RAPID VIDEO SHORELINE ASSESSMENT

A case study in Kien Giang Province

INTRODUCTION

This case study presents the Shoreline Video Assessment Method (SVAM) developed at the University of Queensland. The video is analysed for a number of features that relate to the 'condition' of the coast. Simultaneous GPS data enables shoreline features to be mapped. SVAM gives qualitative assessments of shoreline habitat, physical condition and human influence from continuous video recordings of the shoreline and intertidal zone of the entire shoreline of Kien Giang Province

FACTORS EFFECTING THE COASTLINE

The mangroves of Kien Giang Province in South Vietnam are a highly valuable resource. These unique coastal forests provide multiple ecosystem services including; carbon storage, wood production for building, fish trap construction and firewood, habitat for aquatic food resources and most importantly shoreline stability and erosion reduction.

Increased fragmentation of these forests has reduced their capacity to withstand physical processes such as wave action, coastal currents and wind that are related to their location on a semi-exposed coastline. Consequently large areas of coastline are currently eroding or are at risk of erosion in the near future.

This coastal erosion problem is not only removing the mangrove resource and associated ecosystem services, but directly threatens the livelihoods of numerous people and greatly increases the vulnerability of Kien Giang Province to the effects of sea-level rise and storm surges predicted with climate change.

To achieve effective coastal protection it is necessary to assess and quantify the current condition of the shoreline and the mangrove resource in order to identify, locate and quantify the full extent of the issues that directly threaten mangroves and reduce their resilience to coastal erosion processes.

Conservation and Development of the Kien Giang Biosphere Reserve Project

THE SHORELINE VIDEO ASSESSMENT METHOD

In February 2009 a video of the shoreline was taken using a Sony Handycam from a boat running parallel to the coastline approximately 25m from the shore. A GPS was used to record latitude and longitude every 3 seconds.

Video of the coastline was reduced to 1 second frame .jpg files.. The shoreline features in each frame were then scored. Only the initial 20m intertidal zone visible in the frame and/or the directly adjacent terrestrial habitats (if visible) were used for assessment.

The aims of the rapid video assessment were to:

- **Quantify shoreline physical condition– substrate and erosion.**
- **Categorize and quantify shoreline mangrove forest type, extent and condition.**
- **Identify and quantify shoreline mangrove resource use.**
- **Identify and quantify threats to the shoreline mangrove resource.**

The SVAM enables a rapid, cost-effective assessment of shoreline condition that requires little expertise for data collection, enables detailed assessment of shoreline features and is repeatable for future monitoring purposes. The use of video provides a permanent record of shoreline condition from which to assess future change.

SHORELINE PHYSICAL CONDITION

The dominant shoreline habitat type was defined within each frame. The classifications and the descriptions of each class are shown in Table 1.

Mangroves were found along 74% of the shoreline of Kien Giang province.

Table 1. Shoreline Habitat Types.

Shoreline Habitat	Description	km	%
Mangrove	Mostly mangrove forest	117	**65**
Terrestrial Fringe	Mostly covered terrestrial vegetation (trees & grass).	10	**5**
Mangrove & Terrestrial	Mixture of both mangrove and terrestrial trees	10	**6**
Sandy Beach	Presence of a gently sloped shoreline with sandy substrate and intertidal vegetation absent.	4	**2**
Rocky Shore	Dominated by rock with no or sparse vegetation cover.	12	**7**
Human Settlement	Presence of built structures in the intertidal zone or directly adjacent to the shoreline.	21	**12**
Waterways	Natural Creek, Exposed Channel, River	3	**1**
	Canal	**3**	**2**

EROSION

Erosion severity (Table 2) and the condition of exposed mud walls/dykes (Table 3) were determined using qualitative assessment.

Nearly a quarter of the mangrove coastline (30km) is experiencing active mangrove loss due to erosion.

Overall, one-third of the coastline is eroded or eroding.

Coastal erosion leads to a major loss of mangrove area and has implications for the capacity of Kien Giang mangroves to provide coastal defence under predicted scenarios of sea level rise with climate change.

Table 2. Shoreline Erosion.

Shoreline Erosion	Description	km	%
Severe Erosion	Assessment of: exposed sediment layers, slope, exposed roots of mangroves, fallen trees	19	**11**
Eroded		21	**12**
Minor Erosion		18	**11**
Stable	No obvious erosion and deposition present	74	**43**
Depositional	Mangrove seedlings and/or an obvious shallow mud apron extending seaward	29	**16**
Hardened/ Sea-wall	Any continuous built hard surface structure	14	**8**
Total Eroded		58	**33**
Total Eroded - Of concern	Presence of recently fallen trees	**30**	**23**

Table 3. Exposed Mud Walls.

Exposed Mud Wall	km	%
Stable	5	**3**
Eroding	8	**4**
Degraded/Breached	11	**6**
Total Exposed Wall	**24**	**13**

Almost 50% of exposed dykes were severely degraded or breached.

An additional 8 km of dykes are currently eroding.

SHORELINE MANGROVE FOREST TYPE, EXTENT AND CONDITION

Mangrove forest structure was categorized according the visible growth forms of trees leading to an overall forest appearance that indicates structure (Table 4). The dominant mangrove genus (Table 5) was assessed as the genus which made a clear majority of the mangrove trees along the coastal fringe (not the forest behind). Genus was determined by growth form, leaf colour and root

structures present in the frames. Where the forest was an even mix of multiple genus, or no dominant genus could be determined, the forest was classified as mixed.
The shoreline fringing forest was classified into density classes using the spacing between trees, canopy continuousness and forest width. Height was classified using known forest heights as a reference. The combination of density and height was used to classify fringing forest biomass (Table 6) as high (e.g. tall, dense forest), medium (e.g. short, dense forest) and low (e.g. sparse, medium forest).

Table 4. Mangrove Forest Structure.

Mangrove Forest Structure	Description	km	% of mangrove
Continuous	Dense continuous shoreline cover of mangrove trees of even height	53	40
Fragmented	Dense forest with obvious gaps associated with tree felling/erosion	24	18
Regrowth/ Recovery	Continuous forest, but with mangrove tree height variability	11	8
Prograding/ Expanding	Continuous forest along the shoreline with a gradual decline in tree height towards the seaward mangrove margin	24	18
Planted		5	4
Sparse	Non-continuous forest with large gaps between trees, but an overall coverage of the shoreline edge	10	7
Scattered	Only a few mangrove trees present along the shoreline	7	5
Total Mangrove Presence		134	74

Table 5. Mangrove Species.

Dominant Genus	km	% mangrove
Avicennia	67	50
Sonneratia	25	19
Rhizophora	12	9
Nypa	2	1
Mixed	28	21

Table 6. Mangrove Biomass.

Mangrove Biomass	km	%
High	105	74
Medium	19	14
Low	10	8
Average Biomass Score	3.4 (High)	

78% of mangroves along the shoreline have high biomass (although they may be limited in width)

MANGROVE RESOURCE USE

The presence of permanent fish traps and visible aquatic organism harvesting activities observed were recorded. And the presence of dense *Nypa* stands with evidence of cut fronds was used to indentify *Nypa* frond harvesting (Table 7). Wood collection activity was quantified as cutting severity. The presence and density of cut branches, stumps and felled trees was used to classify cutting severity (Table 8).

Table 7. Mangrove Use.

Mangrove Use		km	% effected
Fish Traps	presence of permanent fish traps	31	18 % coastline
	associated with mangroves		80 %
Nypa planting / harvesting	dense Nypa stands with evidence of cut fronds	6	3 % coastline
Human Settlement		7	6 **% Mangroves**

Mangroves were identified as being valuable fish habitat for edible and tradeable aquatic resources.

Assessment of fish traps showed that 81% of all fish traps were associated with mangrove presence and 69% were associated with intact continuous forest.

Table 8. Mangrove Cutting.

Mangrove Cutting	Description	km	% mangrove
None		57	42
Present	one or two trees cut	48	37
Moderate	some trees cut, easily noticeable in the frame	23	17
Heavy	obvious presence of many cut stumps	6	4
Extreme/ All	majority of shoreline trees cut	0.4	0.3
Overall Cutting Pressure		77	58

Pressure on these forests through cutting is evident along 77km of coastline, affecting 58% of the mangrove area along the shoreline.

Human activity, including unsustainable wood harvesting is exacerbating shoreline erosion and severely limiting the ability of mangroves to act as coastal stabilizers.

Most cutting occurred in *Avicennia* (49%) and *Sonneratia* (19%) forests, with cutting observed in 65% of continuous *Sonneratia* forest. This suggests that *Sonneratia* is a target species for wood harvesting. It was also observed being felled and coppiced to create habitat in association with fish traps.

MANGROVE PLANTING ACTIVITY

Areas with dense to moderate seedling/sapling cover present behind the 'planting fence' were recorded as successful planted areas. Areas with few or no seedlings/saplings present behind the fence were considered to be unsuccessful planting areas.

Table 9. Mangrove Planting.

Mangrove Planting	km	% of coastline
Fenced	27	15
Failure	13	50
Success	13	50

50% of recent past mangrove plantings have been successfull.
Current strategies to replant mangroves could be improved to increase seedling establishment success and protect vulnerable coastline.

THREATS TO THE SHORELINE MANGROVE RESOURCE

In addition to wood harvesting, a number of other natural and anthropogenic pressures were identified from the shoreline survey that are likely to further reduce the resilience of the mangrove forest to coastal erosion (Table 10).

Direct mangrove removal for canal, dyke and industrial construction covered 1.7km of the coastline.

Root burial associated with litter accumulation in Kien Luong district was observed to have killed an 800m section of mangroves near Hong Quao. Extensive litter accumulation was noted to be present on a further 7km (4%) of the coastline.

Severe herbivory on *Avicennia* from an unidentified caterpillar, caused extensive foliar leaf loss. This was observed mostly in An Bien and An Minh districts and in planted, prograding forest

Table 10. Threats to Mangroves.

Threats to Mangroves	Description	km	% effected
Herbivory - Caterpillar	occurrence of severe herbivory on trees of the *Avicennia*	13.5	**10 % Mangroves**
Recent Mangrove Removal (Reclamation)	mangroves had obviously been recently removed for dyke/canal/ industrial construction	1.7	**1 % Coastline**
Litter Accumulation	obvious litter **accumulation along the shoreline.**	**7**	**4 % Coastline**

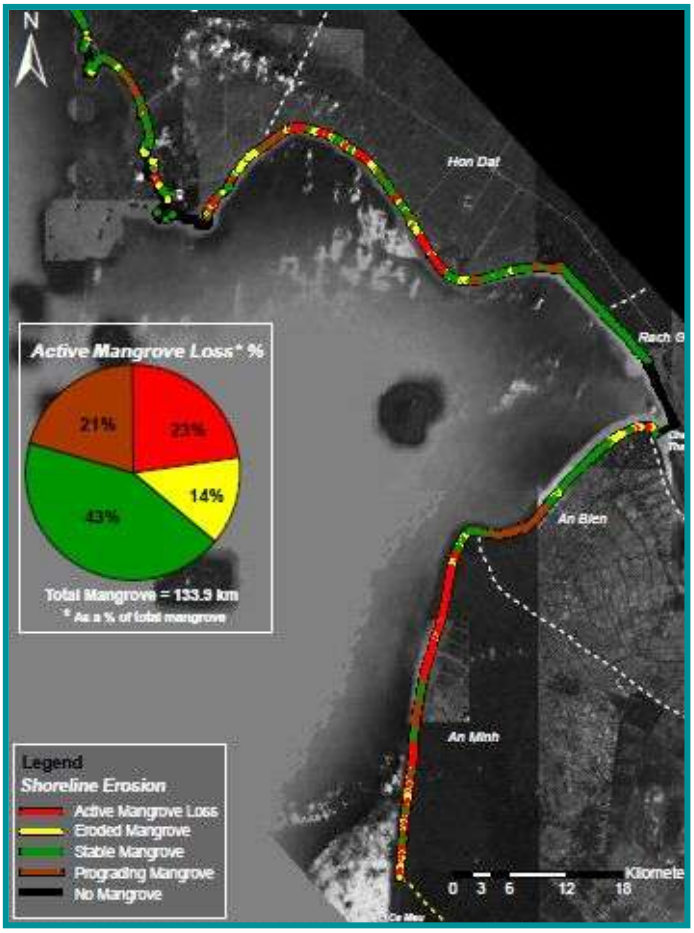
SPATIAL INFORMATION

As the data was collected as a continuous line intercept, it is possible to produce maps showing combinations of characteristics of the shoreline.

The vulnerability of stands and areas requiring extra conservation management can now be defined.

For rehabilitation studies, the maps can be used to define the extent of lands at risk to prioritize restoration works.

Baseline surveys are needed to establish the extent and condition of current tidal wetland habitats in Vietnam, allowing accurate mapping to assess future environmental change to these important habitats.



The rapid degradation of exposed earthen dykes emphasises both the importance of the mangrove fringe in wave attenuation and shoreline protection and the ineffectiveness of earthen dykes as a strategy for coastal defence.

From the survey, 5km of aquaculture ponds were recorded as being breached and damaged by erosion. Additionally, 19 homes and villages were observed to have been abandoned or are directly threatened by coastal erosion. In the event of a storm surge resulting from a typhoon, it is likely that many more homes will be damaged and the loss of life is highly likely. The majority of abandoned and threatened homes and aquaculture were recorded along the An Minh coastline where erosion is the most severe.

1. **It is highly likely that extensive, uncontrolled wood harvesting and felling of shoreline mangroves is exacerbating shoreline erosion.**
2. **Cutting in eroded areas was recorded as being significantly more severe than in non-eroded areas. In the case of An Minh District, 86% of actively eroding areas were cut.**
3. **Once total mangrove loss occurs in front of an earthen dyke, the dyke quickly degrades.**

MANAGEMENT RECOMMENDATIONS

Large areas of mangrove have been lost to coastal erosion processes and much of the Kien Giang coastline is at risk of eroding in the near future. In some instances, coastal erosion has extended beyond the mangrove fringe and now threatens commercial enterprises and homes. This problem is only likely to become more severe under present climate change and sea-level rise predictions. Without appropriate action, the degradation of mangroves along the Kien Giang coastline will remove any effective vegetative buffer and expose the coastline to the effects of sea level rise which will threaten the livelihoods of thousands of people. It is likely that the ability of mangroves to ameliorate the effects of climate change will be significantly reduced unless appropriate mitigation actions are undertaken soon.

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