

reconcile with nature

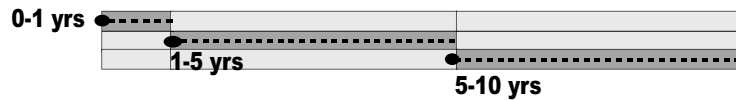
Human impact severed the aftermath of tsunami; the best way to mitigation and rehabilitation is to reconcile with nature: wait or help the nature, to see how it recovers by itself. This workshop focus on reestablishing healthy shoreline habitats around Northern part of Banda Aceh to mitigate the damage in a manner of nature friendly to help the coastal people find a way to live their traditional marine life harmoniously with a sound shoreline ecosystem. . .



intro +
time horizon +
spatial sequence +
vegetation succession +

Time Horizon --- what should we do in 10 years time?

ooooo In order to make good use of the resources, different time periods are designed for special targeted purpose. People in different time period have different concerns and focus. The time span for each period is showing below



Vegetation succession

Spatial sequence

Time horizon

reinforcement

resilient

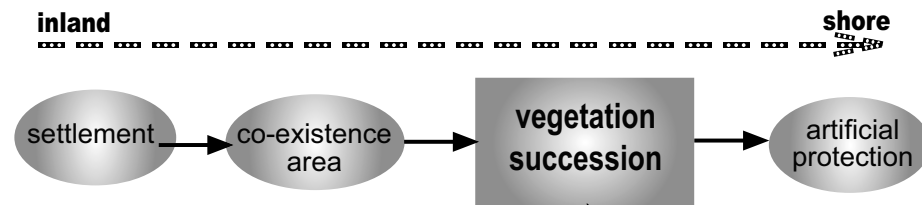
reconcile

nature

ocean

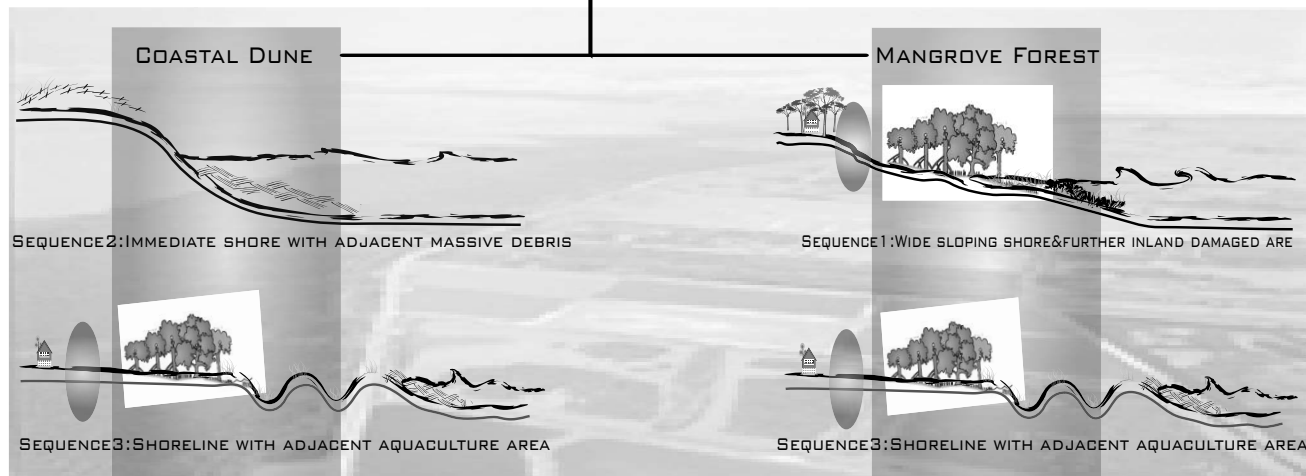
Spatial Sequence --- what should be there from shore to inland?

ooooo Spatial sequence is an order for different elements in the reestablishment process. Three different sequences (showing below) are designed to accommodate different shoreline situation. Generally, all types of shoreline spatial sequence should base on four fundamental elements. Their order in the sequence is essential for the built up habitat.



Vegetation Succession --- what should we plant on the shore?

ooooo Within the spatial sequence, vegetation succession need detailed design because it is essential to shoreline habitat. Two types of vegetation succession are suggested, which may fit into differnt types of spatial sequences.



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human

social

physical

natural

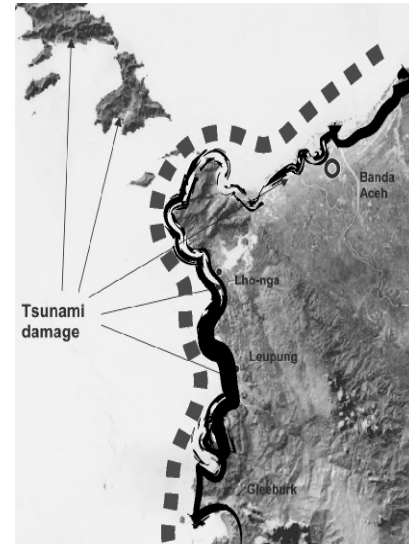
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Time Horizon



0-1 yrs

- +Reinforce and reconstruct damaged shoreline using both artificial methods and natural friendly methods -
After tsunami, shoreline area was badly eroded with great lost of surface sand and soil. Worse still, the land was no longer capable to retain sand and soil against constantly tapping sea water. Before large scale reforestation being implemented, it is important to prevent shoreline area from further erosion and make it strong enough to accommodate vegetation in this time period.
- +Clear up debris and prepare land for revegetation -
Massive debris generated by tsunami could be made use of to build up protection structures
- +Integrate the rehabilitation sites with the new settlement for manpower efficiency -
Newly developed shoreline need to be taken care of. Local people settled in near shore area can participate in the shoreline rehabilitation process. It is also possible to form some memorial ritual such each family help to take care of one segment of the revetment site and have their death's name on the stone to be memorized.

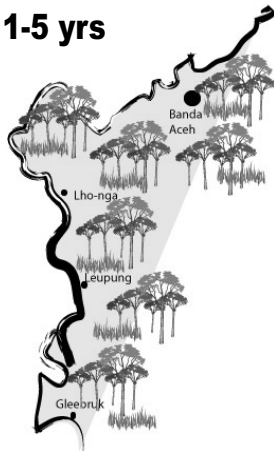


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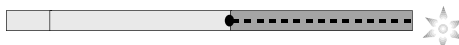


1-5 yrs



- +Large-scale reforestation in shoreline area according to different types of coastal ecosystem -
Coastal ecosystems provide shoreline stabilization and buffering services. Some concerns about the shoreline revegetation are the access to the sea. The scale of the shoreline forest and its relationship with the inland settlement should be well handled to ensure the efficiency of the natural system without forcing local people to change their way of marine life too much. Access can be made together with the estuaries of the rivers.
- +Set up non-developed barren land for eco-recover -
Since people are willing to move back to their original land near shore, some restrains should be made in the early years of eco-recover to ensure that there is no more disturbance on the ecosystem. non-developed areas serve as the transition and buffer from the human settlement to natural system.

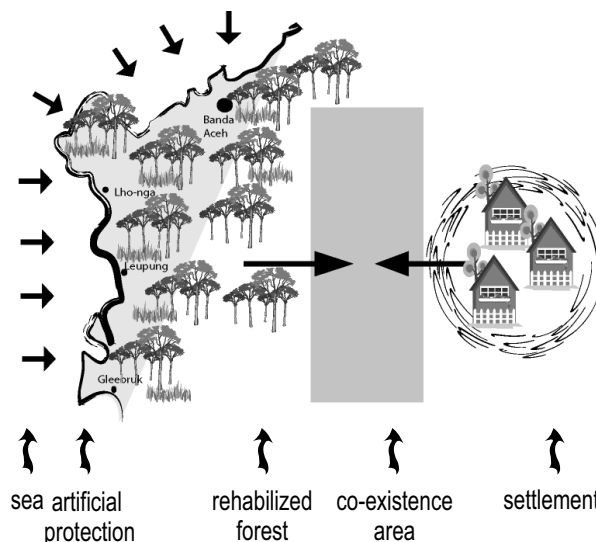
social



5-10 yrs

- +Nurish and aggradize vegetation coverage
- +Gradually resettle to non-developed areas-
The final stage of rehabilitation is to join the human settlement with the natural system. The non-developed areas in the second stage would be developed to co-existence areas for people and the nature.

NOTE: DIFFERENT FOCUS FOR DIFFERENT TIME PERIODS SHOULD BASE ON A COMPREHENSIVE SHORELINE REHILITATION PLANNING. RESETTLE TO SHORELINE AREA SHOULD TAKE A LONG TIME FOR THE ECOSYSTEM FROM RECOVER



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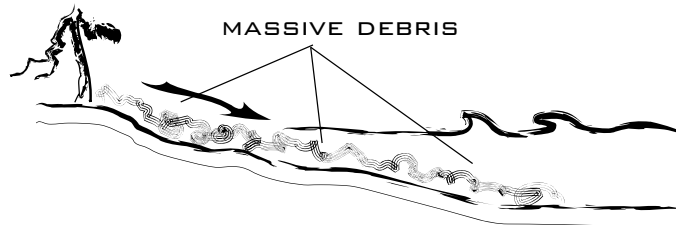
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Spatial Sequence

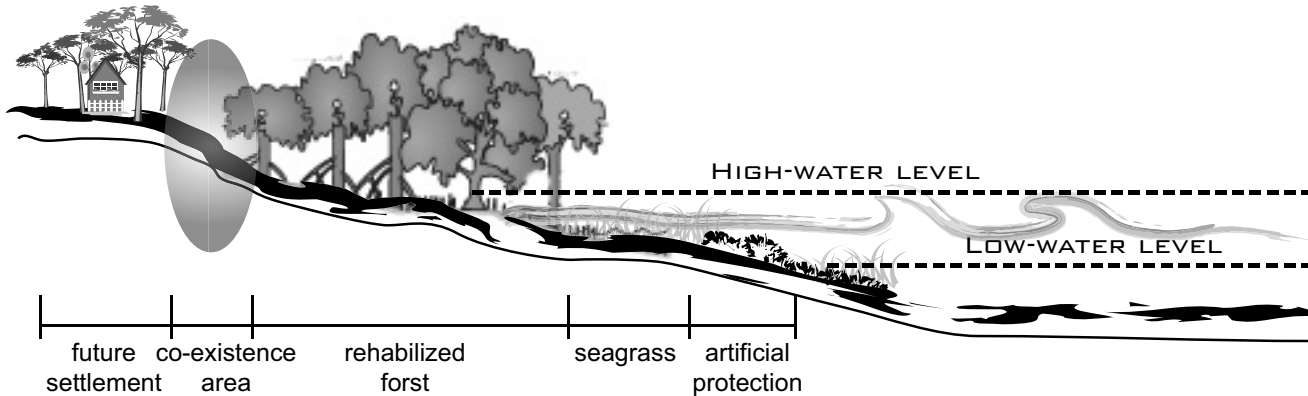
There are three prototypes of the shoreline spatial sequence generated from three typical sites of Banda Aceh . The methods for spatial management are suggested below.

SEQUENCE 1: WIDE SLOPING SHORE

Present: This type is from highly damaged area in Banda Aceh, where 3.3km extensive debris is further inland. Situation now is severe with barrier lands suffering from further erosion.



Designed Sequence



spatial sequence	future settlement	co-existence area	rehablized forest area	foreshore seagrass	artificial protection
suggested method	local people would eventually come back to their former land. The re-settlement sites can be integrated with the rehabilitation sites and the temporarily relocation sites.	certain non-developed strip between coastal area and new settlement sites could serve as a transitional area to help the ecosystem recover without further disturbance. Such strip would be developed into co-existence area in the later stage of rehabilitation	mangrove and some native tidal species such as nipal and other palm forest could be planted in the intertidal areas to establish a sound natural eco-system on shore.	seagrass can be intentionally planted behind those artificial protections to further prevent the erosion	offshore seawall or barrier island could be constructed for high damaged areas; concrete groins for severely eroded areas; stone revetment is the best choice because of its low cost and easy management
Note	It is important to maintain the degree of the slope, for mild slope can mitigate the force of the wave and retain sand and surface soil. Resettlement to the shoreline areas should be restricted. However, people should take care of the newly rehabilitated forest to ensure its success, especially during the first one to five year.				

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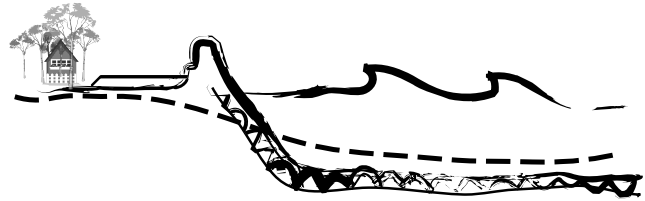
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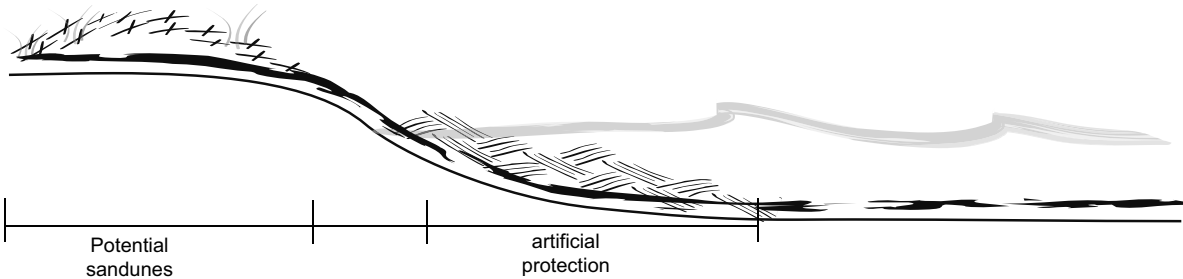
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SEQUENCE 2: IMMEDIATE SHORE WITH ADJACENT MASSIVE DEBRIS

Before&Present: This type is from the northern most part of Banda Aceh, where the shoreline and settlement were totally damaged. The damage is so sever that the shore configuration has been changed a lot with intensive inundation area and receding foreshore.



Designed Sequence



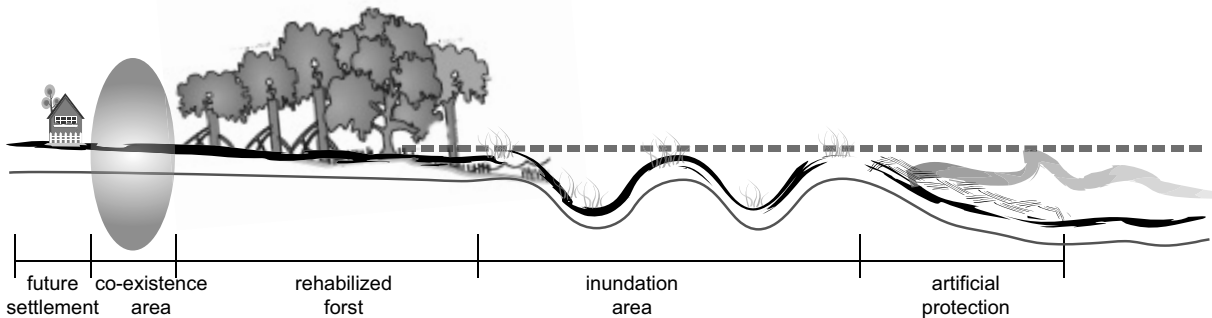
spatial sequence	potential sand dunes	artificial protection
suggested method	The area is no longer suitable for settlement. Changed shore may be suitable for sand deposit.	+offshore breakwater +concret groin +stone revetment
Note	The rehabilitation of these areas is critical, for they are the very front barrier island for the main land. They can serve as buffer area for future disasters.	

SEQUENCE 3: SHORELINE WITH ADJACENT AQUACULTURE AREA

Before&Present: This type of shoreline habitat is widespread all over Banda Aceh. The former aquaculture ponds were inundated or destroyed, left the newly forming lagoon or contaminated lakes.



Designed Sequence



spatial sequence	Inundation area	artificial protection
suggested method	The shape of the land is suitable for sustaining sand from sea waves. It could be left vacant as buffer areas or developed into near shore wetland.	+offshore breakwater +concret groin +stone revetment
Note	This area is originally highly populated area with thriving aquaculture and fishery. Local people from this area are especially willing to move back to the sea. Like type one, non-developed area should be zoned to ensure the land recover.	

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Vegetation Succession

The main ecosystem modulators are temperature, salinity, chemical suitability and physical sustainability. Coastal ecosystem in Sumatra can fall in to the category of mangrove forests, beach vegetation, brackishwater forests rocky shores and coral reefs. Based on the shoreline topography and local climate, two types of vegetation succession are listed below. Each type can fit into types of the context of the spatial sequence discussed above.

COASTAL DUNE

Vegetated dunes can occur on sandy seacoasts to support plant growth and sufficient wind action to move sand. Coastal dunes, particularly those of the barrier type, have a value well beyond that of habitat, serving as coastal protection and preservation in several ways. Continuous barrier dunes serve as flexible barriers to storm surges and waves and are of particular value in affording protection to low-lying backshore areas and in helping to preserve the integrity of low barrier islands. Dunes provide protection more effectively and at a lower cost than a

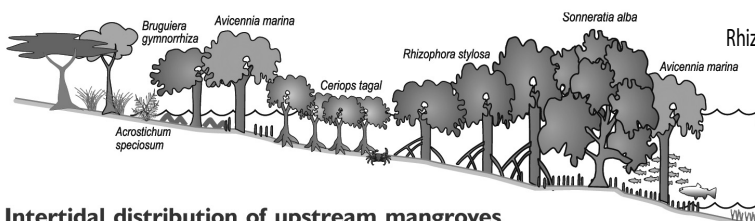
zone	pioneer	intermediate	forest
species	grass, sedge, forb	shrub	varies
function	"dune builders"	"stabilizers"	
substrate	sand	sand	sand/soil
wetness	periodically flooding	less flooded	almost dry
nutrient	low	med	relatively high
Note	Forests form on dunes only after a substantial period of soil development and only on sites with considerable protection from salt spray and flooding. Trees can be planted successfully to convert large mobile dunes and dune fields to forest after dune stabilization with pioneer and intermediate zone species. The most important thing is to build up sand deposit on shore and identify native beach grasses to dune plants.		

source: creation and restoration of coastal plant communities, Roy R. Lewis, III

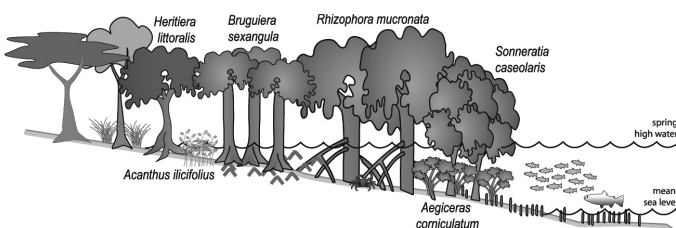
MANGROVE FOREST

Mangrove forest is the most typical and efficient species on shore. It is reported that a large scale mature mangrove forest can reduce the wave force by 35%. It is reasonable to choose mangrove as the primary species for reforestation.

Intertidal distribution of downstream mangroves



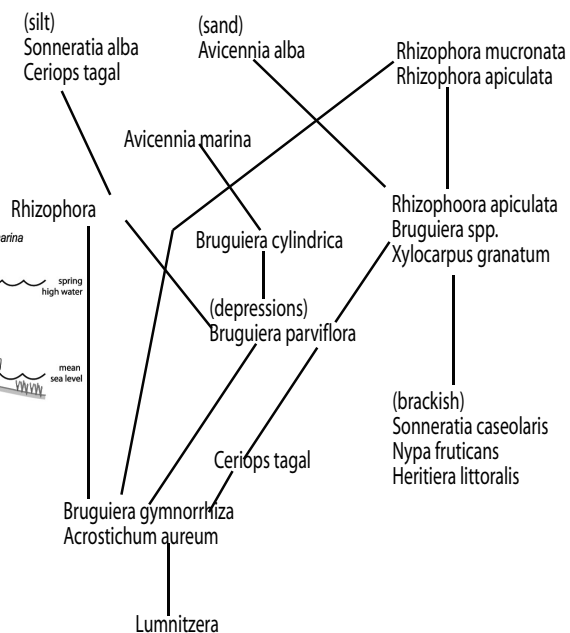
Intertidal distribution of upstream mangroves



source: "Daintree Mangroves" - January 2004, the university of Queensland

Open coast

Creeks, bays and lagoons



source: "the Ecology of Sumatra, Tony Whitten, etc.

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