MANGROVE AND COASTAL EROSION IN THE CONTEXT OF RESILIENCE TO CLIMATE CHANGE IMPACTS IN THE SOUTHERN MEKONG DELTA, VIETNAM

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OVERVIEW

Coastal erosion is a serious problem along much of the 3,260 km coastline of Vietnam. It affects about 25% of the coastline of northern and central provinces, with erosion rates of more than 100m per year in some places [1]. Coastal erosion is also common along the coast of the southern Mekong Delta, which for the purposes of this article is defined as the coastal area between Tien Giang Province on the East Sea coast and Kien Giang province on the Gulf of Thailand coast. Erosion is particularly severe at Go Cong Dong (Tien Giang Province), Hiep Thanh – Duyen Hai (Tra Vinh Province), along almost the entire east coast and parts of the west coast of Ca Mau Province, and Ha Tien (Kien Giang Province). Between 1965 and 1995, erosion stripped up to 2 km from the east coast of Ca Mau province [3], and nowadays is still continuing at a rapid rate.

As part of the national strategy for coastal protection, mainly against salinity intrusion and storm surges, sea dikes have been built along parts of the Vietnamese coastline. In the southern Mekong Delta, these have generally been built 100 to 1000m inland from the shoreline, with a protective mangrove belt to the seaward. This protective mangrove belt has helped to reduce the rate of coastal erosion and in some areas it has even promoted sediment accretion. However, the mangrove belt is gradually being lost from some parts of the coast, exposing sea dikes and coastal communities to the full force of “mother nature”.

Recently, the Prime Minister promugated Decision 667, dated May 27, 2009 to launch the Programme for Consolidation and Upgrading of the Sea Dike System from Quang Ngai to Kien Giang Provinces. Ministry of Agriculture and Rural Development (MARD) is the agency responsible for the implementation of this programme, which involves dike construction and the rehabilitation of a mangrove belt of at least 500m in width along 1700 km of coastline nationwide [2].

Coastal erosion and accretion (sedimentation) are both part of the normal dynamic interaction between shorelines and the sea. Erosion along the East Sea coast of the southern Mekong Delta appears to be mainly structural erosion caused by waves and longshore sediment transport which strips sediment from the coast and deposits it at the tip of Ca Mau Cape at the confluence of the East Sea current and the circular pattern of water flow in the Gulf of Thailand. Changes in sediment inflow to the coastal zone from the Saigon, Mekong and other rivers in the southern Mekong Delta could also be involved.

Any rise in sea level or increase in the frequency and intensity of coastal storms is likely to accelerate the rate of coastal erosion, and could lead to changes in its spatial pattern.

Sections of the coastline that are now eroding could become areas of accretion and conversely, sections that are now accreting may become areas of erosion in the future.

It is against this backdrop that projects implemented by GTZ in coastal provinces of the Mekong Delta have been formulated. Given the length of coastline being eroded the complete prevention of coastal erosion would be impractical and too expensive, so the focus of adaptive strategies should be to minimize the rate of erosion and its impact on coastal communities. A key element in reducing the rate of erosion is to use mangroves to provide a protective barrier along the shoreline. Mangroves themselves cannot provide complete protection against erosion in all situations, as shown by the severe erosion along some parts of the coastline in Ca Mau where there are reasonably well-developed mangrove stands. Arguably, however, the rate of erosion would have been much faster without them.

In order to manage the problem of coastal erosion it is necessary firstly to understand its causes. For this, some knowledge of seasonal changes in wind direction and strength, wave energy and direction, and the pattern of longshore currents, and how these interact with the shape of the coastline. This is location specific. Without this understanding, it is difficult to plan interventions to minimize erosion, and it is possible that an intervention taken along one section of the coastline will simply transfer the problem to another section. Hydrodynamic models, for example LITPACK modeling software, are useful tools for analysing and predicting coastal erosion patterns, and for developing an effective response. While these are relatively expensive in terms of data requirements, the longer term economic and social costs of inaction or inappropriate short-term fixes are far greater. The Vietnamese-Dutch Rehabilitation of Mangrove Forests Project (1996 – 1998) explored low cost structural solutions for coastal protection, and in its 1998 main report stated "*the unknowns and the complexity of seasonal near-shore currents, varying sediment loads and sediment behaviour along the Soc Trang (and Tra Vinh) coast call for an in depth study in coastal dynamics.... Without such a study, the risk of failure of selected structures will be too high to warrant the substantial investments needed for such works.*" [3] Somewhat surprisingly, the World Bank Coastal Wetlands Protection and Development Project chose not carry out such a study prior to the implementation of that project. Had such a study been undertaken then, provincial authorities in the southern Mekong Delta would now be much better equipped to tackle the problem of coastal erosion.

Secondly, a wider selection of mangrove species better matched to particular hydrologic conditions should enhance coastal protection. At present, the seaward protective mangrove belt in the southern Mekong Delta is comprised almost entirely of *Rhizophora*. Interplanting *Rhizophora* with other species having different root architectures is likely to provide greater coastal stability. Other species, particularly *Sonneratia* and *Avicennia* are also more effective than *Rhizophora* for stabilizing newly accreting mudflats. *Sonneratia,* for example, has been used very effectively for coastal protection in southern Tra Vinh Province, and for dike protection in northern Vietnam.

In some cases it may be necessary to move sea dikes further inland and plant protective belts of mangroves or other trees in the area between the old and new sea dike. It takes time for trees to grow to the stage where they provide effective coastal protection. There are social and economic costs involved in this, because households living outside the new sea dike have to be relocated.

CONCLUSION AND RECOMMENDATIONS

The long term problem of coastal erosion in the southern Mekong Delta will continue and could become more severe in the future, particularly if sea level rises and the frequency and intensity of coast storms increase. It is unlikely to be feasible to stop erosion completely, but a combination of revetments or other structural measures in critical areas of erosion, together with a more effective mangrove protection belt in others could reduce coastal land loss significantly. In order to implement an effective strategy for managing the problem of coastal erosion in the southern Mekong Delta it is critical to have a good understanding of coastal hydrodynamics, and so a comprehensive study of coastal dynamics along the entire coastline of the southern Mekong Delta must be given high priority.

Specific recommendations include:

Develop a hydrodynamic model for the coastline of the southern Mekong Delta

Better land use planning, with attention being paid to the relocation of sea dikes further landward in areas where serious erosion is taking place could form a crucial basis for mangrove-based resiliency strategies to deal with climate change adaptation as well as coastal livelihood development.

Diversify the mangrove species used for coastal protection, paying particular attention to the diversity of root architecture and the suitability of each species to local hydrologic conditions.

References

[1] Ngo Ngoc Cat, Pham Huy Tien, Do Dinh Sam and Nguyen Ngoc Binh (no date). Status of coastal erosion of Vietnam and proposed measures for protection. Downloaded from FAO as *www.fao.org/forestry/11286-1-0.pdf* **.**

[2] Programme for Consolidation and Upgrading of the Sea Dyke System from Quang Ngai to Kien Giang Provinces, Prime Minister's Decision 667, May 27, 2009.

[3] Sub-Forest Inventory and Planning Institute (1998). Zoning Plan for Coastal Forests in Ca Mau – Bac Lieu, Soc Trang and Tra Vinh Provinces, Technical Report No. 17, Rehabilitation of Mangrove Forests Project. Sub-FIPI, Arcadis Euroconsult and Haskoning, Ho Chi Minh City, Vietnam.

Map of the southern Mekong Delta showing areas experiencing serious coastal erosion

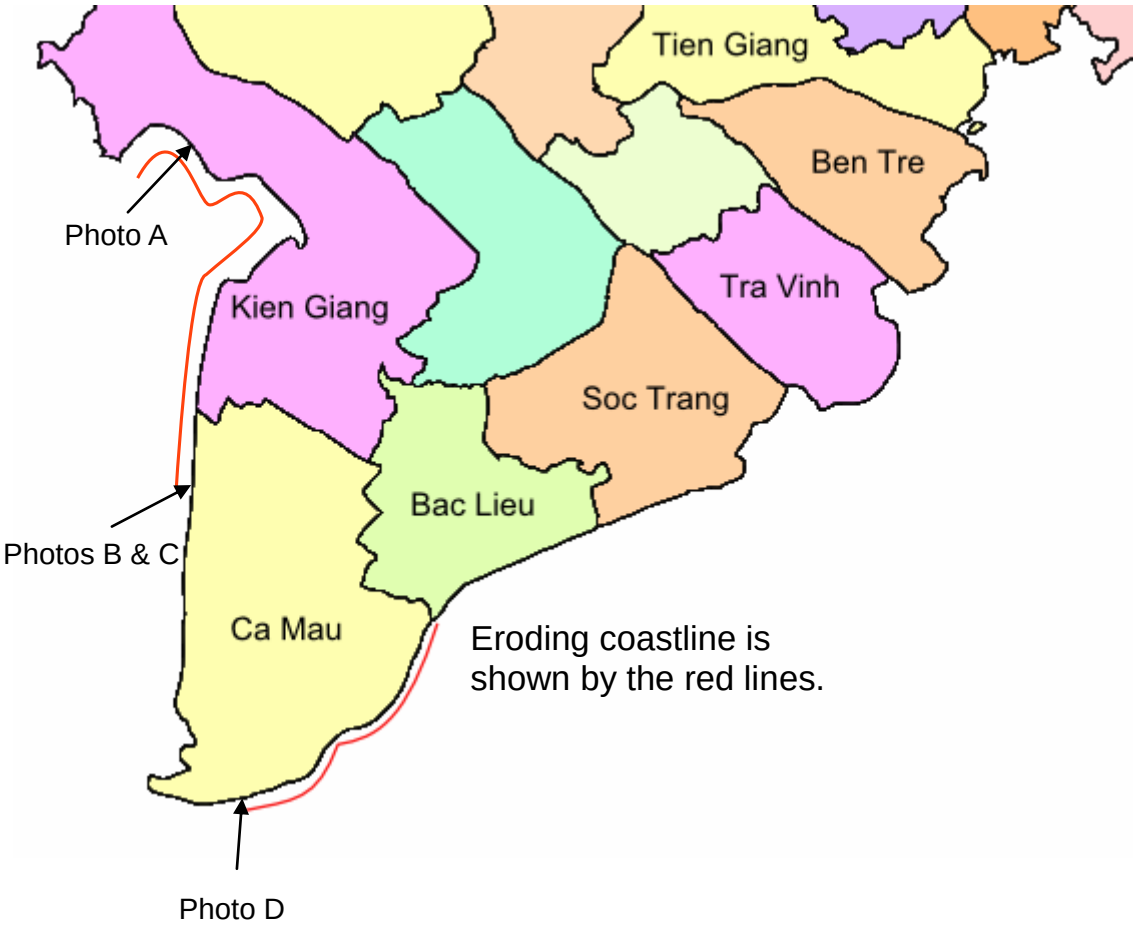

Photo A. An erosion site in Hon Dat district, Kien Giang province. The sea dike is exposed to the sea, with agricultural crops to the landward.

Photo B. Recent sea dike erosion at Khanh Hoi in U Minh District on the west coast of Ca Mau. This was previously protected by a seaward mangrove belt which disappeared rapidly over a period of several months (see Photo C below). The reason why the mangrove belt was breached here, but remains intact elsewhere is unknown.

Photo C. Breached mangrove protection belt at Khanh Hoi.

Photo D. Serious coastal erosion at Nhung Mien on the eastern coast of Ca Mau Province