Mangrove and beach forest program of the Department of Environment and Natural Resources. (Djolly Ma. P. Dinamling)

Mangroves as Buffer against Natural Hazards (Philippines)

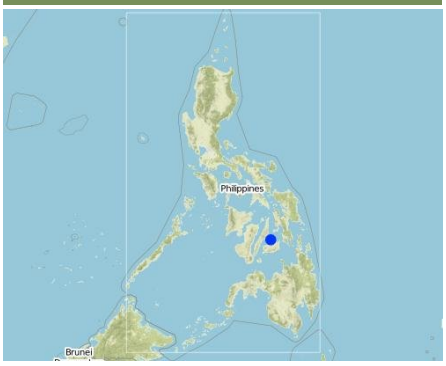
"Bakauan"

DESCRIPTION

Mangroves "bakauan" are planted in the island coast to form barriers and as first line of defense during storm surges.

Mangrove plantation in the island of Banacon which is 10.91 kilometers away from the municipality of Getafe, Bohol in Central Visayas started in 1957.The most common specie grown is the “Bakauan” under the Rhizophoracea family. Mangroves contribute in protecting the coast against natural hazards such as storms, tsunamis and coastal erosion. It weakens the impact of typhoons that bring strong winds, continuous high waves and storm surges. A dense cluster of bakauans obstruct the entry of winds and waves when passing through the mangroves minimizes the force of wind sand waves. According to the residents of the island, they were spared from total destruction of properties during onset of typhoons because of the presence of the bakauans. Mangroves were utilized also by the Banacon residents as source of poles for houses, fishpens and charcoals for cooking. The dense roots of the trees bind the soils thus preventing erosion. The tree roots serve as spawning ground for fishes and other variety of sea species that lead to an increase in harvest of sea foods in the area. The mangrove plantation was also developed into ecotourism site. Site evaluation is the pre-requisite in the establishment of mangrove area. An ideal area is with sand dune during low tide. It is followed by site lay out using the planting design that is adopted, and direct planting of propagules in the soil. Planting materials used are the cigar-shaped mature propagules harvested from the Bacauan- Lalake specie of mangroves. The direct seeding planting is the ideal method of planting in establishing a mangroves plantation. Mangrove propagules must be planted after collection. It should not be exposed to direct sunlight to prevent moisture loss. There are (3) planting designs used in the establishment of the mangroves. First, the high density planting of propagules with no lay out to be followed. This planting design can accommodate 30,000 pcs of propagules per hectare. Second, design has a spacing of 1 meter by 1 meter planted in rows and can hold 10,000 pieces of propagules per hectare. Third is the block/cluster design in which each cluster was planted with 750 pieces of propagules with a distance of 30 centimeters apart per propagules. The spacing between the blocks or cluster is 10 meters and can contain 5,000 pieces of propagules per hectare. Maintenance includes monitoring of the crop status, replanting of missing hills and weeding by removing sea weeds, barnacles and sea debris.

LOCATION



Location: Banacon Island, Getafe, Bohol, Philippines

No. of Technology sites analysed: single site

Geo-reference of selected sites

- 124.15446, 10.20104

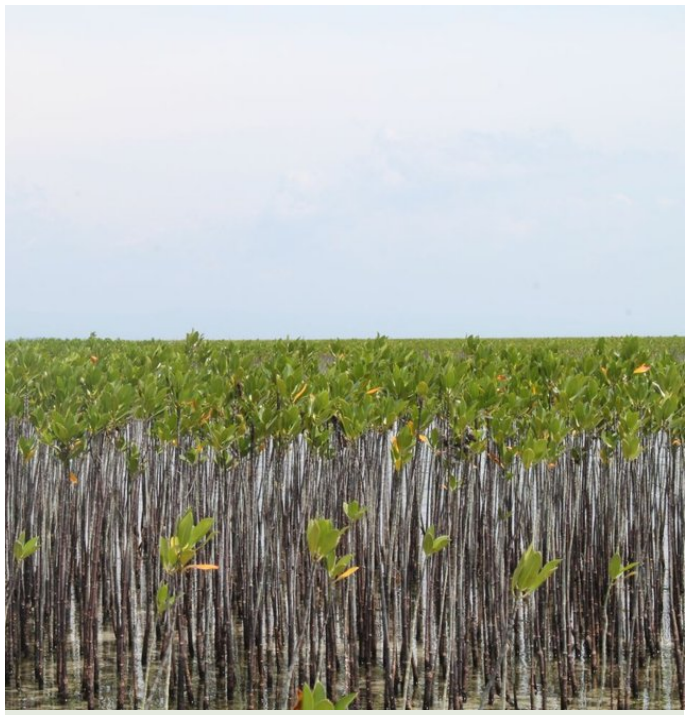
Spread of the Technology: evenly spread over an area (approx. 1-10 km2)

Date of implementation: more than 50 years ago (traditional)

Type of introduction

- ☐ through land users' innovation
- ☑ as part of a traditional system (> 50 years)
- ☐ during experiments/ research
- ☑ through projects/ external interventions

Mature mangroves (Engr. Djolly Ma. P. Dinamling)



Mangroves planted in Banacon island (Ace Wilfred Abarro II)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- reduce, prevent, restore land degradation
- ✓ conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- ✓ preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- ✓ mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use

Forest/ woodlands - other (specify): Crustaceans breeding ground
Products and services: Nature conservation/ protection, Recreation/ tourism, Protection against natural hazards

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: n.a.
Land use before implementation of the Technology: n.a.
Livestock density: n.a.

Purpose related to land degradation

- ✓ prevent land degradation
- reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed

biological degradation - Bc: reduction of vegetation cover, Bh: loss of habitats

SLM group

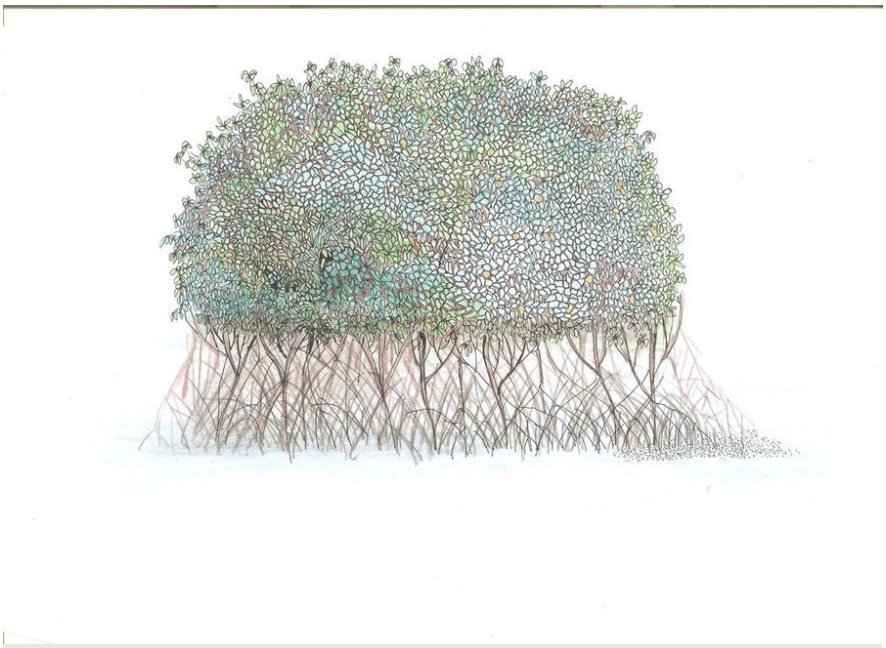
- forest plantation management
- ecosystem-based disaster risk reduction

SLM measures

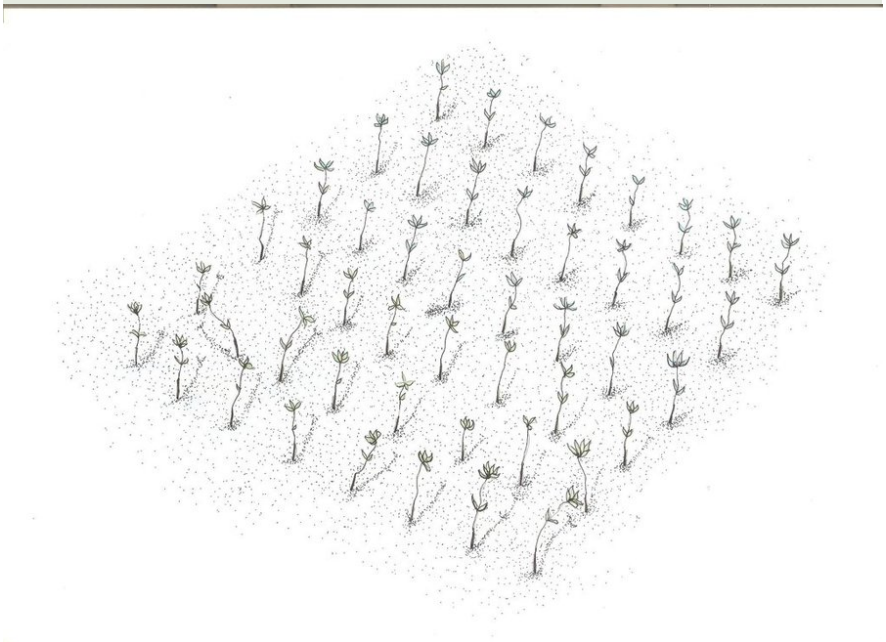
vegetative measures - V1: Tree and shrub cover

TECHNICAL DRAWING

Technical specifications
There are (3) planting designs used in the establishment of the mangroves. First, the high density planting of propagules with no lay out to be followed. This planting design can accommodate 30,000 pcs of propagules per hectare. Second, design has a spacing of 1 meter by 1 meter planted in rows and can hold 10,000 pieces of propagules per hectare. Third is the block/cluster design in which each cluster was planted with 750 pieces of propagules with a distance of 30 centimeters apart per propagules. The spacing between the blocks or cluster is 10 meters and can contain 5,000 pieces of propagules per hectare. Maintenance includes monitoring of the crop status, replanting of missing hills and weeding by removing sea weeds, barnacles and sea debris.



Author: Patricio A. Yambot



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ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **1 hectare**)
- Currency used for cost calculation: **Philippine peso**
- Exchange rate (to USD): 1 USD = 50.0.
- Average wage cost of hired labour per day: 250.

Most important factors affecting the costs

n.a.

Establishment activities

1. Harvesting of matured propagules (Vegetative; During the month of June)
2. Direct seeding of propagules (Vegetative)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit	Total costs per input	% of costs borne by land users
Labour					
	Person day/ hectare	10.0	250.0	2500.0	
Plant material					
mangrove propagules	pieces	5000.0	1.0	5000.0	
Total costs for establishment of the Technology				**7500.0**	

Maintenance activities

1. Replanting of propagules (Vegetative; monthly)
2. Weeding and cleaning of site (Vegetative)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit	Total costs per input	% of costs borne by land users
Labour					
labour	person day	3.0	250.0	750.0	
Plant material					
propragules	pieces	250.0	1.0	250.0	
Total costs for maintenance of the Technology				**1000.0**	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [x] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [x] humid
- [ ] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
n.a.

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [ ] medium (1-3%)
- [x] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [x] unusable

Is salinity a problem?
- [ ] Yes
- [ ] No

Occurrence of flooding
- [x] Yes
- [ ] No

Species diversity
- [x] high
- [ ] medium
- [ ] low

Habitat diversity
- [x] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [x] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [x] state
- [ ] company
- [ ] communal/ village group

Land use rights
- [x] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

- [ ] individual, not titled
- [ ] individual, titled

Water use rights
- [x] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	☐	☐	☑	☐	good
education	poor	☐	☑	☐	☐	good
technical assistance	poor	☐	☑	☐	☐	good
employment (e.g. off-farm)	poor	☐	☐	☑	☐	good
markets	poor	☐	☐	☑	☐	good
energy	poor	☐	☑	☐	☐	good
roads and transport	poor	☐	☐	☑	☐	good
drinking water and sanitation	poor	☐	☑	☐	☐	good
financial services	poor	☐	☐	☑	☐	good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

forest/ woodland quality	decreased	☐	☐	☐	☑	increased

Socio-cultural impacts

recreational opportunities	reduced	☐	☐	☑	☐	improved
community institutions	weakened	☐	☐	☑	☐	strengthened

Establishment of beach forest

Formation of Peoples Organization.

Ecological impacts

flood impacts	increased	☐	☐	☐	☑	decreased
impacts of cyclones, rain storms	increased	☐	☐	☐	☑	decreased

Off-site impacts

damage on neighbours' fields	increased	☐	☐	☐	☑	reduced
damage on public/ private infrastructure	increased	☐	☐	☐	☑	reduced

Benefits compared with establishment costs

Benefits compared with maintenance costs

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/extremes

Climate-related extremes (disasters)

storm surge/ coastal flood — not well at all ☐ ☐ ☐ ☑ very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology
- [ ] single cases/ experimental
- [ ] 1-10%
- [x] 10-50%
- [ ] more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?
- [ ] 0-10%
- [ ] 10-50%
- [ ] 50-90%
- [ ] 90-100%

Number of households and/ or area covered

Most of the people in the community are involved in the mangrove forest program because of the support of the Department of Environment and Natural Resources.

Has the Technology been modified recently to adapt to changing conditions?
- [x] Yes
- [ ] No

Planting design was modified through clustering for a technology resilient to climate change

To which changing conditions?
- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths

- It provides protection in the coastal communities from storm surges, waves, tides, and currents. Mangrove has buffering capacity to hold back sea waves and reduce wave forces because of its extensive and dense above ground roots. (land user's view)
- Mangrove plantation has potentials for ecotourism development. (land user's view)
- Innovative planting design using clustering as climate change mitigation measure. Mangroves are planted in cluster to achieve strength. The community and the Peoples' Organization (POs) determine the size of cluster to allow space as passage for boats. Spacing design used is flexible to adjust to local conditions that include depressed grounds, and patches of vegetation. (compiler's or other key resource person's view)
- It provides livelihood for the community since it supports fisheries production and aquaculture. (compiler's or other key resource person's view)

Weaknesses/ disadvantages/ risks → *how to overcome*

- Mangrove sites are threatened by urbanization, conversion to agriculture, cutting/overharvesting of mangrove trees for industrial uses such as timber and charcoal → *Strict implementation of rules, policies related to the protection and conservation of coastal areas and mangrove forest sites.* (compiler's or other key resource person's view)
- Mangrove pests and diseases have caused failure of mangrove forest development.Planted propagules that are submerged most of the time have a low mortality rate. → *Proper site selection of plantation site* (land user's view)

REFERENCES

Compiler

Philippine Overview of Conservation Approaches and Technologies - philcatsecretariat@gmail.com

Resource persons

- land user
Djolly Ma. Dinamling - SLM specialist
Wilfredo Gultiano - SLM specialist
Ace Wilfred Abarro II - SLM specialist
Rufino Lofranco - SLM specialist

Full description in the WOCAT database

https://qcat.wocat.net/en/wocat/technologies/view/technologies_578/

Linked SLM data

n.a.

Documentation was faciliated by

Institution

- n.a.

Project

- Decision Support for Mainstreaming and Scaling out Sustainable Land Management

Key references

Links to relevant information which is available online