community agroforestry

Agriculture + Forestry

"Participatory forestry refers to processes and mechanisms that enable those people who have a direct stake in forest resources to be part of decision-making in all aspects of forest management, from managing resources to formulating and implementing institutional frameworks. More specifically, community forestry refers to a component of participatory forestry that focuses on local communities as key stakeholders for sustainability." -www.fao.org

supporting agroforestry +
3 different strategies +
context +

financial

human

social

physical

natural

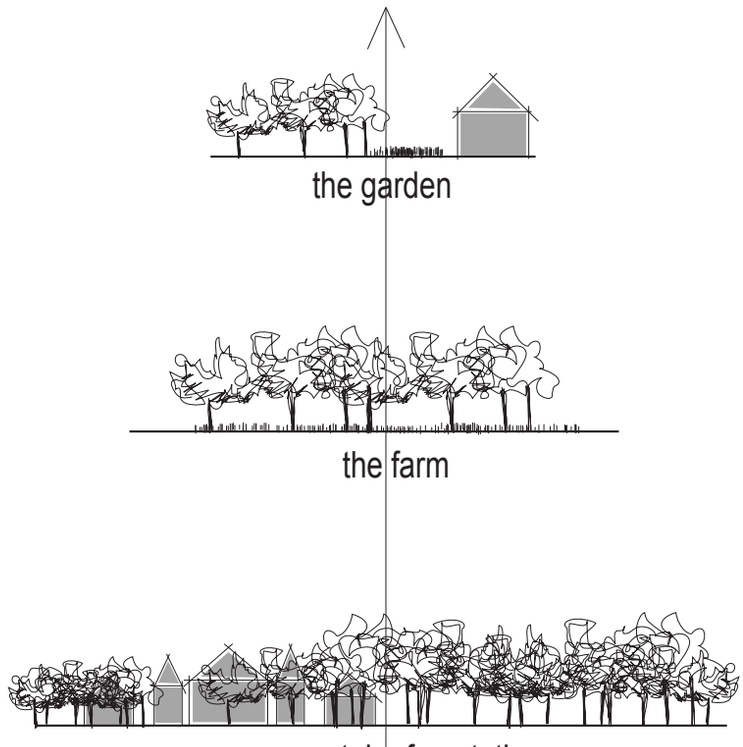
Supporting Agroforestry

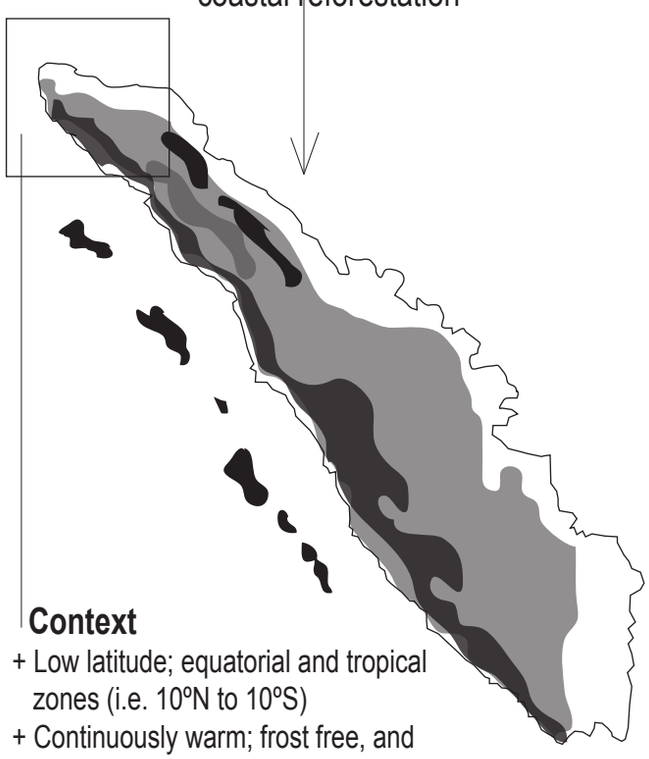
The December 26, 2004 tsunami destroyed Indonesia, and and more specifically, Aceh's primary sources of livelihood – agriculture. However, it is also necessary to acknowledge the physical and ecological degradation of the land and its resources due to poor agricultural practices even prior to the destruction from the tsunami, including a long history of slash-and-burn, illegal logging of timber, monoculture plantations, and shifting cultivation. Along with the devastating loss of habitats and lowland forests from the tsunami, it is now critical to implement and adopt more sustainable and community-oriented methods in the management of their natural resources.

Individuals and communities have the opportunity to re-establish lost forest systems by making small efforts such as planting fruit trees alongside their gardens. To create more substantial forested areas, shelterbelts can be planted adjacent to farmlands, and coastal reforestation projects that support local industries, resources, and coastal biodiversity. These projects can be implemented within the local communities or with the aid of facilitators such as NGOs and government agencies.

The Garden, **The Farm**, and **Coastal Reforestation** represent the 3 different community agroforestry plans which demonstrate the different scales in which the local community can manage and directly benefit from reforestation. Each plan looks at how both the private landowner and communities can practice sustainable agroforestry practices as a means to regreen, increase biodiversity, minimize and mitigate further soil degradation, and promote social and economic recovery. These plans also provide useful planting techniques that can be applied to the lowland areas of the Aceh Province.

These reforestation strategies can be applied simultaneously or independently, depending on the needs of its respective community. And each suggestion can be evaluated and adopted based on specific site conditions, community needs, and resource availability.





Context

+ Low latitude; equatorial and tropical zones (i.e. 10ºN to 10ºS)
+ Continuously warm; frost free, and approximately 1000cm of annual rainfall.

Agriculture + Forestry

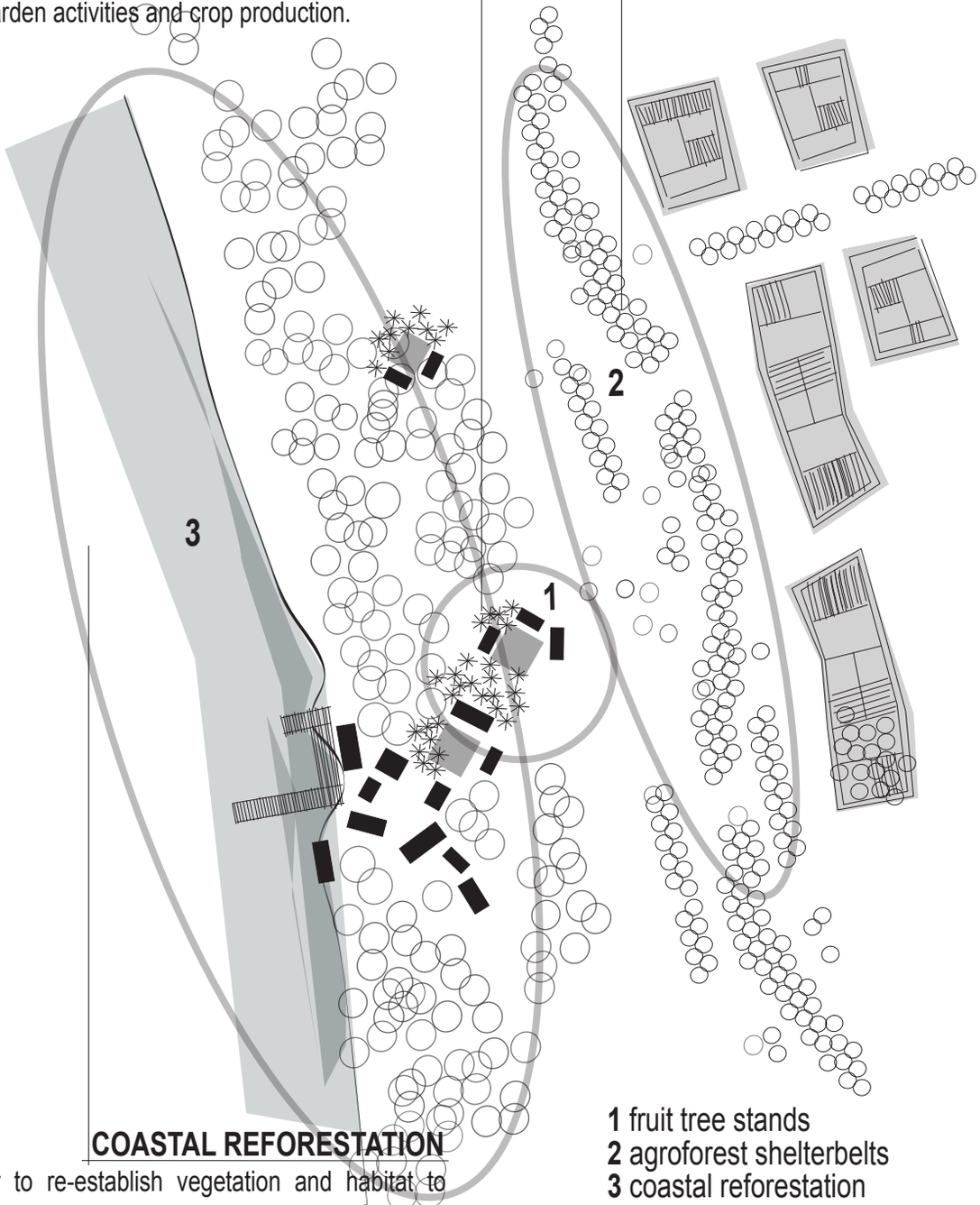
Community-oriented reforestation and environmentally sensitive agricultural practices can occur at 3 different scales and/or land uses.

THE GARDEN

Incorporate fruit tree stands adjacent to private and community garden spaces to add vegetative complexity to the site and provide additional resources to complement garden activities and crop production.

THE FARM

Establish agroforest shelterbelts alongside farmlands to supplement and replace agricultural activities, provide windbreaks, and discourage the necessity of shifting cultivation. Shelterbelts help to reduce wind speed, prevent wind erosion, provide areas of shelter and shade.



COASTAL REFORESTATION

In order to re-establish vegetation and habitat to Aceh's devastated shoreline, a program will focus on the maintenance of protected swaths of coastal forest adjacent to development and establish community-based forest management practices.

1 fruit tree stands
2 agroforest shelterbelts
3 coastal reforestation

See http://courses.washington.edu/larescue/jenn/design.htm for more in-depth information and resources

financial
human
social
physical
natural

The Garden

Phase I [0-6 months] **: Container Planting**
Phase II [6 months - 3 years] **: Transplanting into Permanent Communities**
Phase III [3-5 years] **: First Harvest**
Phase IV [5+ years] **: Full Garden Production**

goals +
planting fruit trees +
techniques & plant list +
economic benefits +

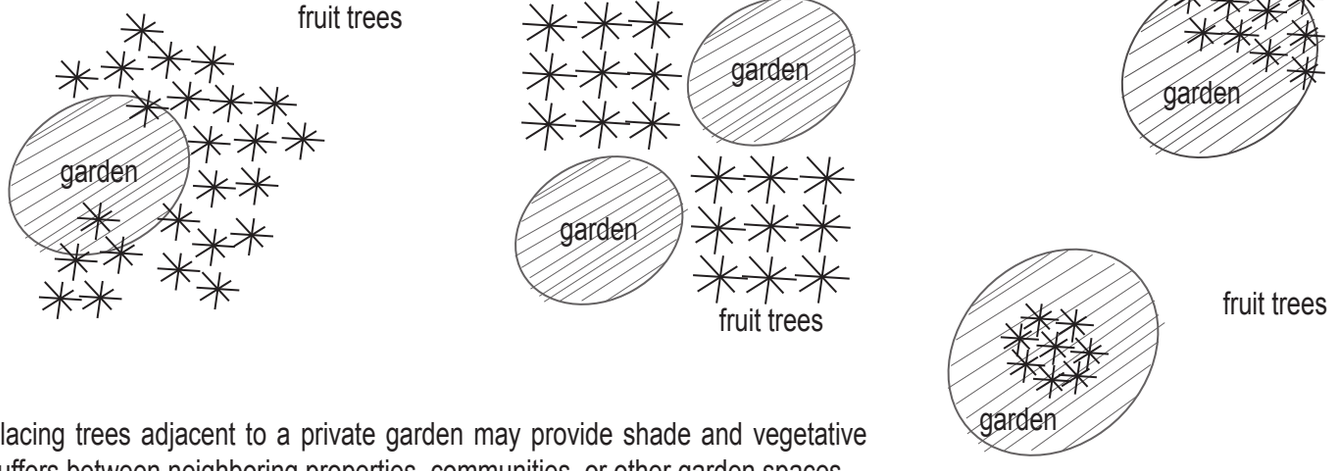
Fruit Tree Stands

Goals

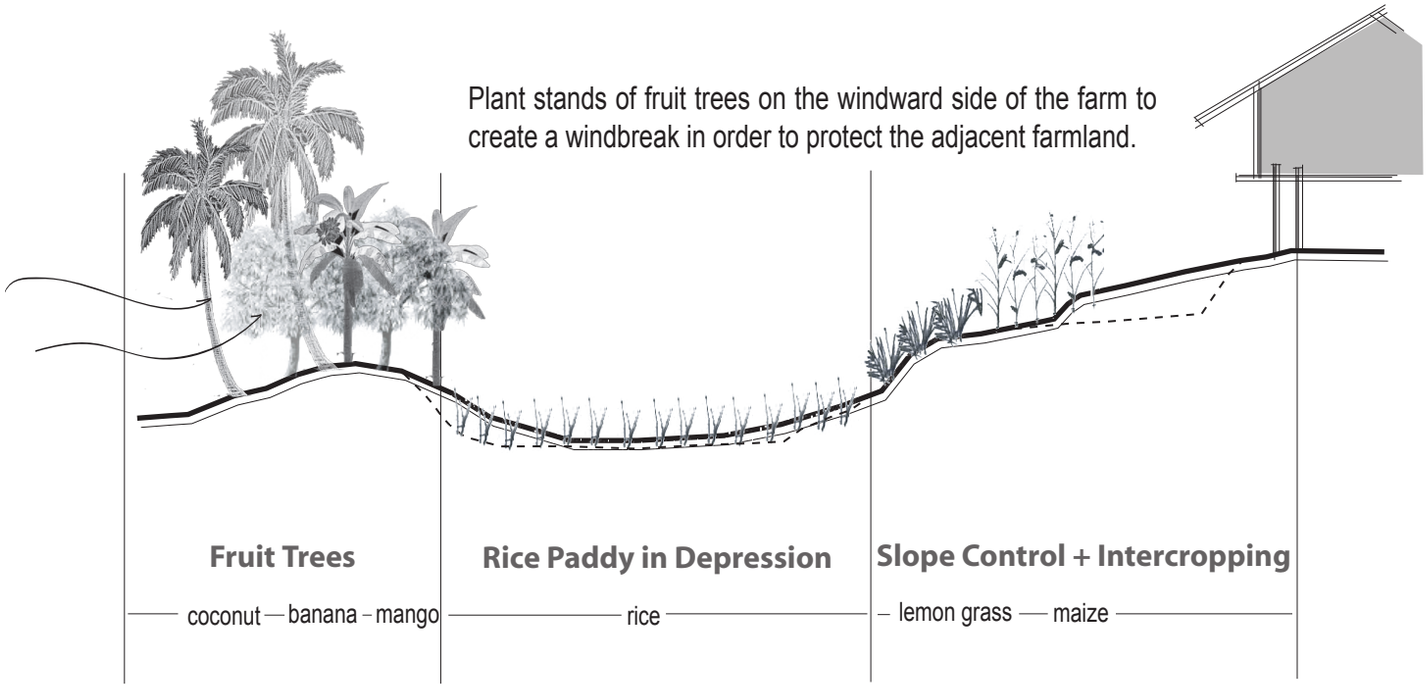
Incorporate fruit tree stands adjacent to private garden spaces to add vegetative complexity to the site and provide additional resources to complement garden activities and crop production.

Planting Fruit Trees

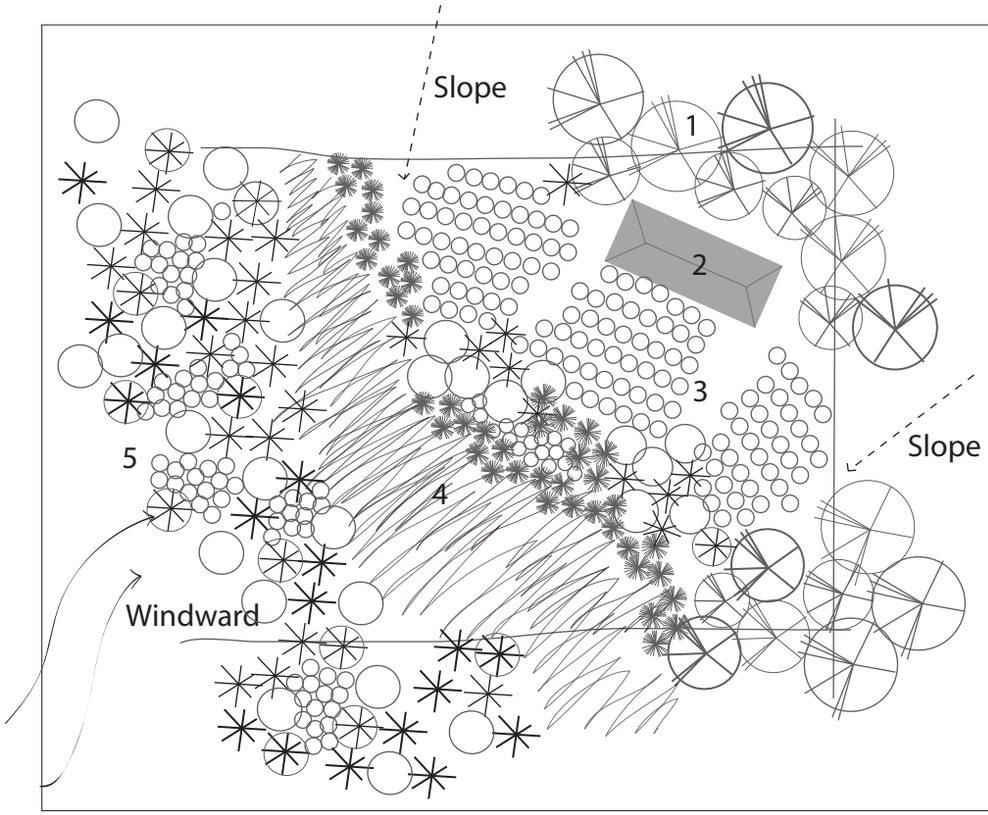
Fruit tree stands may be planted in a variety of forms that depend on the relationship between the garden and its immediate context. Planting in dense clusters establishes a distinct canopy and has the potential to support biodiversity in the understory.



Placing trees adjacent to a private garden may provide shade and vegetative buffers between neighboring properties, communities, or other garden spaces.



The Garden



1 Vegetation surrounds house or community structure to stabilize slope and infiltrate runoff

2 Shelter roof collects rain water to storage tank

3 Contour Plowing Intercropping + Crop Rotation + Fallow

4 Rice paddy planted at the lowest elevation of the site

5 Fruit tree stands

Techniques

SOIL

Short Term: A simple and low cost technique to soil desalinalization at the garden scale is labor-oriented tillage of clean, coarse materials into the soil in order to promote saline drainage. Fast growing legumes should be planted to provide organic matter, fix soil nitrate level, and provide a cheap and easy source of protein to the community.

Long Term: Intercropping and crop rotation should be implemented to maintain soil nutrients. Green mulch helps to build healthier soil and control invasives while enhancing garden productivity.

WATER

Short Term: Supply of irrigation water might not be sufficient before any clean water well or storage plant is restored / established. Rain barrels or other collection devices can be used to collect irrigation water if there is a lack of clean water available.

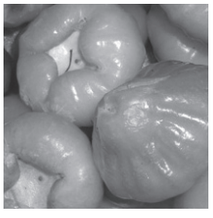
Long Term: Effective mulching techniques should be considered to maintain long-term soil moisture. On slopes, more drought tolerant species should be planted uphill and more water-dependent species such as rice should be planted in depressions, valleys, or foothills.

Planting List

Plant low maintenance fruit trees that can be cultivated in low and medium elevations. The following list of fruit trees can be customized according to the demands of the land and its respective communities.

Mango - Mangifera indica [Mango]
Soursop - Annona Muricata [Soursop]
Starfruit - Averrhoa Carambola [Starfruit]
Jambu Air - Sizygium Aquem Merr & L.M. Perry



Economic Benefits

To produce a larger variety of non-timber products (e.g.fruits) that can be harvested throughout the year for self-consumption or sale in the local markets.

The Farm

Phase I [0-2 years] **: Site Selection + Intercropping**
Phase II [2-7 years] **: Shelterbelt Planting + Crop Rotations**
Phase III [7-15 years + beyond] **: Integrating Agroforests + Farming**

goals +
how to create a shelterbelt +
techniques & plant list +
economic benefits +

financial
human
social
physical
natural

Agroforest Shelterbelts

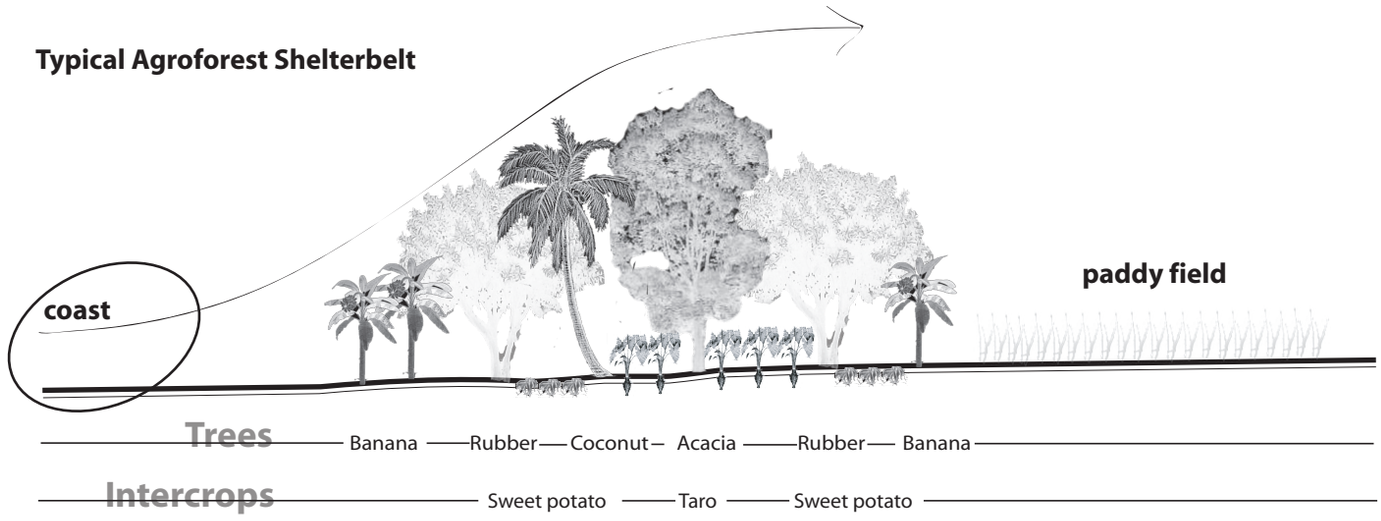
Goals

Establish agroforest shelterbelts alongside farmlands to supplement and replace agricultural activities, provide windbreak, and discourage the necessity of shifting cultivation. Field Shelterbelts reduce wind speed and prevent wind erosion, provide sheltered areas, and provide shade. The practice also provides more diverse agricultural products to improve local economy.

Typical Phases of Growth of a agroforest shelterbelt:

Phase I : quick changes and growth of shrubs and intercrops.
Phase II : trees begin to develop and shade out non-woody species. shade tolerant species can be established.
Phase III : trees mature and forest canopy develops. shelterbelt form establishes.
Phase IV : forest canopy can reach up to 35 meters

Typical Agroforest Shelterbelt



How to create a shelterbelt?

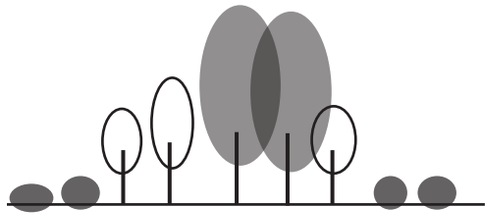
Height and Density : Dense shelterbelts that include tall standing trees of large, evenly dispersed canopies.

Row Design + Spacing : Plant 2-4 rows of taller tree species near the center of the shelterbelt to achieve an effective windbreak. Shelterbelts do not necessarily have to take up large portions of land, but biodiversity increases with the width of the shelterbelt. It is suggested that rows should be spaced at 2 to 4 meters apart. Low growing intercrops can be planted between rows to retain moisture.

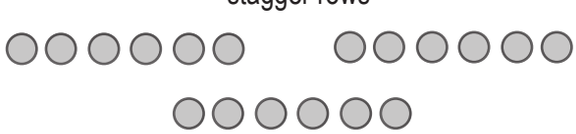
Species Composition : Species selection determines the success of shelterbelts. It is important to choose native tree species of appropriate hardiness, foliage, uniform canopy, and good branch retention for taller species that occupy the center (windbreak) of the shelterbelt. Smaller trees and shrub species should be planted on the outer edges of a belt.

Intercropping : Intercropping techniques can be implemented between tree rows to encourage agroforestry practices within a shelterbelt while supplementing agricultural revenue.

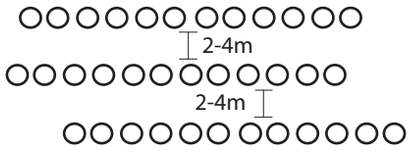
tall trees near center



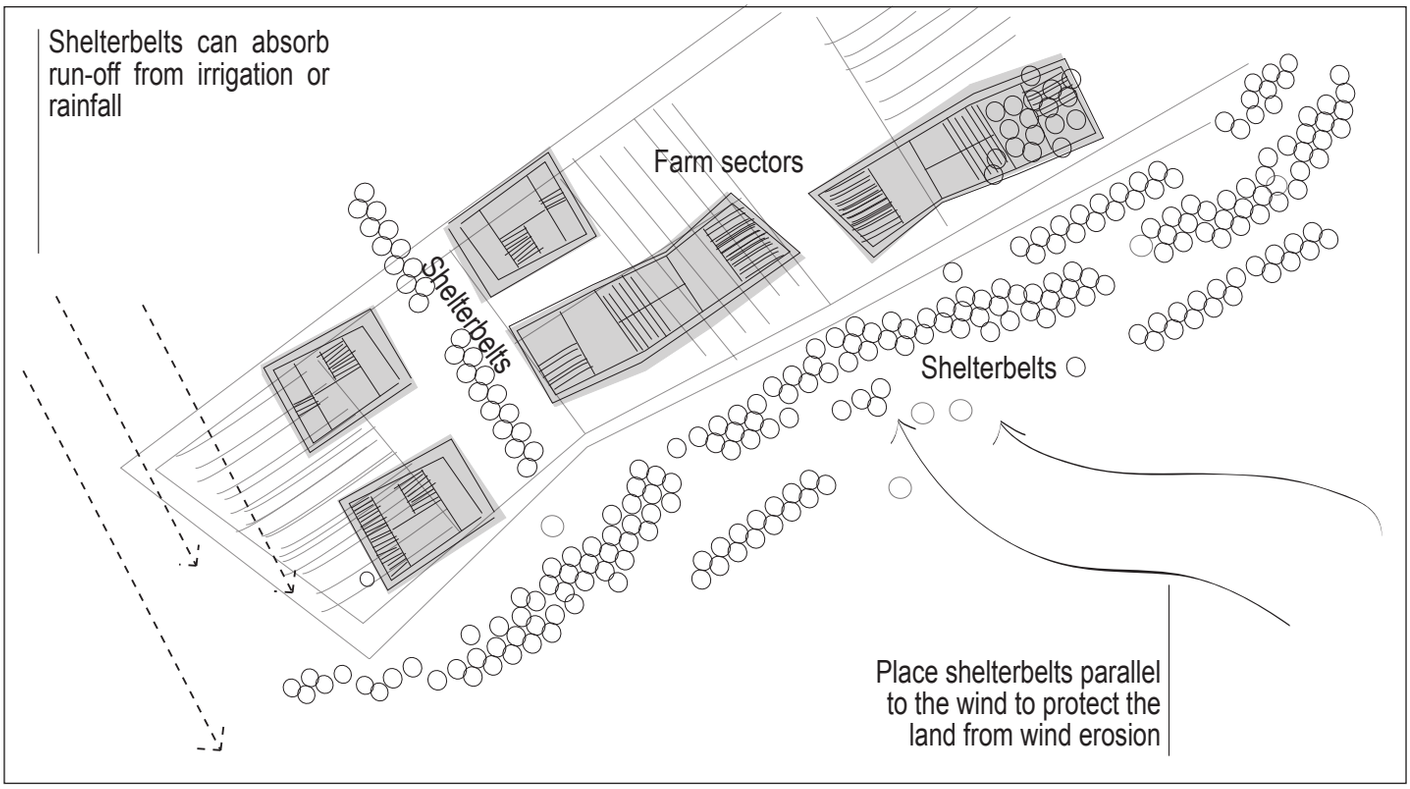
stagger rows



sufficient spacing



The Farm



Techniques

SOIL

Short Term: At the farm scale, machines like a mechanical roller/tiller should be considered to mix coarse materials intothe soil to improve drainage (site and salt content specific).

Long Term: Intercropped shelterbelts should be planted along windward periphery to slow runoff, check soil erosion and invasives, and to promote soil nutrients through intercropping and green mulching. When land is left fallow, controlled and productive species should be introduced to replenish soil nutrientsas well as substitute and discourage traditional slash-and-burn practices.

WATER

Short Term: The size and shape of the farm, the slope, and and the orientation of planting beds should all be considered to collect runoff and minimize surface evaporation (open water surface under tree canopy). On slopes, more drought tolerant species should be planted uphill, and more water demanding species like rice should be planted in depressions, valleys, or foothills.

Long Term: Matching plant selection to site conditions reduces the need of long-term irrigation. Microtopography such as depressions or trenches helps to trap irrigation or drinking water. Maximize vegetation coverage to promote extensive and consistent infiltration rate and groundwater recharge.

Planting List

The following tree species function successfully within a shelterbelt and/or common coastal and lowland species that will contribute to the reestablishment of lowland forest systems.

Trees:	**Intercrops:**
Rubber Tree - *Ficus elastica*	**Phase I and II:**
Sumatran Pine - *Pinus merkusii*	+ Sweet potato, Soybean
Coconut tree - *Cocos nucifera*	+ Cinnamon, Rice, and
Acacia - *Acacia mangium*	+ Leguminous crops
Durian - *Durio zibethinus*	(e.g. Groundnuts)
	Phase III +:
	+ Maize, Cocoa, Taro
	+ Banana, Nutmeg, Clove
	+ Pineapple

Other intercrops that have a varying degrees of shade tolerancy (less shade tolerant in the beginning phases of the shelterbelt, and intercrops with higher shade tolerance as the canopy develops) will provide a sustainable environment to retain moisture and prevent invasive growth along the understory.

Economic Benefits

On top of basic crops from farms, shelterbelts would provide non-timber products such as fabrics, fruits, annual crops and firewood to maximize overall revenue for local communities year-round and improve the standard of living.

Coastal Reforestation

phase I [0-2 years] **: Rebuilding Coastal Communities**
phase II [2-5 years] **: Establishing Young Coastal Forests**
phase III [5-8 years] **: Harvesting Young Coastal Forests**
phase IV [8+ years] **: Coastal Forests Matured**

Coastal Economy + Biodiversity

Goals

Use large-scale planning strategies to identify and reclaim coastal community land in order to establish and preserve coastal forests, mitigate coastal erosion and re-establish coastal habitat in order to sustain aquaculture.

In order to re-establish vegetation and habitat to Aceh's devastated shoreline, a program will focus on the maintenance of protected swaths of coastlines as agroforests adjacent to coastal development in order to improve forest management and community economy.

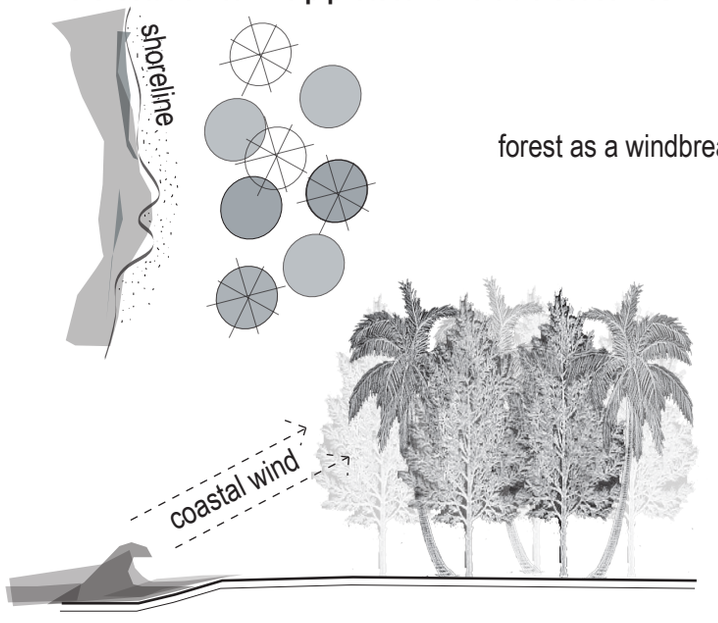
Short-Term Program :

+ Delineate reforestation areas adjacent to coastal development and communities
+ Tree Propagation
+ Building of coastal infrastructure
+ Establish community ownership of coastal forests

Long-Term Program :

+ Coastal forests to function as a landscape buffer and productive agroforest.
+ Establish and preserve sustainable coastal ecosystems.
+ Integrate forestry management practices in coordination with other coastal industries and sources of livelihood.

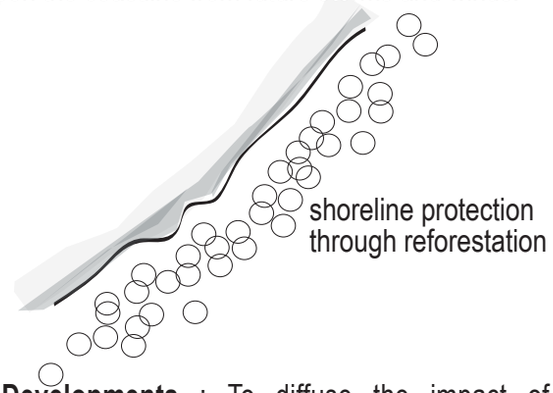
Reforestation can help protect vulnerable coastlines



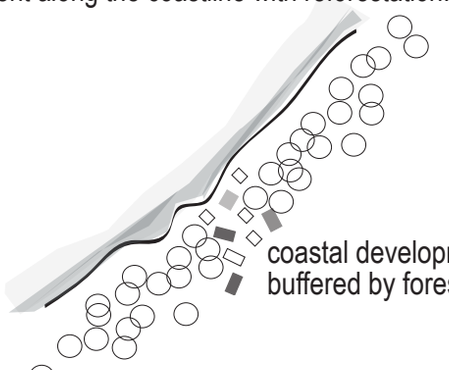
Creating Biodiversity

The coastal forest as a landscape buffer between:

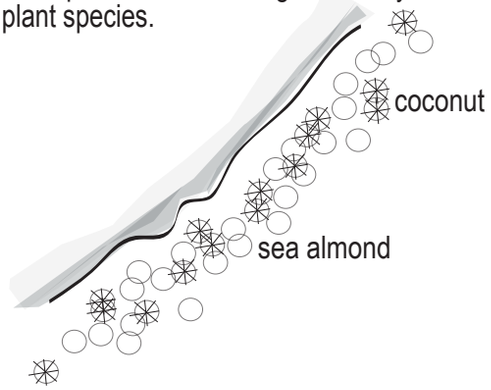
Sea + Shore : Mitigate further coastal erosion and reduce impacts upon the coastline from future storms and winds.



Coastal Developments : To diffuse the impact of development along the coastline with reforestation.

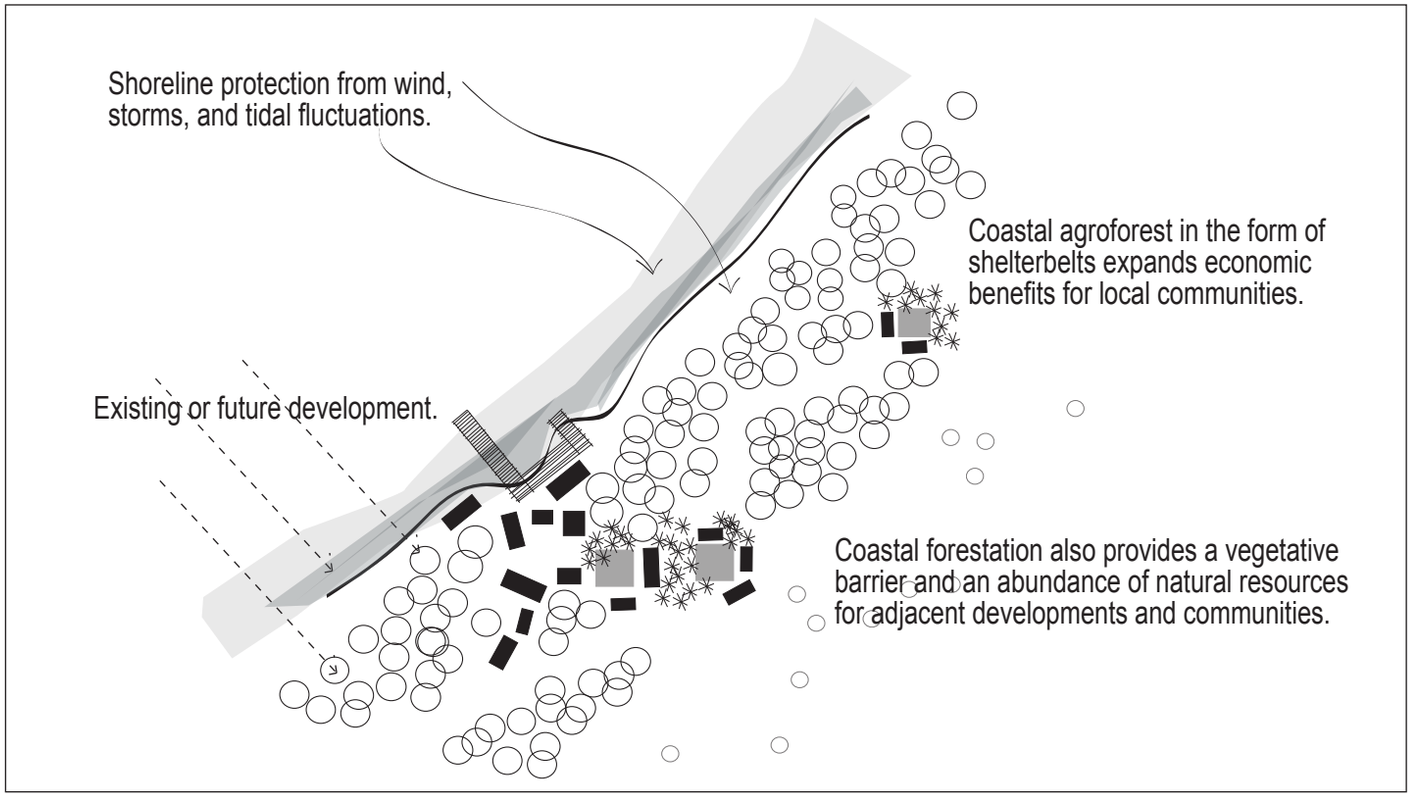


Habitats : Promote vegetative density planting of a variety of coastal tree species to encourage diversity in coastal habitat and plant species.



+ Establish herbaceous, shrub, and fast-growing tree species in initial development to create biomass.
+ Interplant with slower growing tree species that will help in long-term stabilization of the land.

Coastal Reforestation



Techniques

SOIL

Short Term: For large-scale coastal reforestation, wash soil with chemicals and mix with coarse materials. It is ideal to mitigate the soil through the cultivation of salt tolerant annuals and then gradually shift to fruit trees or other complex plant communities as soil quality improves. Green mulch or other groundcovers can be planted to protect fragile transitional spaces from weed invasion.

Long Term: Agroforestry and intercropping promote biodiversity and a healthy ecosystem. Here, healthy soil can be established as various macro and micro flora and fauna flourish, espeically in a no-tillage, forested environment.

WATER

Maximize vegetation coverage to promote extensive and consistent infiltration rate and groundwater recharge. Select appropriate plants to specific site conditions which will also reduce the need of irrigation in the long run.

Planting List

Coconut tree - *Cocos nucifera*
Casuarina - *Casuarina equisetifolia*
Sea Almond Tree - *Combretaceae Terminalia catappa*

Other coastal species in the Aceh province:
Casuarinaceae Casuarina equisetifolia [tree]
Euphorbiaceae Glochidion sp.
Goodeniaceae Scaevola sericea [shrub]
Guttiferae Calophyllum inophyllum [tree]
Lecythidaceae Barringtonia asiatica [tree]
Leguminosae - Papilionoideae [tree]
Sagu Palm - *Palmae Metroxylon sagu*
Nipah palm - *Nypa fruticans* [grows well in mangrove forests]
Pandanaceae Pandanus sp. [palm tree]

Economic Benefits

Major economic benefits would come from noon-timber products of coconut, rubber, palm fabrics and various fruit trees. Selective harvesting of the timber would be recommended, giving communities the option to replace initial species with market-demand crops. Instead of selling raw materials for timber products, communities should also consider processing and crafting their resources into products to increase economic gains.