

REHABILITATION OF ERODED SHORELINES

A case study in Kien Giang Province



OVERVIEW

Throughout mainland Kien Giang province, people are utilising mangrove forests and their many products. In coastal areas the local people seem aware of the key benefits to be gained from mangrove forests. Identified benefits derived from timber and thatch products, associated aquaculture, barriers to erosion on canals and seashores, and even aesthetic gardens are observed throughout the province.

It is not possible to prevent predicted rises in sea level. So the most appropriate strategy needs to be both adaptation and defence. 'No action' will result in re-active and uncontrolled retreat from coastline areas with huge consequences accompanied by the loss of productive agricultural lands and massive displacement of people.

IMPROVED MANGROVE FOREST MANAGEMENT

This case study provides recommendations that might contribute to improved mangrove forest management in Kien Giang Province. It assesses alternate and complimentary strategies for coastal managers and landholders who must deal with rising sea levels and eroding shorelines. To be successful the strategy only needs to delay erosion loss, giving more time for communities to adjust and adapt in a more considered way.

One key component necessary to improve mangrove management is to increase awareness and appreciation of the great benefits to be gained from healthy and sustainable mangrove forests. Shoreline vegetation has significant intangible benefits. Healthy mangrove forests support the bulk of regional fisheries production and these same forests contribute to improved quality of coastal waters and hold and bind sediments, reducing erosion and loss of coastal lands.

To improve the capacity of mangroves to provide these important ecosystem services, mangrove areas need to be both enlarged and better maintained, specifically as the 'green barrier' along the sea edge that protects the coastal margin. While mangroves have multiple benefits, like increased fisheries production, it is their benefit towards coastal protection that needs to be officially recognised and fully supported. Official recognition is needed to ensure lands are allocated specifically for the task of hosting mangroves as shoreline stabilizers. Shoreline development needs to be kept to a minimum in these area, and appropriate strategies must be put in place to deal with anticipated increases in sea level.

OBSERVATIONS ON LIVELIHOOD PROJECTS AND AWARENESS RAISING

In Ha Tien estuary in far northern Kien Gian there are large estuarine areas that are in the process of being divided up and turned into ponded crop lands of *Nypa* palms. This appears unique for Kien Giang, if not elsewhere in Vietnam. The going price of each frond is 3000 VND. A stack gets around 384,000 VND.



The ready advantage in *Nypa* is that it is saltwater tolerant. There are also likely to be intangible benefits in their support of nearshore fisheries.

Mangrove forests are not used by the locals of Phu Quoc, and they are treated with considerable neglect. It seems that mangrove wetlands are seen only as areas of future development. Development is occurring rapidly in Phu Quoc due to the high level of tourism in the area. Many mangrove remnants and remains are evident around the island in the form of cut dead stumps and stagnant ponded areas that have been cut off from the sea by ground work alterations. There is a real and urgent need to raise people's awareness of mangroves in this important district, which will lead to better management and conservation of these essential resources.

OBSERVATIONS ON RESTORATION PROJECTS AND RECOMMENDATIONS FOR FUTURE EFFORTS

Shoreline surveys carried out by the project provide full quantification of the extent and proportions of coastal areas affected by erosion and breaching of dykes, with 33% of the coast (59.4 km) eroding. Mapping and remote sensing identified that in Hon Dat the coastline area is being lost at a rate as much as 24 m per year. In addition to the current eroding areas, a further 59% of the coastline in Kien Giang province is considered to be at risk of future erosion due to factors including steep coastlines and low mangrove density.



Eroding coastlines threaten homes and livelihoods.

Pressures from both erosion and habitat transformation (development, cutting, conversion of aquaculture etc) have resulted in the mangrove area of Kien Giang being reduced to the point of being only a narrow fringe in many areas. Large scale efforts to re-establish mangroves at the coastal fringe through seedling planting, combined with restoration of mangroves at the landward margin are required to protect both the mangrove resource and the communities they support.

The recent Prime Ministerial decision (667) on coastal dyke strengthening highlighted the current attention regarding these issues. This decision sets a desirable target of 500 m mangrove width, recognising the role played by mangroves in attenuating wave action. These strategies will ultimately increase carbon storage as well.

SHORELINE DEFENCE

DYKE CONSTRUCTION

One solution to coastal erosion has been to build dykes to keep the sea out. Observations show that dykes have collapsed and breached during periods of severe storms and large waves. Dykes must also be accompanied by increasingly sophisticated water control systems for associated river canals.

Unfortunately, as sea levels rise, the vulnerability of communities behind these 'high-maintenance' constructions increases exponentially. In addition, dredging of coastal areas to maintain and establish dykes exacerbates the problems presented by rising sea levels through a reduction in the

elevation of the wave wash zone and an increase of cross currents. These factors will prevent successful establishment of mangrove seedlings.



MANGROVE PLANTING

Sea front mangrove plantings often do not thrive and many plantings have failed in Asia. Only 50% of sea front plantings undertaken in Kien Giang have been successful and they have been costly in terms of money and time. In many areas the physical nature of the coastline has been altered dramatically due to erosion such that the construction of short-term barriers, coastal sediment replenishment and measures to increase the elevation of the wave wash zone, will be required to facilitate mangrove re-establishment at the coastal fringe.



The project is currently trialling planting strategies in Kien Giang, however they are unproven on a broad scale.

Establishment and early growth are the most sensitive stages and planting may assist in passing through these stages.

The success of large-scale community planting can be partially quantified from our shoreline assessment during 2009. While a notable 27 km, or 15%, of the Kien Giang coast is fenced for planting, only 50% of these areas have successfully-

established seedlings.

Importantly, fenced planting has only been undertaken in areas of little or no erosion. In other words, planting is evidently not being undertaken where it is needed most. For the entire mainland coast of the province, approximately 58 km, or 32%, is affected by erosion and 23% of mangroves are actively eroding. These observations emphasise the great urgency in applying more effective shoreline management and rehabilitation in the region.

In addition to planting into eroded areas, it is also recommended that planting consist of a diversity of species. The recorded effects of herbivory in planted areas highlight the vulnerability of single species planting. Increased diversity is likely to enhance the resilience of planting efforts; it will also increase mangrove forest diversity along the coast. At present the majority of mangrove forest is dominated by *Avicennia* (50%) and 82% of planting is *Avicennia*.

In some areas it is likely that mangrove seedling establishment and alternative engineering solutions will not succeed under any circumstances. In these areas, it remains unlikely that generating a 200 m extension to the front of the existing mangrove (as discussed in Kien Giang) is possible. This needs to be further evaluated. Coastal retreat and landward mangrove regeneration must be accepted as the only viable long-term cost-effective solution to protect inland areas given sea-level rise predictions in these areas.

MANAGEMENT OF MANGROVE HARVESTING

Cutting of mangrove forests for firewood has been identified as a significant threat to the ability of mangroves to provide their important services in coastal stabilisation. Minor harvesting of mangrove trees within the mangrove forest is very widespread, as is the collection of food and scavenging of debris. Observations on timber harvesting found cutting to be evident in every forest stand, principally of small size specimens for poles or perhaps firewood.

Cutting is found even at the front of narrow eroded mangrove fringes, suggesting a disconnection between the needs or knowledge of locals in cutting trees and that of the protective role of mangroves.

Based on the results of the shoreline survey it is recommended that wood harvesting be managed to limit removal and felling of trees in actively eroding and fragmented areas.



To minimise the threat to fringing mangrove forest presented by mangrove harvesting, it will be necessary to produce alternative sources of wood through the production of timber species such as the cannonball mangrove, *Xylocarpus granatum*. A potential trial mangrove plantation site could be used to produce timber species like *Xylocarpus granatum*.

One potential strategy is to explore rotational harvesting and to encourage wood collection from prograding forest and regrowth forest. These areas are the least likely to be impacted by erosion and have the greatest potential for recovery. At present, only 8% and 9% of total mangrove harvesting occurs in prograding and regrowth forest, respectively.

A specific wood harvest management strategy should be developed for An Minh province, as these mangroves are experiencing the most intense harvesting activity and are the most at-risk of shoreline erosion that is likely to directly threaten homes and livelihoods.

As a proportion of forest type, high biomass, continuous, *Sonneratia* forest (11%) is the most threatened by wood harvesting with 65% of this forest type being cut. This forest type represents the few remaining stands of large mangrove trees and should be protected from cutting to provide shoreline protection and fish habitat to the areas directly north of Rach Gia. They also represent the forest type with the greatest carbon storage potential.



It is unlikely that any of the presented solutions will succeed unless appropriate management actions are taken to prevent the continued haphazard fragmentation and degradation of existing and restored mangrove areas.

The prevention of such habitat destruction will require a number of key components:

- 1) The provision of **education at all levels** of community, local, provincial, national and international to highlight the scale and severity of the coastal erosion issue and highlight the value of mangrove forests for coastline protection and other ecosystem services.
- 2) **Regular year-to-year monitoring and assessment of shoreline condition and the success of various mitigation strategies**, including construction of dykes and planting, along the entire coastline.
- 3) The **facilitation of local management and protection of mangrove forests** by improving the direct monetary value of these valuable natural resources through the implementation of a REDD carbon storage scheme in conjunction with targeted livelihood projects.
- 4) The **provision of alternative sources of firewood and building materials** with the establishment of community plantation forests that can be accessed by the poorest members of the community. This selected harvesting might feasibly be linked with carefully applied shoreline rehabilitation projects.
- 5) The **implementation and trial of well-considered shoreline restoration strategies**, especially like the 'hedge row' planting strategy as a method that accommodates the inevitability of sea level rise.

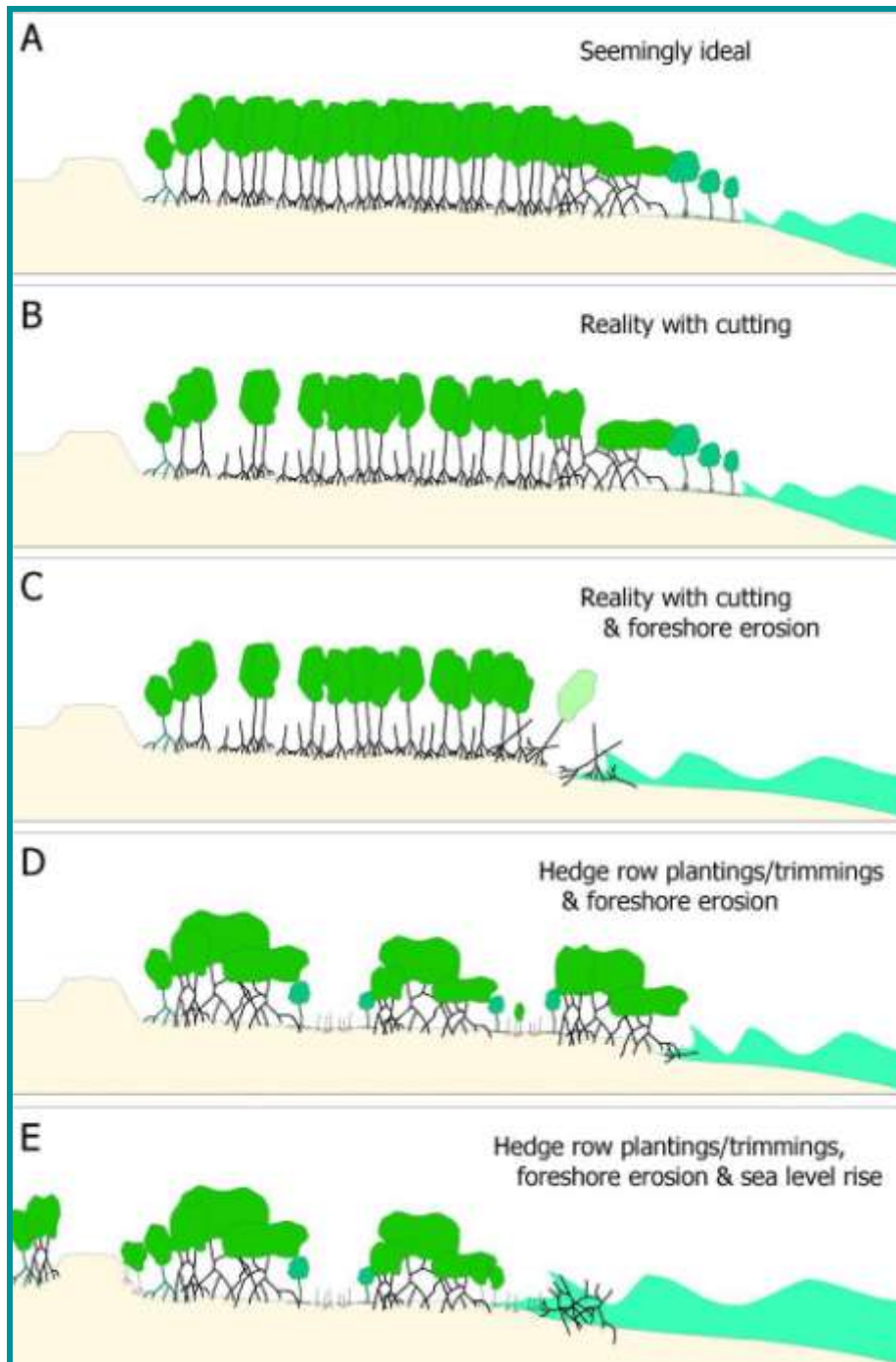
EDUCATION AND AWARENESS

Education needs to highlight the scale, severity and consequences of the coastal erosion problem and the importance of mangroves at all levels to promote awareness of the issue that will encourage and facilitate local, provincial, national and international action.

POTENTIAL PLANTING SOLUTION

The mangrove-fringed shoreline is not often in an ideal condition (A), because of indiscriminate cutting and other direct human pressures (B). In locations with shoreline erosion, once specially-adapted 'edge' trees are lost, remaining trees offer little resistance and the shoreline recedes rapidly (C). A suggested solution is to nurture shoreline coastal defenses with selected planting and cutting to develop 'hedge rows' parallel to the shoreline (D).

Faced with rising sea level, these hedges always present a defensive barrier of 'edge' trees, which exhibit growth patterns resilient to wave and current action. As each is eventually overwhelmed, there is time to grow new rows behind. This action buys precious time for coastal communities to adapt to climate change.



ON-GROUND WORKS – WHAT, HOW, WHERE

- 1. Provide protection to mangrove seedling planting areas through the establishment of short-term engineering solutions that reduce wave action and current forces for long enough such that trees can become established. Such barriers will also facilitate sediment deposition, further assisting mangrove establishment**
- 2. Nurture coastal mangrove vegetation rehabilitation using a 'hedge row' defensive strategy where local communities can buy time by reducing the rate of shoreline retreat.**
- 3. In some cases, build up the elevation of the near-shore warp zone to reduce water depth to levels that enable successful mangrove establishment.**

CONCLUSION

Planting efforts at the coastal fringe should no longer be undermined by continued mangrove degradation at the landward edge as it reduces the capacity of the ecosystem to naturally restore and buffer erosive forces. There are few non-mangrove sources of firewood and building materials available in Kien Giang Province as only small areas of natural melaleuca and terrestrial trees remain. This means areas that are eroding are still actively cut, perhaps even more so than other areas as erosion creates ease of access. This cutting exacerbates the shoreline erosion. Large scale planting efforts are further undermined by a perceived lack of protection and understanding of mangrove value amongst community members. In addition, a lack of some alternate income streams which may reduce mangrove degradation and fragmentation further intensifies the problem.

A series of maps produced by the project identifies that current mangrove planting efforts are focused on stable or depositional coastlines. To improve the usefulness of mangroves as coastal defense, planting should be concentrated on actively eroding coasts. These maps identify shoreline conditions throughout the province (eroding, stable, depositional etc.), and will be valuable tools in the selection of future sites for mangrove planting. Future analyses should identify and map specific locations where coastal retreat and mangrove restoration is necessary. This information can be combined with identification of areas where additional efforts are needed to promote mangrove establishment, allowing informed site selection to concentrate seedling planting efforts.

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