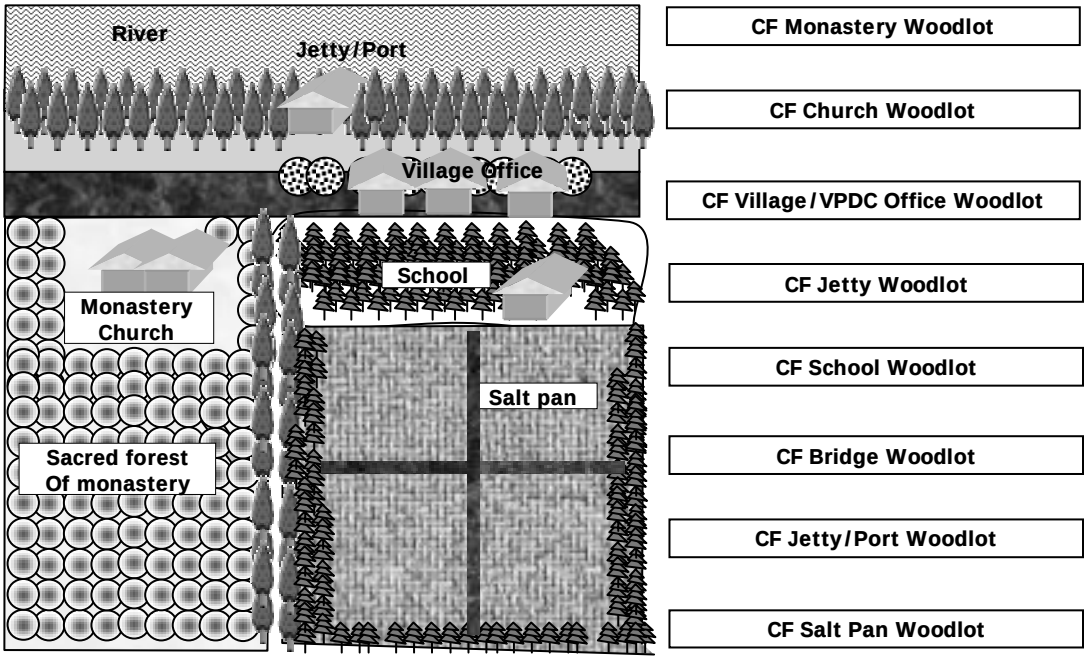
Methodology

- **FD shall obtain understanding about the CF activity of schools (PTAs), monks, nuns, village authorities as key persons of the CF activities**
- **FD shall support formulation of CF user groups for those CF activities**
- **FD shall allocate CF public woodlot areas based on objectives of the activity**
- **FD shall support the CF user group for delineation, mapping and planning of CF areas**
- **Tree seedlings and technology for practicing those CF activities shall be supplied by FD**
- **FD shall support harvesting and utilization of products of those CF activities based on rules and regulations for each CF activity**

Rule

- **FD shall support the CF user group for implementation of those CF activities based on the management plan**
- **FD shall register new members or drop out members of CF public woodlot UsG**

Image of CF School, Monastery, Church, Salt Pan etc



Key points

- **CF can help improving paddy fields and increasing production of paddy**
- **Paddy fields in the delta have low production, low benefits because of circumstance**
- **Paddy fields have to be protected by forest vegetation from sun ray, wave, wind, rain, etc**
- **Forest vegetation by CF can also supply shade for cattle & buffalos**
- **FD can promote CF to farmer-paddy owners and also casual labors for the paddy**

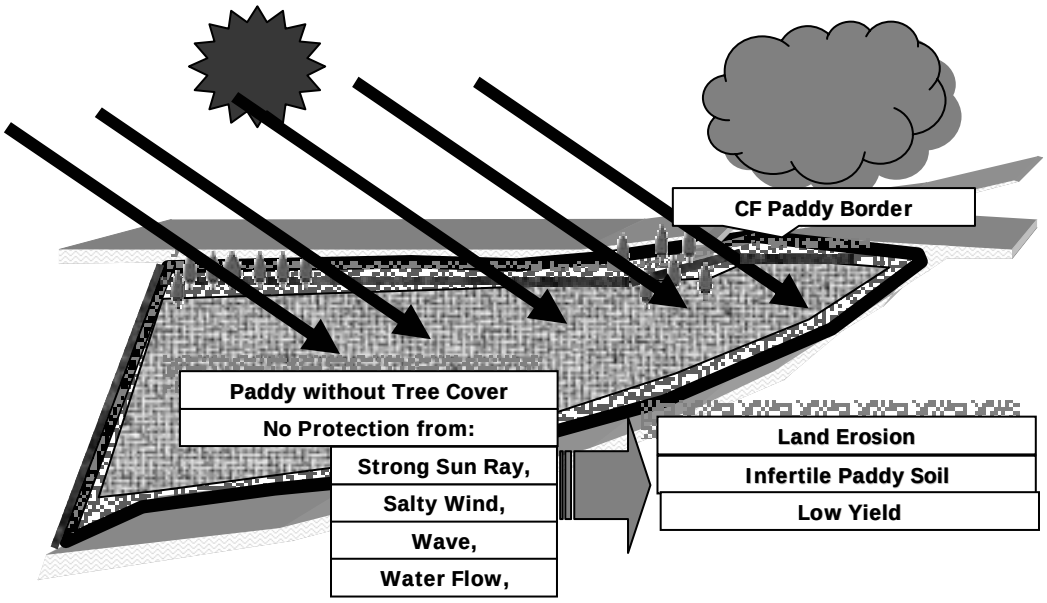
Methodology

- **FD shall approach paddy owners first and obtain understanding about functions of mangrove**
- **FD can arrange technical support of MAS for approached and interested paddy farmers**
- **FD shall discuss with farmers about a ratio of mangrove (forest) areas to be planted based on objectives of the CF paddy activities**
- **CF paddy can target various kinds of activities i.e. river bank stabilization, compost making, wind break establishment, fodder production, shade establishment, homestead garden establishment, etc**
- **FD shall allocate / delineate CF paddy area with the farmer**
- **FD shall support a formulation of CF paddy CF user group including casual labors for the paddy**
- **FD can allocate CF areas for the casual labor as CF communal woodlots, CF individual woodlots**
- **FD shall support maintenance of CF paddy woodlots**

Rule

- **FD shall delineate whole paddy areas in reserved forests as CF paddy areas for confirmation about land utilization and fixing ratio of mangrove areas to the paddy field**
- **FD shall register new members or drop out members of CF paddy UsG**

Function of CF Paddy



Key points

- **The CF village is the only legal measure to register villages formed inside the reserved forest, and to change current illegal situations of existing all villages**
- **Delineation of CF villages serve for fixing village borders, and can be countermeasures against current verbal delineation of village areas which has no consistency with legislation**
- **FD can promote CF villages to VPDC/village authorities related to the village located inside the reserved forest,**
- **User group members of CF village shall be all villagers**
- **Objectives of CF villages are for administration and protection of natural lands through fulfillment of forest function through CF activities**
- **CF areas of CF villages shall be delineated for all types of land uses such as residential area, paddy, etc**

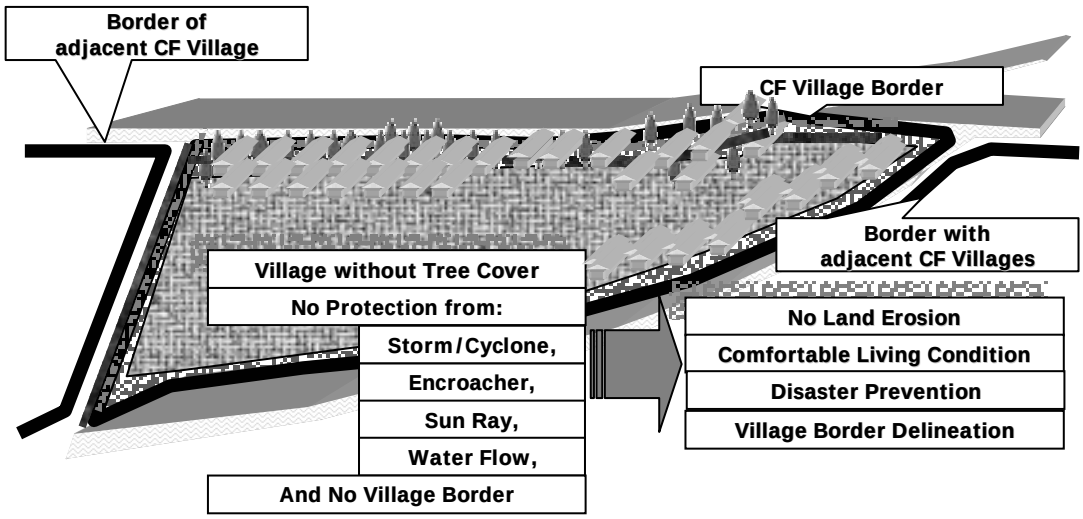
Methodology

- **FD shall approach village/village tract authority members first for promotion about CF villages**
- **FD shall discuss with the authority member about the objectives of the CF village**
- **CF villages can target various kinds of activities i.e. village border management, river bank stabilization, compost making, wind break establishment, fodder production, shade establishment, homestead garden establishment, etc**
- **FD shall allocate / delineate CF village areas to all user group members or as community sharing**
- **FD shall support a formulation of CF village user group including casual labors as the member**
- **FD can allocate CF village areas based on coordination between adjacent villages**

Rule

- **FD shall support any dispute arbitrations**
- **FD shall keep contact about update of management plan with VPDC for change about the CF village user member**
- **FD shall register new members or drop out members of CF village user groups**

Image and Function of CF Village



Key points

- **FD has entirely shortage of budget for CF management and support**
- **The FD CF camp is an emergency countermeasure for scarcity of the budget for implementing t CFI**
- **FD CF camps shall be the best observance of each article of CFI**
- **FD CF camps shall be a model for ordinary CF user groups to avoid any special cases against CFI**

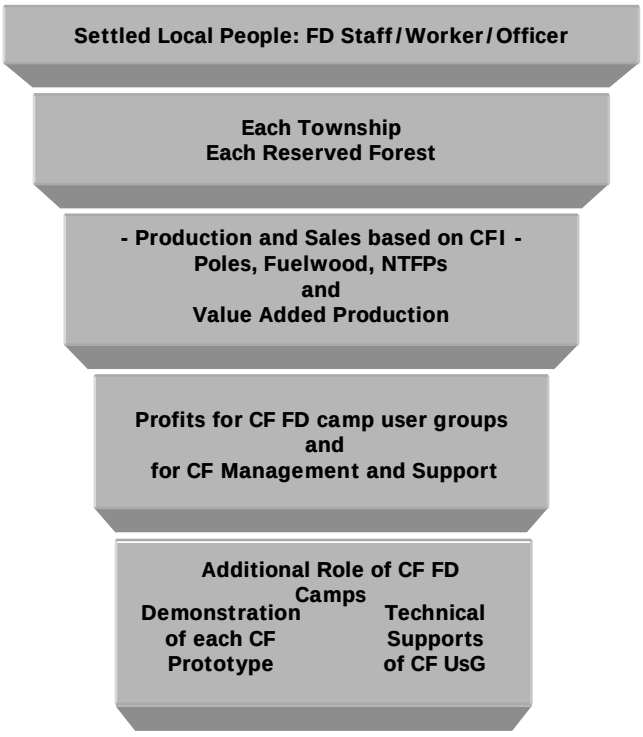
Methodology

- **FD CF camps can be promoted to FD staffs/workers/officers who can be regarded as local settlements by CFI**
- **FD can allocate appropriate areas for CF FD camps to the user group based on CFI**
- **FD can support preparation of management plans and maps based on CFI for granting CF certificates to the FD CF Camp user group**
- **The management plan shall cover design for demonstration and production in addition to ordinary contents**
- **The management plan shall employ rotational plantation and prepare value added production**
- **FD can support the CF FD camp user group for developing rules and regulations including benefit sharing between the CF FD camp user group and FD for CF management and support activities**

Rule

- **The FD CF camp shall be in accordance with CFI and no special cases shall be applied**
- **FD shall register new members or drop out members of CF FD camp user groups**

Essences of FD CF Camp



FD Volume IV: Technical Guidance
IV-3:Buffer Zone Management Technique

Key points

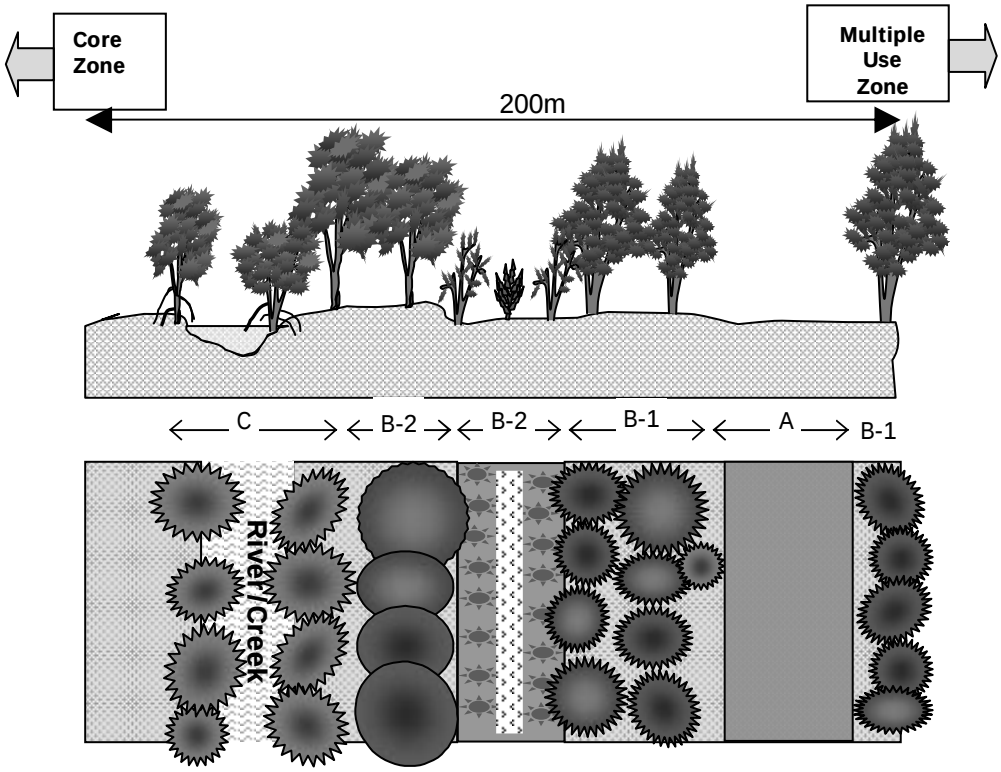
- **Combination of following activities ; 1) fire break, 2) CF Prototypes (Plantation, agroforestry, aqua-agroforestry, river bank management), and 3) Patrolling**
- **Joint buffer zone patrolling system between FD and UsGs**

Utilization

- **Section A for fire break and patrol,**
- **Section B for various CF prototypes (for example B-1 as CF plantation, B-2 as CF for agroforestry**
- **Section C for riverbank management including river bank stabilization, and CF aqua-agroforestry**

Rule

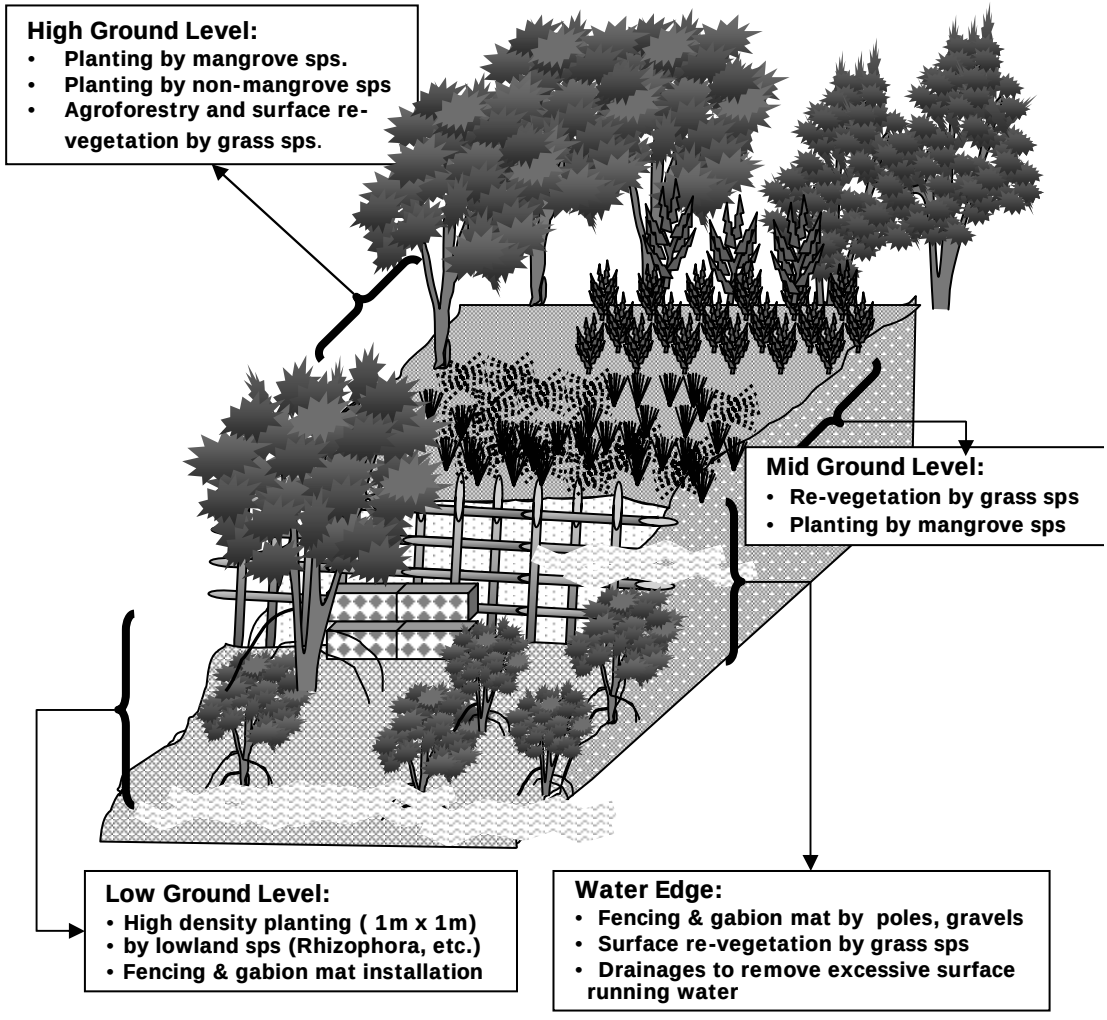
- **FD staffs authorize and supervise buffer zone activities by user groups**
- **Joint buffer zone patrolling shall be conducted by CF User's group in cooperation with FD staffs.**
- **FD to provide basic equipment, materials and technical guidance for patrol, agroforestry and other CF operations**



FD Volume IV: Technical Guidance
IV-4: CF River Bank Management Technique

Key points

- **Combination of reforestation and re-vegetation based on situation and ground level**
- **Utilization of grass species. and fast growing non-mangrove species for erosion control & stabilization**
- **Minor construction works (fencing, gabion mats) to be introduced for important / urgent areas**
- **FD to cover direct operations in the core zone**
- **FD to provide seedlings and technical guidance to CF river bank management in the buffer zone and the multiple-use zone**



CF subgroups for implementation and maintenance of rive bank management

V-1 FD Camp for CF Management and Support, CF Extension Center cum Mangrove Garden

Key points

- **Objective of the center is for sustainable CF activities through developing close relationship among villagers/local community, local authorities and FD**
- **FD should maintain FD camps for CF management and support, a CF extension center cum mangrove garden at each FD camp because of a remoteness of the mangrove area**
- **Role of CF Extension Center is for demonstration and training of CF activities to the CF UsG**
- **Role of Forest Camp (FC) should be a front office of FD CF management and support (CF Task Force)**
- **Player: FD staffs of CF task force under management of FD township**
- **Location of the FD camp: At least one FD camp should be allocated to each reserved forest**

Methodology (Objective and Activities)

- **Objective: Demonstration, training, and consolidation of CF activities**
- **Activities:**
  - **Demonstration: CF activities i.e. Mangrove environment, O & M of CF UsG, technology regarding; Seedling production, plantation, NFIO, CF agroforestry, CF aqua-agroforestry, CF paddy woodlot, River bank stabilization, embankment type water reservoir, women group activity, etc.**
  - **Training of FD CF task force staff, villager/community and CF UsG about the CF activities**
  - **Consolidation of CF activities: Convention with local authority about Patrol, Holding CF UsG meeting, Information and technology center regarding CF activities, Monitoring of CF activities**

Rules

- **Development of mangrove conservation formation by the FD, Local authorities and Villagers**
- **Information sharing about the training with CFDTC**

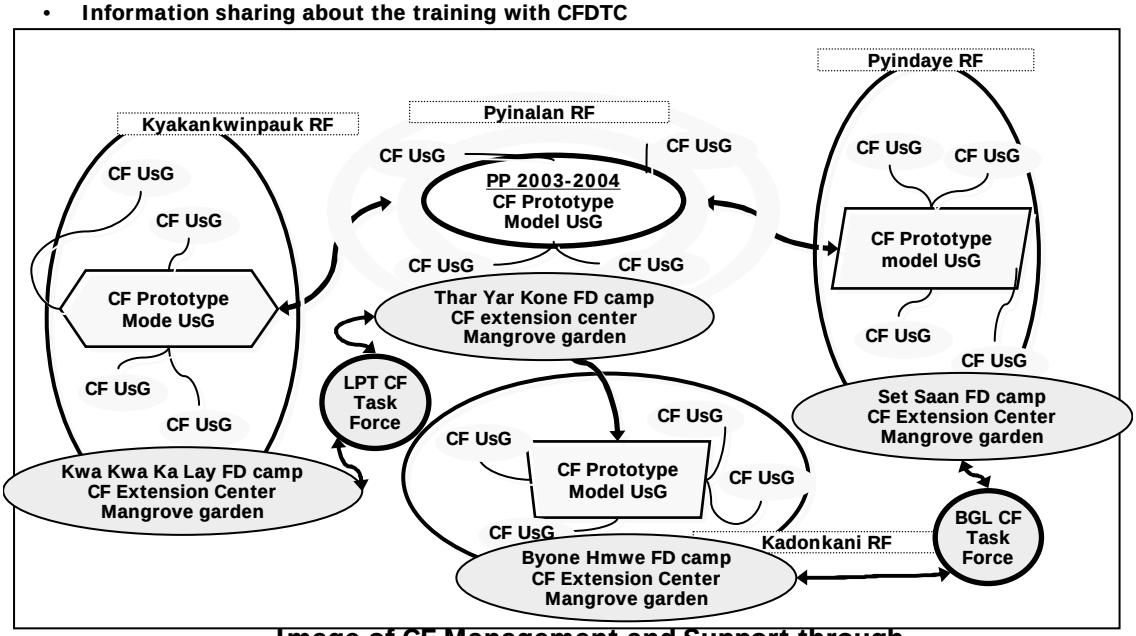


Image of CF Management and Support through FD Camp, CF Extension Center and Mangrove Garden

FD Volume V: Consolidation Activities of CF
V-2 Double Cropping (Utilization of Paddy during Summer)

Key points

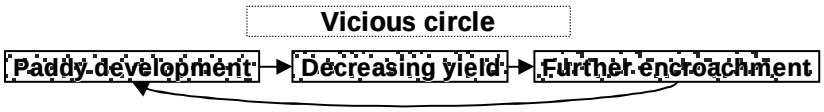
- **No utilization of paddy fields during summer causes loss of soil fertility**
- **No utilization of paddy fields during summer is one of reasons of the vicious circle below**
- **Double cropping is one of counter measures to break through the vicious circle**
- **So FD promotes double cropping as a part of CF paddy for supporting CF as well as improvement of livelihood**

Methodology

- **Target for promotion of double cropping is CF UsG member**
- **Target area for promotion of double cropping is paddy of UsG member**
- **FD should promote double cropping through formulation of double cropping subgroups and/ or CF Paddy subgroups**
- **Cultivation methods: double cropping e.g. rice and green gram, cultivation under roof shade e.g. garden croton, and mix cropping green gram and cover crops e.g. sweet potato, clover**

Rules

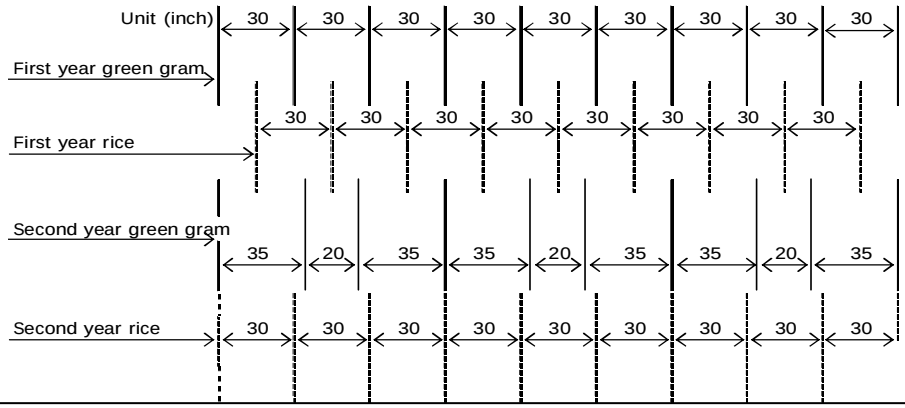
- **FD should lead UsG to minimize inputs; introduce seed collectable crops**
- **FD should lead UsG to minimize cultivation period e.g. raising vegetable seedlings**
- **FD should lead UsG to increase double cropping cultivation area year by year in the paddy**



Sample of Double Cropping Calendar

Subject	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Monsoon Paddy				planting				harvesting				
Green Gram	harvesting								planting			

Sample of Planting Design



FD Volume V: Consolidation Activities of CF
V-3 Embankment Type Water Reservoir

Key points

- **Where there is no fresh water, no production, no population. So let's construct the water reservoir, because water is critical foundation for the daily life and agri-production in the delta**
- **Construction of durable reservoir: Digging type of water reservoir has no durable against tide intrusion into the reservoir, so the embankment type water reservoir is the better fit for the delta**
- **Maintenance: CF UsG must keep maintenance of the reservoir**

Key points for the Construction of the reservoir

- **Through compaction of the embankment by every10 inch at height**
- **Utilization of coconuts fibers instead of rice straw as of organic glue for long year durability of the embankment and bottom**
- **Do not dig the water reservoir-bottom level too low, it must be higher than the high tide level**
- **Silt, lime and coconut fiber are the major construction material of the embankment**

Key points for the management of the water reservoir

- **The CF UsG is a recommendable management body of the reservoir for planning, construction and maintenance inside reserved forests**
- **The water use fee should be collected for the maintenance of the reservoir**

Planning, Management and Maintenance

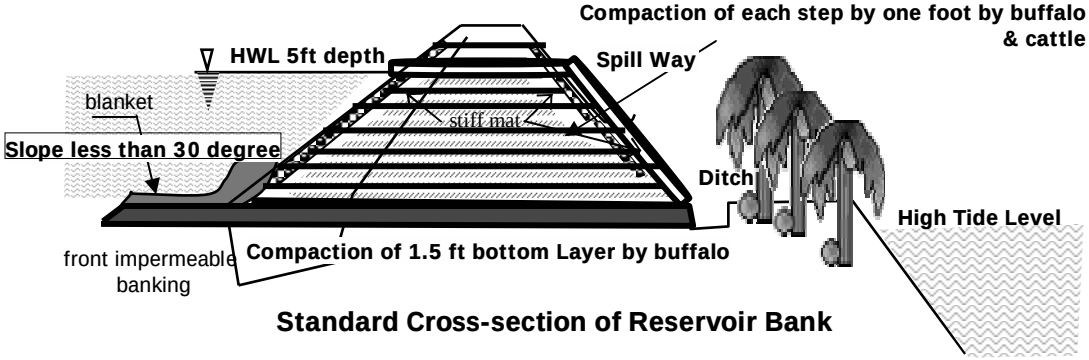
- **FD can allocate water reservoir site in the RF based on the condition i.e. ground level, soil, and accessibility**
- **FD can support the planning of construction, management and maintenance of the reservoir by CF user group**
- **FD can support UsG for preparation of the reservoir management and maintenance as of bylaw including collection of water fee, periodical check of reservoir condition**

Rules

- **Based on FD permission, the water reservoir must be constructed inside the reserved forest**
- **FD has to support CF UsG request regarding water reservoir**

Important Subjects for the Construction

- **Compaction of the bottom and embankment with clay, lime, and coconuts fiber by buffalo and cattle.**
- **Vegetation must be located outside of the embankment**
- **Set spillway at the highest water level for over flow**
- **Construct ditch for drainage of the over flowed water**
- **Embankment slopes must be less than 30 degrees for stability**
- **The reservoir configuration must be square**
- **The dimension of the reservoir must be consulted of experienced civil engineer of the delta**
- **Clay soil must be applied for bottom and embankment construction**



Standard Cross-section of Reservoir Bank

FD Volume V: Consolidation Activities of CF
V-4 CF Compost Woodlot

Key points

- **Applying compost to agri-land is an essential activity for sustainable use of paddy for maintaining yield by means of keeping soil fertility**
- **Compost can maintain yield of agri-production**
- **Compost woodlot can promote together with CF agroforestry, CF aqua-agroforestry, CF paddy woodlot, etc. that requires compost application**

Methodology

- **Target stakeholders for such compost making activity is CF UsG members**
- **Target area for production of compost material is all CF area such as CF plantation, CF agroforestry, CF paddy, CF village woodlot, CF school woodlot, CF monetary woodlot, CF FD camp, where need of compost exists.**
- **Construction of cattle houses and duck/ pig cabins is good for collection of animal dung**
- ***Sesbania grandiphora* plantation is recommended for production of organic material for compost**

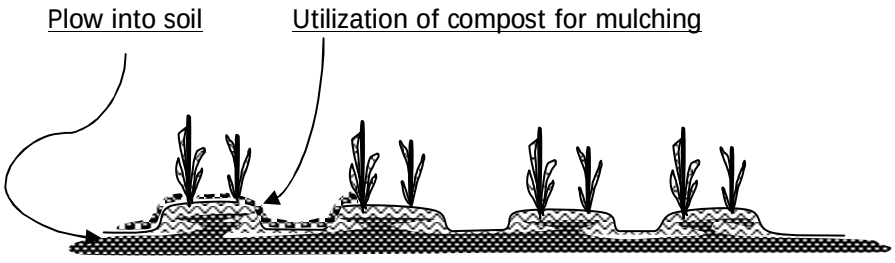
Compost making

- **September: Cumulate materials by layers (20 % dung), add water and cover with mad**
- **October: turning over compost two times every 10 days**
- **November- January: apply compost to paddy fields and/or farmland**

Applying methods

- **Applying compost on surface**
- **Applying compost on surface and plowing into soil**
- **Combination with mulching and compost**

Example for applying compost on and in a farmland



FD Volume V: Consolidation Activities of CF
V-5 Self Reliance Micro Credit (SRMC)

Key points

- **Objective: Establishment of CF mangrove rehabilitation through consolidation of home economy**
- **Livelihood improvement is foundation of sustainable CF activities**
- **Utilization of SRMC;**
  - **not restricted rending purpose but recommended for start small business such as agroforestry**
- **Self Fund: All users are investors and borrowers**
- **Own management by UsG based on bylaw**

Role of FD

- **Promotion of SRMC to CF UsG**
- **Lead CF UsG for development system of SRMC such as bylaw**
- **Support CF UsG for operation and management of SRMC**
- **Support CF UsG by supplying materials regarding CF activities e.g. seedlings**
- **Support CF UsG by supplying information about SRMC activities by other UsG**

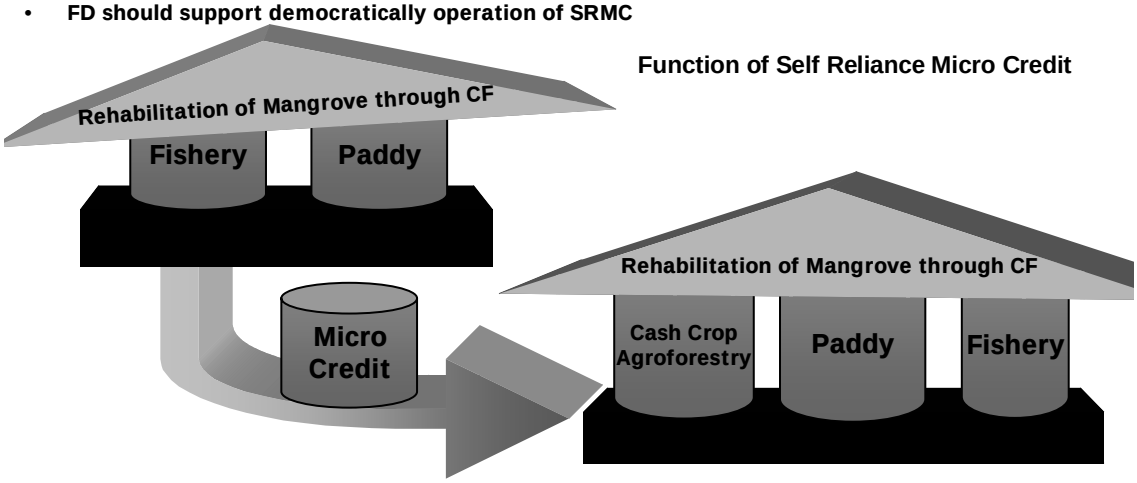
Structure of SRMC

- **Organization 1: Formulation of sub UsG of SRMC who intend to participate namely: sub UsG SRMC**
- **Organization 2: Formulation of Bank Management Committee of sub UsG SRMC**
- **Organization 3: Selection of auditing committee member**
- **Source of loan capital: compulsory savings of all CF UsG**
- **Hold the assembly of sub UsG SRMC every month led by BMC of sub UsG SRMC**
- **Flow of rending**
  - **Application for borrowing money (member of SRMC to the BMC)**
  - **Monthly meeting of the BMC for reviewing the application for accept or reject, if yes,**
  - **Preparation contract between the BMC and applicant**
  - **Rending**
- **Auditing SRMC operation and management and**
- **Apply penal conditions for breach**

Rules

- **FD supports should be limited within technical matters**
- **FD staff should not be a member of SRMC**
- **FD should support democratically operation of SRMC**

Function of Self Reliance Micro Credit



FD Volume V: Consolidation Activities of CF
V-6: Water Filtration

Key points

- **Sources of drinking water are limited to rain water, well, water reservoirs**
- **Qualities of water (smell, transparency, etc.) is not favorable for drinking**
- **There is a risk of health problems from current available drinking water**
- **Change current drinking water to favorable drinking water**
- **Getting safer drinking water during dry season without buying water**

Water Filtration Function

- **Gravel: preliminary filtration of solid material from raw water**
- **Charcoal: deodorize, purify, and removes unfavorable mineral from the raw water making favorable drinking water**
- **Coconuts fiber layer: secondary filtration and for dividing each layer**
- **Sand: final filtration for drinking**

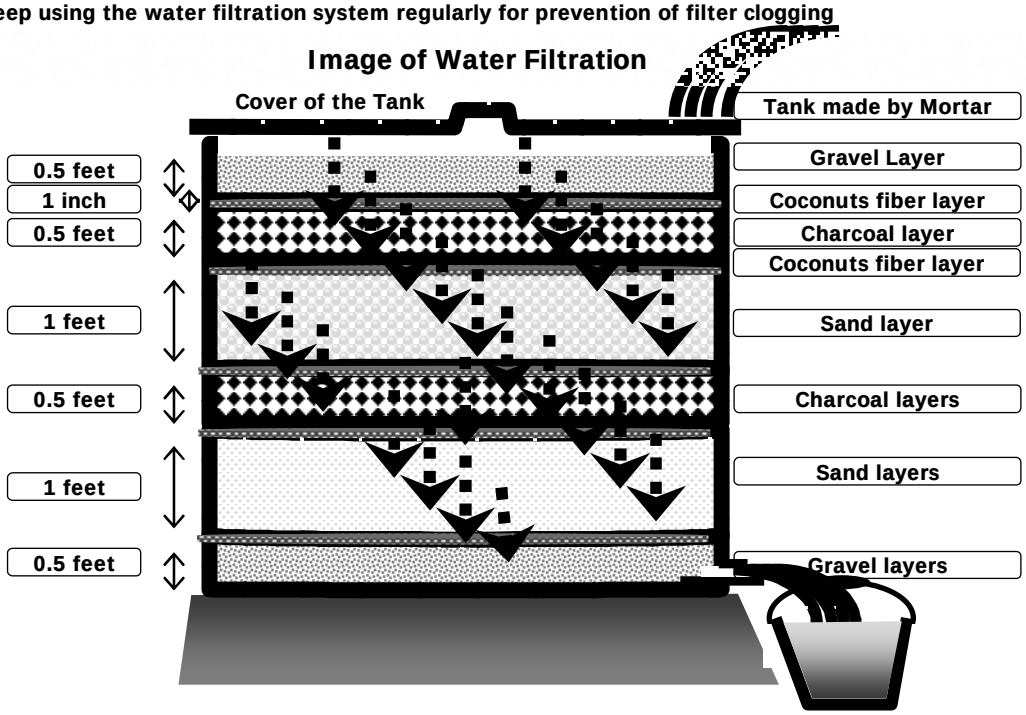
Methodology

- **Prepare the tank (~50gal) by metal/plastic frame and mortar for protection from rusting by salt**
- **Collect and prepare material for each layer (gravel, sand, charcoal, and coconuts fiber)**
- **Put each material by layer one by one by the indication of the figure**
- **Pour raw water from top, and then wait filtered water from the tap/hole at the bottom**
- **Gravel and sand should be recycled by sterilizing in boiling water, and charcoal should be replaced for maintenance, when filtered water has odor, changes in taste and volume**

Rules

- **Avoid drinking filtered water without boiling**
- **CF water reservoir sub user group operates the water filtration**
- **Keep using the water filtration system regularly for prevention of filter clogging**

Image of Water Filtration



FD Volume V: Consolidation Activities of CF
V-7: Value Added Products
- an Example from Boiled Phoenix Heart Trial Production -

Key points

- **Value added production is one of essential activities for income generation**
- **Value added products are efficient way of utilization of existing natural resources**
- **Phoenix heart (shoot) for commercialization is an example of the value added product**
- **Other candidates value added products are medicinal plants, seasoning material, perfume material, mush room, flowers, charcoal, etc**
- **Villagers/CF user groups have limited information about market, values, and technology for the production, so FD has to lead and support the production and selling including related permission**

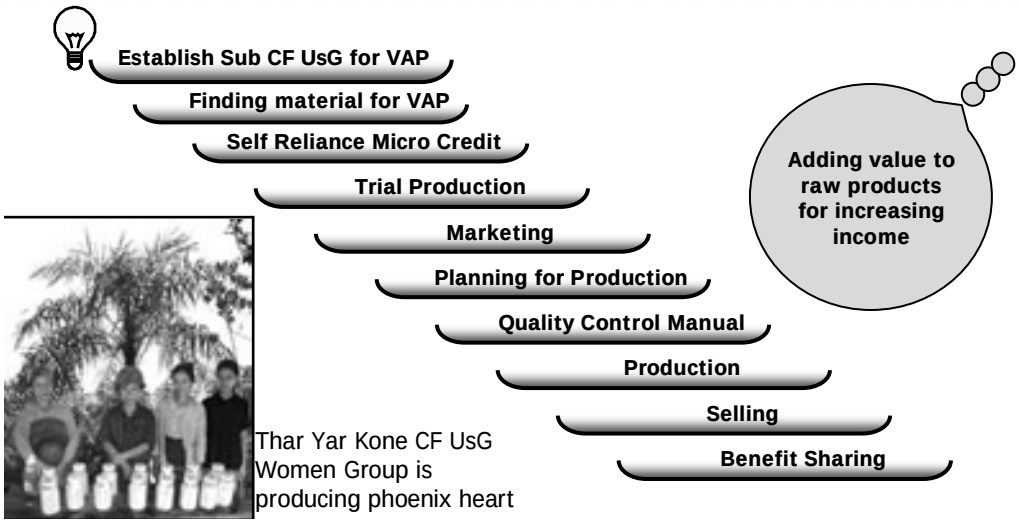
Methodology

- **Form CF sub user group such as a women group for production and sale of value added products**
- **FD leads the sub CF user group for finding candidates for value added products**
- **FD leads the sub CF user group for establishing self-reliance micro finance**
- **FD leads the sub CF user group for preparation of trial production for marketing**
- **Based on needs of market such as production volume, quality and target price, a plan for the value added products can be finalized**
- **FD support sub CF user group for organizing production and selling teams**
- **Sub user groups start production and prepare production manuals for quality control**
- **In compliance with production, start selling based on promotion.**
- **Sell the production to whole sellers or retail merchants directly**
- **Share benefit based on developed rules and regulation with consideration for continuous production**

Rules

- **Be serious with quality control, secure food safety first**
- **Develop own products of sub CF user group "each group each products"**
- **No unnecessary exploitation of natural resource! Natural resource material for value added products shall be reproduced**

Road to the Commercialization of Value Added Products (VAP)



Thar Yar Kone CF UsG Women Group is producing phoenix heart

FD Volume V: Consolidation Activities of CF
V-8: Value Added Forest Products
- Charcoal Production -

Key points

- **Charcoal can increase production/profits from CF activities**
- **Management plans of the value added production have to be prepared by same manner with CF management plan**
- **Charcoal production have to be operated under FD CF management and support based on permission of Ayeyawady Division**
- **High quality white charcoal production technology is required**
- **Rehabilitation of charcoal market is required such as price setting for each different quality of charcoal, for domestic consumption and for export**

Methodology

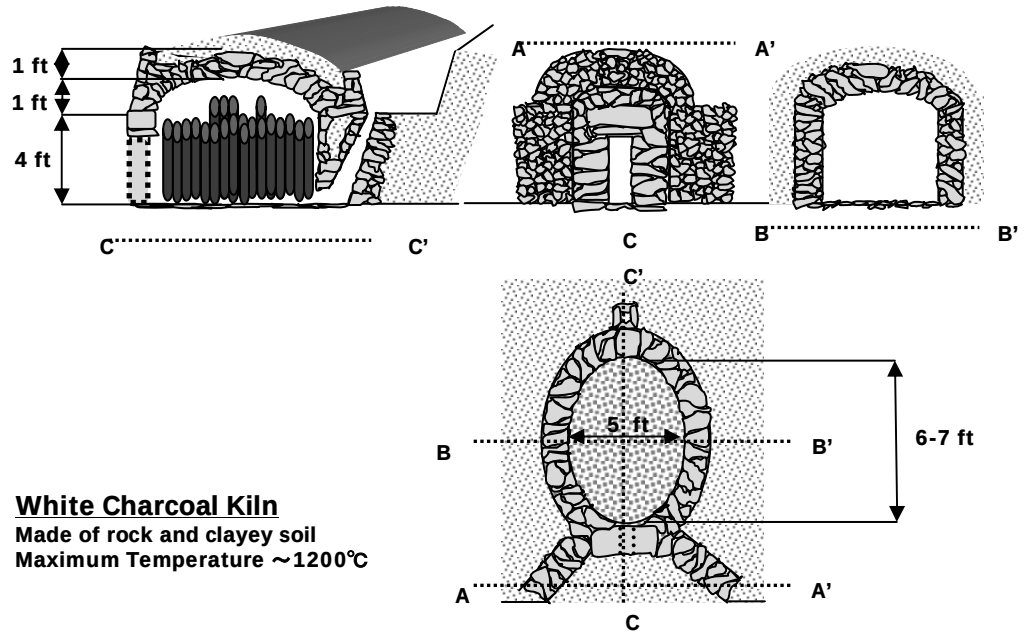
- **Charcoal have to be produced and harvested based on CF management plan at plantation**
- **FD supports UsG for formulation of CF sub user group for charcoal production and merchandizing**
- **FD supports charcoal production technology to the CF UsG**
- **FD supports the CF UsG for issuance and registration of sales voucher for charcoal**

Installation of Charcoal Kiln and production

- **FD can install white charcoal kilns at CF extension center for demonstration**
- **White charcoal kiln construction technology can be introduced by donors**
- **FD can prepare the white charcoal production manual and conduct its extension**

Rule

- **Charcoal production material shall be harvested under CF plantation**
- **Charcoal shall be produced based on rotational CF plantation and felling plan**
- **CF charcoal have to be merchandized based on the CF sales voucher**



White Charcoal Kiln

Made of rock and clayey soil
Maximum Temperature ～1200℃

FD Volume V: Consolidation Activities of CF
V-9: Efficient Stove

Key points

- **Efficient stove saves 30 to 40 % of fuelwood consumption and contribute to home economy**
- **For firewood, briquette, charcoal such multiple type of efficient stove should be promoted**
- **Efficient stove can promote to all UsG member as of their duty**

Methodology

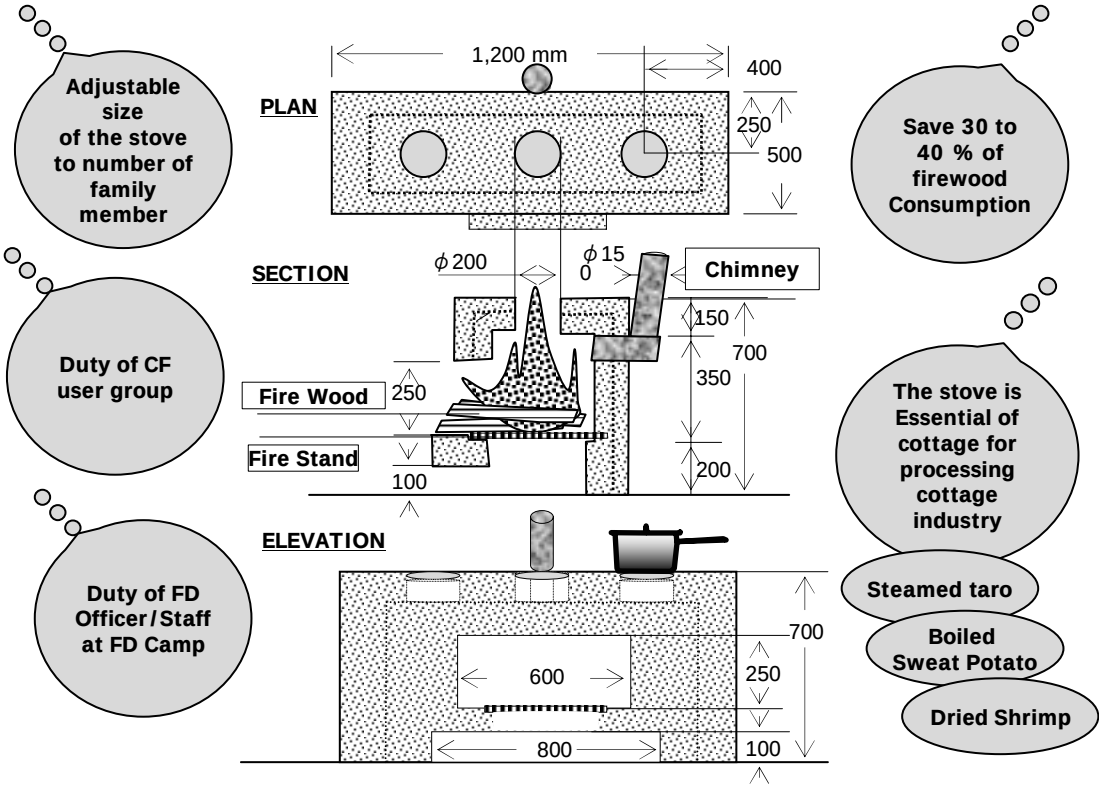
- **Target for promotion of multiple type efficient stove is all CF UsG members**
- **Sizes of multiple type efficient stove have to be flexible by objectives such as home use, cottage industry, etc., i.e. number of fire place**
- **Multiple type efficient stove can be installed at indoors and also outdoors**
- **Multiple type efficient stove is available for boiling water, usual cooking, and grill at same time**

Installation of multiple type efficient stove

- **Installation and demonstration of model stove at the CF extension center, FD camp, and/or the FD mangrove nursery**
- **Training of UsG member for how to make efficient stove**
- **Promote self monitoring about installation of efficient stove on UsG Progress/report**

Rule

- **Fire safe first**
- **Multiple type efficient stove should be promoted as duty of all UsG member**



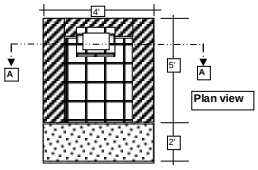
FD Volume V: Consolidation Activities of CF
V-10: Living environment
- Incinerator -

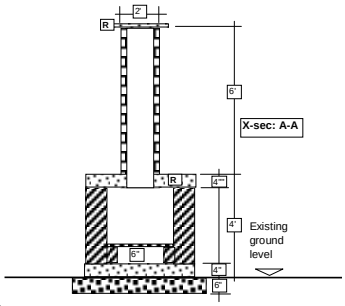
Incinerator

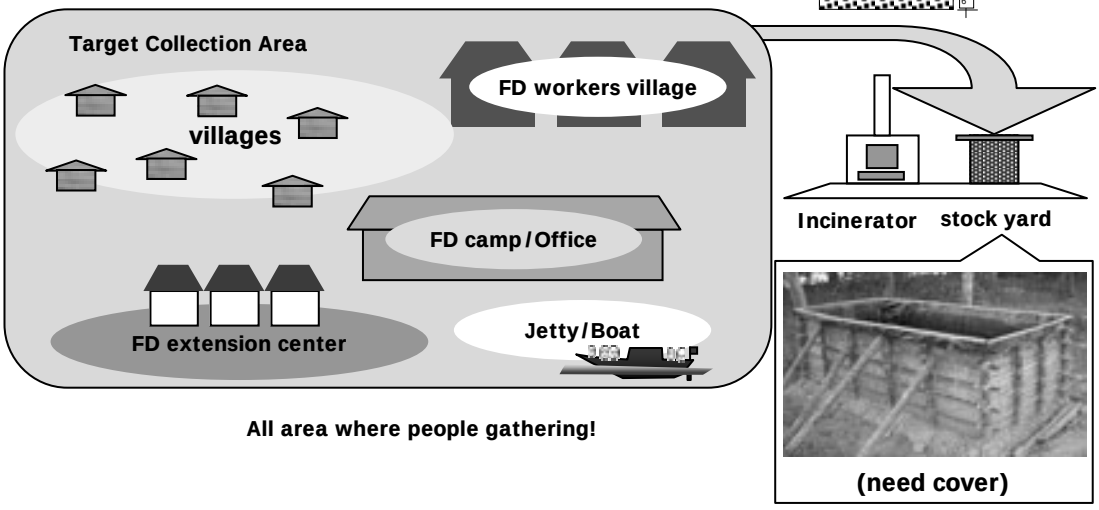
Key points
- Toward clean mangrove and residential area
- Incinerator as of core of environmental education such as littering plastic rubbishes

Methodology
- FD shall start operation of garbage collection and incinerating operation at FD camp
- FD shall establish an incinerator for center of garbage collection and incineration
- In collaboration with school children environmental education, the operation can be started
- FD extension staff at FD camp should be in-charge of the operation
- Stock yard of the garbage shall be installed

Rules
- Target garbage: Plastic made materials and paper made materials (except metal)
- Target people: FD officer/staff, FD workers, villagers living near FD camps and visitors
- Collection area: Surrounding all area produce the garbage such as FD office, FD camp, FD extension center, FD worker's village, village, etc.
- Frequency of incineration
  - ✓ Dry season: Anytime when the stock yard is filled up.
  - ✓ Rain season Basically, rubbishes shall be stored in the stock yard. (If necessary, incineration with fuel wood or diesel)







All area where people gathering!

FD Volume VI: Source Book

Purpose of Source Book:

This source book covers the following items.

Part1: Species characteristics

Part2: Sample formats for CF map, management plan, annual/ monthly reports

The part 1 is aimed to serve as a concise field guide for major mangrove/non-mangrove species to be used for rehabilitation and production purposes in the Ayeyawady delta.

Most of information is obtained from field interviews and seedling production activities conducted in the southern Pyinalan reserved forest. Therefore, information such as fruiting time may varies in other parts of the Ayeyawady delta.

Moreover, in a long run, information on silvicultural characteristics and related technologies which serve to assist selection of appropriate forestry operations shall be incorporated to this manual. Such information has not been integrated to this manual yet, since slivicultural operations are still limited to a few species covered in the sourcebook.

The part 2 gives some ideas for users of this manual to prepare and/ support preparing necessary documents related to CF activities.

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

Reference:

Final Report on Mangrove Reforestation Feasibility Study, Feasibility Study on Mangrove Reforestation MYA/90/003, M. Kogo, 1993

Multiple Use Potential of Mangrove in the Ayeyarwady Delta, Feasibility Study on Mangrove Reforestation MYA/90/003, U Ohn, 1992

Report on Mangrove Forest Products and Utilization of the Ayeyarwady Delta, Feasibility Study on Mangrove Reforestation MYA/90/003, U Ohn, 1992

Handbook of Mangroves in Indonesia - Bali & Lombok -, The Development of Sustainable Mangrove Management Project, S. Kitamura et al., 1997

Mangrove Nursery Establishment Technique, Environmentally Sustainable Food Security and Micro-income Opportunities in the Ayeyarwady Delta UNDP/FAO MYA/1996/008

Establishing and Operating Tree Nurseries, Environmentally Sustainable Food Security and Micro-income Opportunities in the Ayeyarwady Delta UNDP/FAO -MYA/99/008

The Botany of Mangroves, University of Cambridge, P. B Tomlisnon, 1986

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

Terms and Abbreviations used in this Section (1)

Tree Shape

- tree (T): woody perennial plant, typically large and with well-defined stem(s) and crown

- shrub (S): woody perennial plant usually with multiple stems without well defined main stem and height < 2m

- vine (V): climbing or trailing woody-stemmed plant

- fern (F): plant having fronds and reproduces by spores

- palm (P): woody plants belonging to family of Palmae

- herb/grass (G): non woody plants either perennial or annual

Root Type

- stilt root (SR): looping aerial roots exposed to the air, arising from the trunk and lower branches and extending outward and downward into soil

- pneumatophore (PN): conical or pencil shape aerial roots protruding upward from horizontal root

- knee root (KR): horizontal aerial root with bending knee shape,

- plank root (PR): horizontal ribbon/strip-like undulating aerial roots

- buttress root (BR): board like structure extending radially from the bottom of trunk

- non aerial root (NA): normal roots without aerial root

Fruit Type

- cylindrical (C): stick or pole shape mainly recognized in Rhizophoraceae

- ball (B): ball or flattened globe shape mainly recognized in *Xylocarpus and Sonneratia*

- bean like (BL): bean form with various shapes mainly recognized in *Avicennia*

- pod (P): elongated seed vessels mainly of leguminous plant

- other (O): fruits with other shapes mentioned above

Terms and Abbreviations used in this Section (2)

Seed Type

- **viviparous (V):** seeds germinating while attached to parent trees. Usually called propagule.
- **criptovivparous (C):** seeds germinate while attached to parent trees but are covered with their pericarp (fruit skin). Usually called propagule.
- **normal (N):** seeds not categorized as viviparous or criptovivparous

Ground Level

-low (L): flooded by all high/ medium tides daily through out the year
-medium (M): flooded by Yenuhta (small rise), Yehta U (beginning of the rise), and Yehta (high rise) through out the year
-high (H): flooded by Gaungye (highest rise, spring tide) through out the year

Water Salinity

-brackish water (B): slightly salty water in river estuaries by mixing of fresh water and sea water,
-fresh water (F):
-sea water (S):

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

List of Species

Mangrove Related Species

Scientific Name	Local Name
Aegialitis rotundifolia	(Sarthar)
Aegiceras corniculatum	(Yekaya)
Amoora cucullata	(Pantha Kha)
Avicennia alba	(Thame Kyet Tet)
Avicennia marina	(Thame Phyu)
Avicennia officinalis	(Thame Gyi)
Bruguiera cylindrica	(Hnan Byu)
Bruguiera gymnorrhiza	(Byu-u-talon)
Bruguiera parviflora	(Byu War Kyaing Laing)
Bruguiera sexangula	(Byu Ket Tet)
Ceriops decandra	(Madama)
Cynometra ramiflora	(Myinga)
Excoecaria agallocha	(Thayaw)
Heritiera fomes	(Kanazo(Kone))
Heritiera littoralis	(Kanazo(Lay))
Kandelia candel	(Byu Baingdaung-she)
Lumnitzera racemosa	(Pyan Shar)
Nipa fruticans	(Dani)
Phoenix paludosa	(Thinbaung)
Rhizophora apiculata	(Byuchidauk (apo))
Rhizophora mucronata	(Byuchidauk (ama))
Sonneratia alba	(Lame)
Sonneratia apetala	(Kanbala)
Sonneratia caseolaris	(Lamu)
Sonneratia griffithii	(Laba)
Xylocarpus granatum	(Pinleon)
Xylocarpus moluccensis	(Kyana)

Non Mangrove Species

Acacia mangium	(Shar)
Albizia lebbeck	(Kokko)
Albizia procera	(Sit)
Casuarina equisetifolia	(Pinlaikavie)
Eucalyptus spp	(Yukalys)
Melaleuca spp.	(Malarluca)
Samanea saman	(Koko(Thin Baw)
Terminalia belerica	(Thitsein)

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

Mangrove Species

Aegialitis rotundifolia (Plumbaginaceae)

Local Name: Sarthar
Tree Shape: T/S Root Type: NA Fruit Type: C Seed Type: C
Other Description: Endemic to Myanmar, Bengal, the Andaman Island
Ground Level: M Salinity: B/S Flowering Time: Apr. - May Fruiting Time: Jun. - Jul.
Seed Collection Time: Jun. - Jul.
Seed Collection Method: Pluck seeds directly from trees
Seed Storage & Pre-treatment: Viable up to 2 weeks under shade. For germination improvement, remove seed cover by hand
Notes for Seedling Production: Use topsoil for potting material
Usage:

Aegiceras corniculatum (Myrsinaceae)

Local Name: Yekaya
Tree Shape: T/S Root Type: NA Fruit Type: P Seed Type: C
Other Description: fruit strongly curved
Ground Level: (L) M, H Salinity: F/B/S Flowering Time: Apr.- May Fruiting Time: Jun. - Jul.
Seed Collection Time: May - mid-Jun. (High ground level), Aug. – Sept. (Low ground level)
Seed Collection Method: Pluck seeds directly from trees/ collect seeds on the ground
Seed Storage & Pre-treatment: Viable up to 1-2 weeks in jute bag or bamboo basket under the shade. For germination improvement, remove seed cover
Notes for Seedling Production: Direct planting to plantation sites or direct sowing to pots.
Usage: Firewood, construction material (pole), attractive to bees for honey, medicinal uses

Amoora cucullata (Meliaceae)

Local Name: Pantha Kha
Tree Shape: T Root Type: NA Fruit Type: B Seed Type: N
Other Description: -
Ground Level: M Salinity: F/B Flowering Time: Dec. – Jan. Fruiting Time: Apr. - May
Seed Collection Time: May
Seed Collection Method: Pluck cracked fruits from trees or gather undamaged fruits on ground
Seed Storage & Pre-treatment: Viable up to 1 week under the shade. Require removal of fruit cover before germination
Notes for Seedling Production: Use wider pot (4” x 8”) for better survival and growth
Usage: pole, firewood, (charcoal)

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

Mangrove Species

Avicennia alba (Avicenniaceae)

Local Name: Thame Kyet Tet
Tree Shape: T Root Type: PN/SR Fruit Type: BL Seed Type: C
Other Description: long slender leaves than other *Avicennia spp.*
Ground Level: L, M, (H) Salinity: B/S Flowering Time: Jun. - Jul. Fruiting Time: Aug. - Sep.
Seed Collection Time: mid-Sep. (about 20 days)
Seed Collection Method: Pluck seeds from trees/ collect undamaged seeds on ground
Seed Storage & Pre-treatment: Viable up to 1 week in jute bags or bamboo baskets under the shade. May require seed cover removal depend on seed maturity
Notes for Seedling Production: Remove old leaves for hardening
Usage: Post, pole

Avicennia marina (Avicenniaceae)

Local Name: Thame Phyu
Tree Shape: T Root Type: PN Fruit Type: BL Seed Type: C
Other Description: pioneer species in high salinity areas
Ground Level: L, M Salinity: B/S Flowering Time: Jun. - Jul. Fruiting Time: Aug - Sep.
Seed Collection Time: mid- Sep. (about 20 days)
Seed Collection Method: Pluck seeds from trees/ collect undamaged seeds on ground
Seed Storage & Pre-treatment: Viable up to 1 week in jute bags or bamboo baskets under the shade. May require seed cover removal depend on seed maturity
Notes for Seedling Production: Remove old leaves for hardening
Usage: Post, pole, flower attractive to bees for honey, (charcoal)

Avicennia officinalis (Avicenniaceae)

Local Name: Thame Gyi
Tree Shape: T Root Type: PN/SR Fruit Type: BL Seed Type: C
Other Description: leaf apex rounded, young leaves hairy, larger flower than other *Avicennia spp.*
Ground Level: L, M, (H) Salinity: B/S Flowering Time: Jun. - Jul. Fruiting Time: Aug. - Sep.
Seed Collection Time: mid- Sep. (about 20 days)
Seed Collection Method: Pluck seeds from trees/ collect undamaged sees on ground
Seed Storage & Pre-treatment: Viable up to 1 week in jute bag or bamboo basket under the shade. May require seed cover removal depend on seed maturity
Notes for Seedling Production: Remove old leaves for hardening. Bare-root seedlings and direct sowing are also possible but more care is necessary
Usage: Post, pole, Timber (charcoal)

Mangrove Species

Bruguiera cylindrica (Rhizophoraceae)

Local Name: Hnan Byu
Tree Shape: S/T Root Type: KR/BR Fruit Type: C Seed Type: V
Other Description: fruit is slightly curved compare to other *Bruguiera spp*. Less common and has smaller flower compare to *B. gymnorrhiza*
Ground Level: L, M Salinity: B/S Flowering Time: Jan. - Feb. Fruiting Time: May – Jun.
Seed Collection Time: Mar. - Jun.
Seed Collection Method: Pluck mature fruits from trees/ collect undamaged fruits on the ground or floating in the river
Seed Storage & Pre-treatment: Viable up to 1 week (sometimes 4 weeks) in nipa house with good ventilation
Notes for Seedling Production: Less is known about this species due to few seedling production practices
Usage: Firewood, post, pole,

Bruguiera gymnorrhiza (Rhizophoraceae)

Local Name: Byu-u-talon, Byu Oask Saung
Tree Shape: T Root Type: KR/BR Fruit Type: C Seed Type: V
Other Description: big red flower, leaves smooth and thick, lower surface no black dots
Ground Level: L, M Salinity: B/S Flowering Time: Apr. - Jul. Fruiting Time: Mar. - Jun. Aug. - Sep., Nov. - Dec. Seed Collection Time: Mar. - Jun., Aug. - Sep., Nov. - Dec.
Seed Collection Method: Pluck mature fruits from parent trees/ collect undamaged fruits on the ground or floating in the river
Seed Storage & Pre-treatment: Viable up to 4 weeks in nipa house with good ventilation
Notes for Seedling Production: Direct planting to plantation sites or direct sowing to pots. Seed collection time varies by locations. Normally 2~3 seed collection time per year.
Usage: Firewood, post, pole, charcoal, medicinal uses

Bruguiera parviflora (Rhizophoraceae)

Local Name: Byu War Kyaing Laing
Tree Shape: T Root Type: KR/BR Fruit Type: C Seed Type: V
Other Description: Less common and has smaller flower compare to *B. gymnorrhiza*
Ground Level: L, M Salinity: B/S Flowering Time: Jan. - Feb. Fruiting Time: May - Jun.
Seed Collection Time: Jun.
Seed Collection Method: Pluck mature fruits from trees/ collect undamaged fruits on the ground or floating in the river
Seed Storage & Pre-treatment: Viable up to 1 week in nipa house with good ventilation
Notes for Seedling Production: Direct planting to plantation sites or direct sowing to pots. Less is known about this species due to few seedling production practices
Usage: Poles, post, firewood, medicinal uses

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

Mangrove Species

Bruguiera sexangula (Rhizophoraceae)

Local Name: Byu Kyet Tet, Byu Shwe War
Tree Shape: T Root Type: KR/BR Fruit Type: C Seed Type: V
Other Description: Resemble B. gymnorrhiza, but has yellowish flower (calyx) and smaller/ thinner leaf. Less common compare to *B. gymnorrhiza*
Ground Level: L, M Salinity: B/S Flowering Time: not clear Fruiting Time: not clear
Seed Collection Time: around Jun.
Seed Collection Method: Pluck fruits from parent trees/ collect undamaged fruits on the ground or floating in the river
Seed Storage & Pre-treatment: Keep in Nipa house with good ventilation in one month
Notes for Seedling Production: Direct planting to plantation sites or direct sowing to pots. Less is known about this species due to few seedling production practices
Usage: Firewood, post, pole, medicinal uses

Ceriops decandra (Rhizophoraceae)

Local Name: Madama
Tree Shape: T Root Type: BR Fruit Type: C Seed Type: V
Other Description: peduncle short, cotyledonary collar dark red in mature fruit
Ground Level: L, M Salinity: B Flowering Time: Sep. - Oct. Fruiting Time: Mar. - Apr.
Seed Collection Time: Mar. - Apr. (mid-Jun.)
Seed Collection Method: Pluck seeds from trees/ collect undamaged seeds on the ground or floating in the river
Seed Storage & Pre-treatment: Viable up to 2 weeks in jute bag or bamboo basket under the shade
Notes for Seedling Production: Direct sowing to pots
Usage: Firewood, post, pole, charcoal, flower attractive to bees for honey,

Cynometra ramiflora (Caesalpiniaceae)

Local Name: Myinga
Tree Shape: T Root Type: NA Fruit Type: BL Seed Type: N
Other Description: -
Ground Level: M, H Salinity: F/B Flowering Time: Jan. – Feb. Fruiting Time: May- Jun.
Seed Collection Time: (mid-Mar.) May - Jun.
Seed Collection Method: Pluck mature seeds from trees, collect undamaged seeds on the ground
Seed Storage & Pre-treatment: Viable up to 4 month in jute bag or bamboo basket under the shade
Notes for Seedling Production: Direct sowing in pots
Usage: Firewood, post, pole, timber, charcoal, flower attractive to bees for honey,

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

Mangrove Species

Excoecaria agallocha (Euphorbiaceae)

Local Name: Thayaw
Tree Shape: T Root Type: NA Fruit Type: O Seed Type: N
Other Description: abundant in white latex, irritating to the eyes and skin
Ground Level: M, H Salinity: F/B Flowering Time: May - Jun. Fruiting Time: Jul. - Aug.
Seed Collection Time: Jul. - Aug (mid-Sep.)
Seed Collection Method: Pluck mature seeds from trees/ gather seeds caught in fishing nets with small meshes and drifted ashore of small creek
Seed Storage & Pre-treatment: Viable up to 4 weeks under the shade
Notes for Seedling Production: Potted seedlings are advantageous. Bare-roots and cuttings from twigs are also possible
Usage: Packing cases, pulping for the production of news print paper, attractive to bees for honey, and charcoal

Heritiera littoralis (Sterculiaceae)

Local Name: Kanazo (Kone)
Tree Shape: T Root Type: BR Fruit Type: O Seed Type: N
Other Description: Leaf is bigger than *H. littoralis*. Distribute in sandy soil areas
Ground Level: M, H Salinity: F/B Flowering Time: Sep. - Oct. Fruiting Time: Feb. - Mar.
Seed Collection Time: Mar.
Seed Collection Method: Pluck mature seeds from trees/ collect undamaged seed on ground
Seed Storage & Pre-treatment: Viable up to 4 weeks under the shade. Remove seed cover by knife
Notes for Seedling Production: Direct sowing to pots. Use sand an organic matters for potting materials
Usage: Firewood, post, poles, timber, charcoal, preferable for bee species making beehive

Heritiera fomes (Sterculiaceae)

Local Name: Kanazo (Lay)
Tree Shape: T Root Type: BR Fruit Type: O Seed Type: N
Other Description: Endemic to Ayeyawady delta areas
Ground Level: M, H Salinity: F/B Flowering Time: May Fruiting Time: Jun. - Jul.
Seed Collection Time: mid-Jun. to mid-Aug.
Seed Collection Method: Usually on the ground/ sometimes from parent trees by climbing
Seed Storage & Pre-treatment: Pluck mature seeds from trees/ collect undamaged seed on ground
Notes for Seedling Production: Direct sowing to pots
Usage: Timber for construction purposes, post, poles, firewood, charcoal, preferable for bee species making beehive

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation
Mangrove Species

Kandelia candel (Rhizophoraceae)

Local Name: Byu Baingdaung-she
Tree Shape: T Root Type: SR Fruit Type: C Seed Type: V
Other Description: Tree is smaller than *Rhizophora spp.* Propagule is longer than *R. apiculata*
Ground Level: L Salinity: B Flowering Time: Jan. - Feb. (Jun. - Jul.)
Fruiting Time: Mar. - May (Aug.- Sep.)
Seed Collection Time: Mar. - May (Aug. – Sep.)
Seed Collection Method: Pluck mature propagules from trees/ collect prpagules on the ground/ floating in the river
Seed Storage & Pre-treatment: Viable up to 1 week under the shade inside jute bags or bamboo baskets
Notes for Seedling Production: Direct planting to plantation sites or direct sowing to pots.
Usage: Firewood, post, pole

Lumnitzera racemosa (Combretaceae)

Local Name: Pyan Shar, Eike Ma Thwe (Phyu)
Tree Shape: T/S Root Type: NA Fruit Type: O Seed Type: N
Other Description: Tend to grow in cluster on sandy high ground
Ground Level: M, H Salinity: B Flowering Time: Jun. - Jul. Fruiting Time: Aug. - Sep.
Seed Collection Time: Sep
Seed Collection Method: Pluck seeds from trees/ collect undamaged seeds on ground
Seed Storage & Pre-treatment: Viable up to 2 week under the shade
Notes for Seedling Production: Use sand and organic material for sowing and potting material
Usage: Firewood, post, pole

Nypa fruticans (Palmae)

Local Name: Dani
Tree Shape: P Root Type: NA Fruit Type: O Seed Type: C
Other Description: growing close together, often form pure communities along river side
Ground Level: L Salinity: F/B Flowering Time: Whole year Fruiting Time: Whole year
Seed Collection Time: When fruit is mature (Preferably, Jun.)
Seed Collection Method: Pluck seeds from trees/ collect undamaged seeds on ground/ floating in the river
Seed Storage & Pre-treatment: Viable up to 2 weeks under the shade
Notes for Seedling Production: Less is known about this species due to few seedling production practices
Usage: A source of sugar, vinegar, alcohol and fermented beverage, medicines for herpes, toothache, and headache

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

Mangrove Species

Phoenix paludosa (Palmae)

Local Name: Thinbaung
Tree Shape: P Root Type: PN Fruit Type: B Seed Type: N
Other Description: thorny leaf
Ground Level: (M), H Salinity: F/B Flowering Time: Apr. Fruiting Time: Jun.
Seed Collection Time: Jun.
Seed Collection Method: Pluck mature fruits from trees/ collect undamaged fruits on the ground
Seed Storage & Pre-treatment: Viable up to 2 weeks under the shade
Notes for Seedling Production: Direct sowing to planting sites is more common
Usage: post/pole for shanties and sheds, Firewood, phoenix shoots as food

Rhizophora apiculata (Rhizophoraceae)

Local Name: Byuchidauk (apo)
Tree Shape: T Root Type: SR Fruit Type: C Seed Type: V
Other Description: leaf smaller than other *Rhizophora,* two flowers per shoot
Ground Level: L Salinity: B Flowering Time: Nov. - Dec. Fruiting Time: Mar. - May
Seed Collection Time: Mar. - May
Seed Collection Method: Pluck mature propagules from trees/ collect propagules on the ground/ floating in the river
Seed Storage & Pre-treatment: Viable up to 2 -4 weeks under the shade with good ventilation
Notes for Seedling Production: Direct planting is reliable and economical if planted in the beginning of rainy season. Potted seedlings are advantageous for planting in other seasons.
Usage: Firewood, post, pole, charcoal, medicinal uses

Rhizophora mucronata (Rhizophoraceae)

Local Name: Byuchidauk (ama)
Tree Shape: T Root Type: SR Fruit Type: C Seed Type: V
Other Description: Propagule is larger than *R apiculata.* Multiple flowers per shoot.
Ground Level: L Salinity: B/S Flowering Time: Nov. - Dec. Fruiting Time: Mar. - May
Seed Collection Time: Apr. - May
Seed Collection Method: Pluck mature propagules from trees/ collect propagules on the ground/ floating in the river
Seed Storage & Pre-treatment: Viable up to 2 -4 weeks under the shade with good ventilation
Notes for Seedling Production: Direct planting is reliable and economical if planted in the beginning of rainy season. Potted seedlings are advantageous for planting in other seasons
Usage: Firewood, post, pole, charcoal, attractive to bees for honey, medicinal uses

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

Mangrove Species

Sonneratia alba (Sonneratiaceae)

Local Name: Lame, Lamu Tathut
Tree Shape: T Root Type: PN Fruit Type: B Seed Type: N
Other Description: Distribute along coastal and high salinity areas
Ground Level: L Salinity: S Flowering Time: Jun. - Jul Fruiting Time: Aug. - Sept.
Seed Collection Time: Aug. - Sept.
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 2 weeks under the shade in air dry condition.
Removal of fruit cover by soaking/ washing in water for 1 – 2 days
Notes for Seedling Production: Less is known about this species due to few seedling production practices
Usage: Firewood, pole, timber

Sonneratia apetala (Sonneratiaceae)

Local Name: Kanbala
Tree Shape: T Root Type: PN Fruit Type: B Seed Type: N
Other Description: has narrow and tapered leaf, and smaller flower than other *Sonneratia spp.*
Ground Level: L, M Salinity: B/S Flowering Time: May - Jun. Fruiting Time: Jul. - Aug.
Seed Collection Time: Jul. - Aug. (Possible to collect in other seasons when fruits are available)
Seed Collection Method: Pluck mature fruits from trees by climbing, using a bamboo stick with hook or shaking trees (keeping a net under the tree)
Seed Storage & Pre-treatment: Viable up to 4 weeks under the shade in air dry condition
Notes for Seedling Production: Susceptible to insect/ fungus damages especially for bare root seedlings. Keep constant water flow to avoid such damages
Usage: Firewood, construction material

Sonneratia caseolaris (Sonneratiaceae)

Local Name: Lamu
Tree Shape: T Root Type: PN Fruit Type: B Seed Type: N
Other Description: mature leaf short petiole with a reddish-pink base
Ground Level: L Salinity: B/S Flowering Time: May - Jun Fruiting Time: Jul. - Aug.
Seed Collection Time: Jul. - Aug. (Possible to collect in other seasons when fruits are available)
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 2 weeks under the shade in air dry condition
Notes for Seedling Production: Direct sowing to pots seems to be higher survival than transplanting from sowing beds or raising as bare-root seedlings
Usage: Firewood, post, pole, flowers attractive to bees for honey

Mangrove Species

Sonneratia griffithii (Sonneratiaceae)

Local Name: Laba
Tree Shape: T Root Type: PN Fruit Type: B Seed Type: N
Other Description: rounder leaves compare to S. ***caseolaris***
Ground Level: L Salinity: B/ S Flowering Time: Dec. - Jan. Fruiting Time: Mar. - Apr.
Seed Collection Time: Mar. – Apr.
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 2 weeks under the shade in air dry condition. Removal of fruit cover by soaking/ washing in water for 1 – 2 days
Notes for Seedling Production: Direct sowing to pots seems to be higher survival than transplanting from sowing beds or raising as bare-root seedlings
Usage: Firewood, pole, timber, medicinal uses for cough and drink

Xylocarpus granatum (Meliaceae)

Local Name: Pinelon
Tree Shape: T Root Type: PR/BR Fruit Type: B Seed Type: N
Other Description: big hard spherical melon-like fruit in yellowish brown color
Ground Level: L, M Salinity: B Flowering Time: Jan. - Feb Fruiting Time: Apr. - May
Seed Collection Time: mid-Apr. - May
Seed Collection Method: Pluck mature fruits from trees/ collect undamaged fruits on the ground
Seed Storage & Pre-treatment: Viable up to 1 week with daily watering under the shade. Removal of fruit cover by knife
Notes for Seedling Production: Direct sowing to pots. Submerge seeds to regular tide to avoid insect damages
Usage: Firewood, post, pole,

Xylocarpus moluccensis (Meliaceae)

Local Name: Kyana
Tree Shape: T Root Type: PR/PN/(BR) Fruit Type: B Seed Type: N
Other Description: buttress sometimes absent or very short, fruit smaller than *X. granatum*
Ground Level: L, M Salinity: B/ (S) Flowering Time: May Fruiting Time: Jul. - Aug.
Seed Collection Time: Jul. – Aug.
Seed Collection Method: Pluck mature fruits from trees
Seed Storage & Pre-treatment: Viable up to 1 week with daily watering of seeds under the shade. Removal of fruit cover by knife
Notes for Seedling Production: Direct sowing to pots. Submerge seeds to regular tide to avoid insect damages
Usage: Firewood, post, pole, timber

Non-Mangrove Species

Acacia mangium (Leguminosae)

Local Name: Shar (for Acacia spp, in general)
Tree Shape: T Root Type: NA Fruit Type:P Seed Type: N
Other Description: Inflorescences are on loose spikes up to 10 cm long with white or cream colored flowers
Ground Level: M, H Salinity: (B),F Flowering Time: Jan. - Feb. Fruiting Time: Apr -May
Seed Collection Time: Apr- May (Jun.)
Seed Collection Method: Pluck mature seeds by using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 6 months in a plastic bag. Soak in water for 2 days
Notes for Seedling Production: Use sandy soil and organic materials for potting material
Usage: reforestation in very poor soil, timber, chip

Albizia lebbeck (Leguminosae)

Local Name: Koko (Myanmar)
Tree Shape: T Root Type: NA Fruit Type: P Seed Type: N
Other Description: Large compound leaves with oblong leaflets
Ground Level: M, H Salinity: F Flowering Time: Jan. - Feb. Fruiting Time: Apr. - May
Seed Collection Time: Apr – May (Jun.)
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 6 months in a plastic bag. Germination improved by soaking in water for 2 days or immersing seed in boiling water for 3 seconds and then allowing it to cool and dry.
Notes for Seedling Production: Use sandy soil and organic material for potting material
Usage: Wood for furniture, paneling, general construction, and carving, firewood and fodder, shade and ornamental along roads and plantations, attractive to bees for honey

Albizia procera (Leguminosae)

Local Name: Sit
Tree Shape: T Root Type: NA Fruit Type: P Seed Type: N
Other Description: large compound leaves with oblong leaflets
Ground Level: M, H Salinity: F Flowering Time: Nov. - Dec. Fruiting Time: Mar. - Apr.
Seed Collection Time: Mar. - Apr.
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 6 months in a plastic bag. Germination improved by soaking in water for 2 days or immersing seed in boiling water for 3 seconds and then allowing it to cool and dry.
Notes for Seedling Production: Use sandy soil and organic materials for potting material
Usage: Wood for furniture, paneling, general construction, and carving, firewood and fodder, shade and ornamental along roads and plantations

Non-Mangrove Species

Casuarina equisetifolia (Casuarinaceae)

Local Name: Pinlaikavie
Tree Shape: T Root Type: NA Fruit Type: O (woody capsule) Seed Type: O
Other Description: Leaves look like pine needles
Ground Level: M, H Salinity: F Flowering Time: Jan. - Feb. Fruiting Time: Apr. - May
Seed Collection Time: May
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 4 months in a plastic bag.
Notes for Seedling Production: Transplant from sowing beds to pots. Use sand and organic material for potting material
Usage: Pole, firewood and fodder, coastal sandy areas reforestation

Eucalyptus spp. (Myrtaceae)

Local Name: Yukalys
Tree Shape: T Root Type: NA Fruit Type: O Seed Type: N
Other Description: -
Ground Level: M, H Salinity: (B), F Flowering Time: Apr. - May Fruiting Time: Jul. - Aug.
Seed Collection Time: Jul. - Aug
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 6 months in a plastic bag
Notes for Seedling Production: Use sand and organic material for sowing and potting material
Usage: Firewood, pole, timber, chip, leaves are distilled to yield oil

Melaleuca spp. (Myrtaceae)

Local Name: Malarluca (for *M. leucadendron*)
Tree Shape: T Root Type: NA Fruit Type: Woody capsule Seed Type: N
Other Description: spongy bark is distinctive and can be peeled off easily
Ground Level: M, H Salinity: (B), F Flowering Time: Jun.- Jul. Fruiting Time: Sep. - Oct.
Seed Collection Time: Sept - Oct.
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 6 months in a plastic bag
Notes for Seedling Production: Transplant from sowing beds to pots. Use sand and organic material for sowing and potting material
Usage: Windbreak and coastal planting, construction materials, firewood, leaves are distilled to yield oil (especially for *M. alternifolia*)

FD Volume VI: Source Book
VI-1: Major Mangrove Species for Rehabilitation

Non-Mangrove Species

Samanea saman (Leguminosae)

Local Name: Koko (Thin Baw)
Tree Shape: T Root Type: NA Fruit Type: P Seed Type: N
Other Description: large compound leaves with oblong leaflets
Ground Level: M, H Salinity: F Flowering Time: Jan. - Feb. Fruiting Time: Apr. - May
Seed Collection Time: Apr. - May
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 6 months in plastic bag. Germination improved by soaking seeds in water for 2 days or immersing seeds in boiling water for 3 seconds and then allowing it to cool and dry.
Notes for Seedling Production: Transplant from sowing beds to pots. Use sand and organic material for sowing and potting material
Usage: Firewood, construction material

Terminalia belerica spp. (Combertaceae)

Local Name: Thitseit
Tree Shape: T Root Type: NA Fruit Type: B Seed Type: N
Other Description: Deciduous
Ground Level: M, H Salinity: (B), F Flowering Time: Jan. - Feb. Fruiting Time: Jun. – Jul..
Seed Collection Time: Jun. - Jul.
Seed Collection Method: Pluck mature fruits using a bamboo stick with hook
Seed Storage & Pre-treatment: Viable up to 4 months in plastic bag. Germination improved by soaking seeds in water for 5 days
Notes for Seedling Production: Direct sowing to pots. Use sand and organic material for sowing and potting material
Usage: Firewood, Timber, fruit for oil/medicine

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VI-2: Sample Formats for CF Management Plan

Key points

The document below is the example of the management plan in the southern Pyinalan reserved forest;

- **This example was prepared as the first five year plan of the thirty years management plan**
- **The contents of the management plan covers all the activities of community forestry activities, such as CF plantation, CF NFIO, CF agroforestry, the each of steps of these CF activities and so on.**
- **After the first five year plan is completed, the management plan will be updated based on the achievement**
- **CF agroforestry will be continuously implemented every year in the same area**
- **The updated management plan will be submitted to the forest department, and the forest department needs to authorize the update**
- **The individual CF management plan is completed with two maps, namely the stock map and the management planning map**

Community Forestry
Management Plan (Individual)

1. Name- Man Hu Bet **2.** National Registration Card No. -
3. Father Name- U Jam **4.** Village-
5. CF propose area: 20 (acre)
6. [Plantation Area : 10 (acre), NFIO area : 10 (acre)], Species: Ao, Ea,
7. Annual operation Plan (2003- 2007) yr

Sr	CF activity	First Five Year Target (acre)					Total
		2003	2004	2005	2006	2007	
1	Plantation	2 acre	2 acre	2 acre	2 acre	2 acre	10 acre
2	NFIO	2 acre	2 acre	2 acre	2 acre	2 acre	10 acre
3	Agroforestry	0.5acre	-	-	-	-	0.5acre
	Total	4 acre	4 acre	4 acre	4 acre	4 acre	20 acre

7.1 Plantation Activities

Sr	Activity	Period (month to month)
7.1.1	Site preparation	June to Sep
7.1.2	Staking	June to Sep
7.1.3	Seedling transportation	April, May, June
7.1.4	Plantation	July, August
7.1.5	Weeding	September, Oct, Nov
7.1.6	Patching	August to Sep
7.1.7	Fire protection	Nov to April
7.1.8	Pruning	Feb, March,
7.1.9	Selected felling (month)	March, April
7.1.10	Patrolling(month)	all month

7.2 NFIO Activity

Sr	Activity	Period (month to month)
7.2.1	Fire Protection	March to April
7.2.2	Climber cutting	June to September
7.2.3	Branch cutting	June to September
7.2.4	Gap-planting	August to October
7.2.5	Selected felling	March to May

7.2.6. Selective Felling Plan

Sr	Species	GBH (feet, inches)	Production (unit)	First Five Year Target (pc)				
				2003	2004	2005	2006	2007
1	Cd	8 inches	Pole	50	50	50	0	20
2	Pp	10 inches	Post	10	10	10	10	10
3	Bg	8 inches	Pole	0	0	0	0	5
4	Hf	8 inches	Pole/ Post	0	0	0	0	0
5	Ao	2 ft and above	Timber log	0	0	0	0	20

7.3 Agroforestry Activity

Sr	Activity	Period (month to month)
7.3.1	Site preparation	April to May
7.3.2	Plantation of fruit trees	June
7.3.3	Sowing one year crops	June-July
7.3.4	Harvesting	November

8. I hereby admit accomplishing the community forestry activities in accordance with the working schedule mentioned above.
9. This five-year CF management plan is part of the thirty-year CF management plan, which will be updated after 5 years in 2008 based on the achievement.

Signature- Signature- Signature-
Member Member member
Management Committee Management Committee CF User

FD Volume VI: Source Book
VI-3: Example CF Map

Key points

Four key points for drawing community forest management map

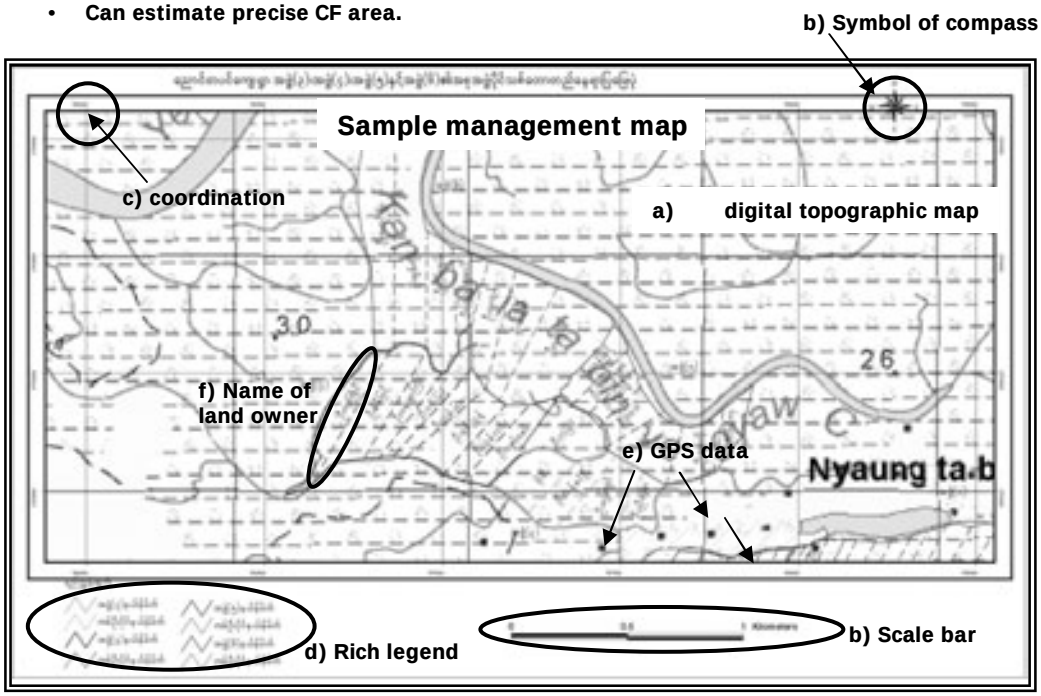
- **New topographical map was supplied as a base map for drawing CF map by the forest department.**
- **CF area was allocated by the forest department based on discussion with the CF user group.**
- **Accuracy of the CF map was gained to employ the GPS/GIS.**
- **The CF map is utilized for implementation of CF activities such as patrolling and CF boundary management.**

Procedure

1. **FD allocated the CF area based on:**
   - **land availability such as current vegetation, location/accessibility , ground level**
   - **availability of labor by each CF user group member**
   - **even benefit for each CF user group member**
2. **CF user group member who allocated the CF area, did staking and border line clearing with FD staff.**
3. **Based on allocation and staking of the CF area, the border of CF area was drawn on the base map by FD staff and CF user group.**
4. **Then the CF management plan such as area and name of CF UsG member were added on the map.**
5. **The completed CF map was submitted to FD CF Task Force together with CF management plan.**
6. **Example of CF map is shown below.**

Recommendation: preparation of CF Map by utilization of GIS/GPS on the topographic map

- **Can secure minimum requirement of accuracy of the CF map,**
- **Can secure minimum accuracy by less input of labor,**
- **Can clarify a scale, direction and area by employing the topographic map, and**
- **Can estimate precise CF area.**



FD Volume VI: Source Book
VI-4: Sample Formats for recording GPS data for Delineation of CF area

Key points

GPS survey team for recording CF area have to be formed by GIS section, CF task force and CF user group.

GPS recorded data for delineation of CF area have to be summarized in the form.

GPS record format have to be provided by the survey team led by GIS section.

The GPS record have to be submitted to GIS section through FD Township and FD District.

Format of GPS record consists of following four contents;

- **"GPS code " means automatic name given by GPS**
- **"Point name" shows specific name of staking pole like "Area name & Number "**
- **"Latitude/Longitude" will be filled out by Degree/minute/second**
- **"Remarks" describes necessary various information for delineation such as big tree as a landmark, existence of creek, distance from previous point etc.**

Sample GPS Record Format

Name of the village Date- / /

Team No( ) Compartment No-

Sr,No	Code.No	Reading						Remark
		N			E			

Recorded by-

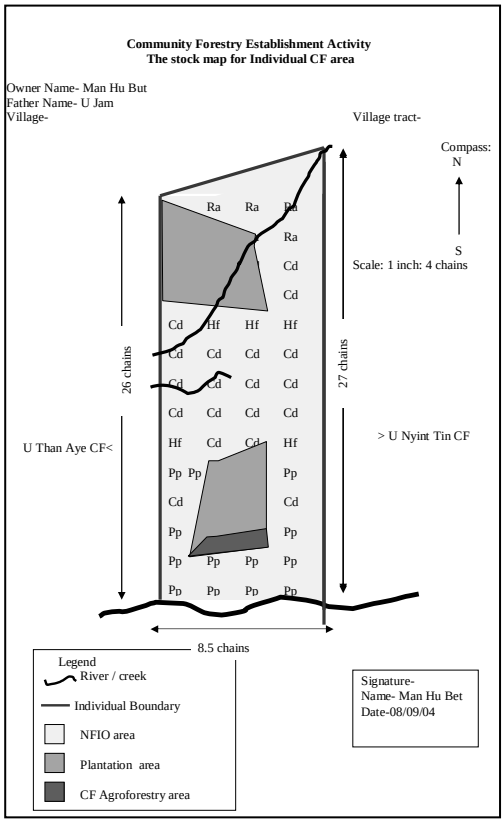
FD Volume VI: Source Book
VI-5: Sample Formats for CF Management Maps (Individual)

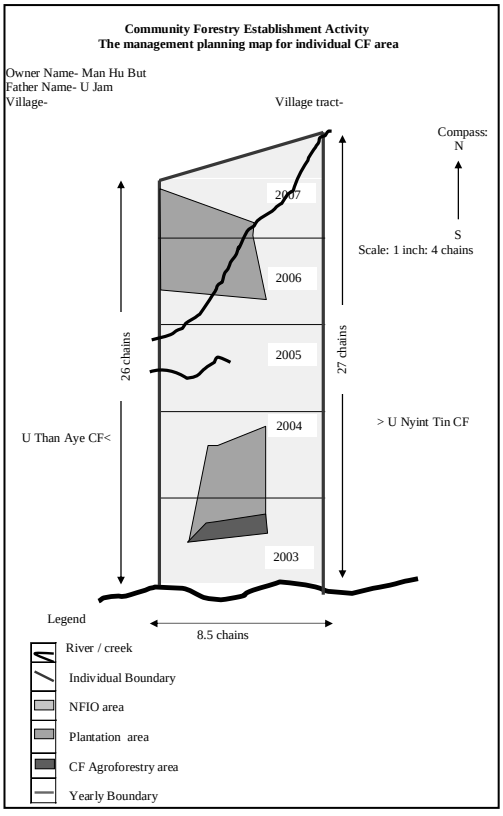
Key points

- **the example of the individual CF management map in southern Pyinalan reserved forest;**
  - **The stock map and the management planning map was prepared by CF UsG with the support of FD**
  - **The stock map was prepared based on the present land condition (land utilization) such as the forest land, bush, and gap**
  - **Management planning map shows the yearly operation area**

- **the user group members used colored pencils to draw these CF management maps, using following colors**

– **Natural regeneration area (NFIO area)**	**Light green**
– **Area appropriate to establish plantation**	**Yellow**
– **Area for CF agroforestry**	**Dark green**
– **Individual boundary line**	**Red**
– **Annual boundary line**	**Blue line**
– **River / creek**	**Black line**





FD Volume VI: Source Book
VI-6: Example of the Annual Progress Reports

Key points

Procedure:

- **The example was prepared by Nyaung Ta Pin village CF user group by support of the forest department Laputta Township based on the definition of the CFI;**
- **The user group prepared the report based on monthly record of the CF activities by each CF user group member;**
- **The each CF user group member recorded monthly progress based on extension activity of the forest department together with the extension worker of the CF user group and sub group leader of the CF user group;**
- **The management committee of the CF user group compiled sub group monthly record as the monthly progress at the monthly meeting of the user group, and then summarized each month activity to whole year progress as annual report.**
- **The annual report was submitted to the forest department Laputta Township;**

Contents:

- **Summarized seedling requirement for succeeding year CF activities;**
- **Summarized harvesting plan as the CF production plan of succeeding year;**
- **New CF prototypes applied such as CF school woodlots, CF community woodlot, etc were reported.**

Community Forestry (CF) Annual Progress Report for YEAR of ( )

p.1

1. Introduction (CF UG Information)

1) UG Name: NTP village CF

2) Number of UG members: 64 persons (Member name list should be attached)

3) Year of CF certificate grant 2003 July

4) Certified Area as is in Management Plan :287.9 acre (for year 2003& 2004)

Total CF Area 287.9 acre (for year 2003& 2004)

Individual

- CF NFIO 128.6 acre
- CF Plantation 13.55 acres
- CF Aqua-agroforestry nil acre
- CF Agroforestry nil acre

CF Communal Woodlot

- CF village woodlot nil acre
- CF church woodlot nil acre

CF paddy woodlot nil acre

5) Current Vegetation of the Natural Forest (Existing Species)

Cd, Pp, Bg, Ra, Hf, Xm, Xg, sarpin, Ea, Sa, Sg, Ao, Ac, Nf.

2. Objective:

A. for the household consumption for fuel wood, pole, post, timber
B. to get more income for selling surplus CF forest products.
C. for mangrove environmental conservation

3. Location: Pyinalan Reserved forest compartment number 57 & 58.

Eastern part: TYK CF
Western part:Hwa zin & sapalin creek
Northern part: kamalartapin creek
Southern part: sarkyin & oh pho creek
Area: 287.9 ac for the 2003 & 2004 year.

4. Progress of the Activities in the Year (April 2003 – March 2004)

4.1. CF Natural Forest Improvement Operation(NFIO)

p.2

1) target area: 128.6 acre

2) progress: 94.35 acre

3) Assessment of the condition of forest (example: average height, girth and volume):

species	-average height	-average girth	-the number of trees	-volume cubic feet
Ao	Not recorded			
Sa	do			
Bg	do			
Ra	do			
Hf	do			
Xm	do			
Ea	do			
Xg	do			
Pp	do			

4) Techniques Applied for NFIO:

branch cutting, climber cutting, weeding, thinning, gap planting

4.2 CF Plantation:

Target: 13.55ac
Implemented area: 13.05ac

Species	Target ac	progress	survival rate	average height feet	average girth inch	numbers of trees	estimated volume cubic feet
Thaemae		acre	43 %	Not recorded	Not recorded	7036	
Kamalar		acre	53 %	Not recorded	Not recorded	3802	
Buyoaksaung		acre	66 %	Not recorded	Not recorded	2645	
Buy chidauk		acre	53 %	Not recorded	Not recorded	9560	
Madama		acre	90 %	Not recorded	Not recorded	450	
Pinlaeown		acre	100 %	Not recorded	Not recorded	35	
Kanazo (sapling)		acre	3 %	Not recorded	Not recorded	9	

Source: December 2003 individual CF area monitoring at the field.

FD Volume VI: Source Book
VI-6: Example of the Annual Progress Reports

Key points:

Way of submission

- **The CFI prescribes the CF user group should submit the progress report for management and support of the CF activities, thus the CF task force of the forest department township office supported the CF user group for the recording and the reporting.**
- **Two copies of the annual report was prepared by the CF user group, and one copy was submitted to the forest department and the other was kept by the group.**
- **The CF user group member has been changed (seven member withdrew and seven new member joined), since the annual progress report was attached updated the CF management plan with updated member list and also updated CF management map, based on support of the forest department Laputta.**
- **The annual report is planned to be submitted from the forest Department Township to the district office, and the district office forward the copies to the divisional office, PSD and director-general office.**
- **The forest department district office will send the original report back to CF UsG with approved signature of AD of district forest department office.**
- **The forest department district office and township office will keep the annual report in order to continue the CF management and support.**

4.3 Plantation for CF Aqua-agroforestry, CF Agroforestry, CF Public Woodlot, etc.

(No information was mentioned)

p.3

4.4 The growth of the major species planted up to the last year.

(No information was mentioned)

5. Production of Timber and Forest Product

Activities	target	Actual production
Nil	Timber Fuel wood	
Nil	Timber Fuel wood	
Nil	Timber Fuel wood	

6. Distribution of Timber and Forest Product

Activities	Within the User Group	Within the Village (not CF member)		Outside the Village	
Nil	cubic feet	cubic feet	ks	cubic feet	ks
Nil	cubic feet	cubic feet	ks	cubic feet	ks
Nil	cubic feet	cubic feet	ks	cubic feet	ks
Nil	cubic feet	cubic feet	ks	cubic feet	ks

7. Condition of the CF Users Group and its members

1) Number of the active members 50members
2) Number of the new members 8members
3) Number of the drop-out members 13members
4) CF UG Meeting 8times/year
5) Submitted Monthly Progress Report 6times/year

8. Miscellaneous

1) Encroachment:
A. illegal cutting: 3 times in NTP CF area
B. action taking for illegal cutting case by CF MC & 100hh head: 2
C. Action taken for illegal cutting by FD: 11 times around NTP are

p.4

D. there was no encroachment such as salt pan, paddy cultivation, shrimp pond inside CF area of 2003 & 2004 year.

2) Other Difficulties Encountered:
Most of CF UG is temporary moved to others villages as the lower price of crab & smaller amount of crab catching during February, March, April . So they cannot finish CF activities. Some members gave up CF.

3) Miscellaneous: One of the MC member, U Moe Zae, quitted from the MC committee. Now substitution is arranging.CF members of Sub village, Mwesein Chaung & Awasu village, are weak for participating at the workshop held at Nyaungtapin main village.

9. Next Year Plan

Activities	target	Planting Plan	Harvesting Plan (timber)	Harvesting Plan (fuel wood)
CF school woodlot	1.8 acre			
Community woodlot	5 acre			
CFchurch woodlot	2acre			
CF AF	0.12 acre			
CFAAF	0.12 acre			
CF plantation	6.4(2004 MP)			
CF NFIO	139.25(2004MP)			
CF plantation	0.05(2003MP remaining)			
CF NFIO	34.25(2003MP remaining)			

10. Conclusion:

CF activities are delay as no boat for patrolling & seedlings carrying. Planted seedlings were died as illegal cutting, late planting, irrelevant with the ground level. NFIO activities are not implemented completely as the one reason of thorny bushes. CF members face illegal cutting as member had not been in their CF area. Sub group leaders are weak in participating.

Sub group leaders should be elected again, to implement cf activities with the remaining actual participated CF members To get official production for the NFIO products such as fuel wood, oaklanfuel wood.FD & village 100hh heads need to cooperate for CF patrolling for more achievement.

U SAN

p.5

Name and Signature
Chairman of the CF UG

Name and Signature
Forester / Deputy Ranger assigned for this area

Name and Signature
District FD AD

- This Annual Progress Report should be prepared two.
- One will be submitted to district FD office through the beat office and township office.
- One will be kept by User Group until the district FD will send one copy back with the signature of AD.