

Short communication

Gradual expansion of mangrove areas as an ecological solution for stabilizing a severely eroded mangrove dominated muddy coast



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ABSTRACT

While current coastal erosion solutions have had limited success in controlling coastal erosion, the gradual expansion of mangrove areas was effective in stabilizing an actively eroded mangrove dominated muddy coast in Vam Ray, Kien Giang, Vietnam for a short time period. The gradual expansion method was developed as a result of local comprehensive involvement and capacity, and the integration of different knowledge systems. However, the method was not sufficiently reported. Local involvement and capacity were not adequately emphasized during the reporting process. Insufficient reporting caused the failure in replicating the method elsewhere in Kien Giang. Inadequate emphasis of local involvement and capacity probably breached moral rights for the Vam Ray community. This manuscript documented the gradual expansion method using different sources of data and information and inputs from the key Vam Ray community members. The gradual expansion method involved closure of current mangrove gaps by transplanting mangroves protected by appropriate fences as the first stage, and gradual expansion of the mangrove belt seawards in the second stage. The method has a potential replication elsewhere in Vietnam and in Southeast Asia.

1. Introduction

Erosion of mangrove dominated muddy coasts can be caused by natural factors (Bao and Healy, 2002; Jelgersma et al., 2002) or result from human activities (Han, 2002). Coastal erosion has caused a significant loss of important coastal habitats (Han, 2002), economic loss, and social unrest (Ramesh et al., 2011), particularly in developing countries. Current strategies for responding to eroded mangrove dominated muddy coasts include engineering solutions, ecological engineering solutions, managed realignment, and no active intervention. Engineering solutions use shoreline structures and offshore or detached structures to mitigate or stop coastal erosion (Weigel 2002; Dugan et al., 2011). Engineering principles are combined with ecological processes as ecological engineering solutions in an attempt at reducing negative environmental impacts (Bergen et al., 2001). Ecological engineering solutions include mangrove transplantation or a combination of mangrove transplantation and engineering solutions (Bergen et al., 2001; Winterwerp et al., 2005). Managed realignment, also called managed retreat or set back, involves the movement of the defence line landwards or to higher land, creating new intertidal mudflats and salt marshes (Pethick, 2002; French, 2006). No active intervention, also known as the 'do nothing strategy', involves no capital investment in coastal protection (Department for Environment, Food and Rural

Affairs (DEFRA) 2006). This strategy allows nature to take its course, normally resulting in further erosion when the process drivers of erosion are not addressed.

Each solution to muddy coastal erosion has a number of challenges. Engineering solutions modify the processes of deposition and erosion of sediments (Miles et al., 2001), alter tidal currents, can result in significant habitat loss, erosion, and shoreline change (Dugan et al., 2011), and can cause lagoon stagnation due to overflow of fine or muddy sediment and organic matter (Martin et al., 2005). Ecological engineering solutions can lead to conflicting demands, and require sufficient understanding of the assemblages in the coastal habitats and frequently, significant ecological research (Holling, 1996; Chapman and Underwood, 2011). The knowledge of the long term impacts of coastal retreat and the likely ecosystem impacts are required for a managed realignment strategy to be accepted (Morris, 2012; Morris, 2013). Consequent erosion and flooding in areas where there has been no active intervention has caused coastal communities to lose residential and farmed areas (French, 2006; Morris, 2012). In highly populated coastal areas in Southeast Asia, managed realignment and no active intervention strategies are unlikely to be accepted or promoted by government agencies (Linham and Nicholls, 2010).

A pilot project was undertaken between May 2009 and May 2011 to stabilize a severely eroded mangrove dominated muddy coast in Vam

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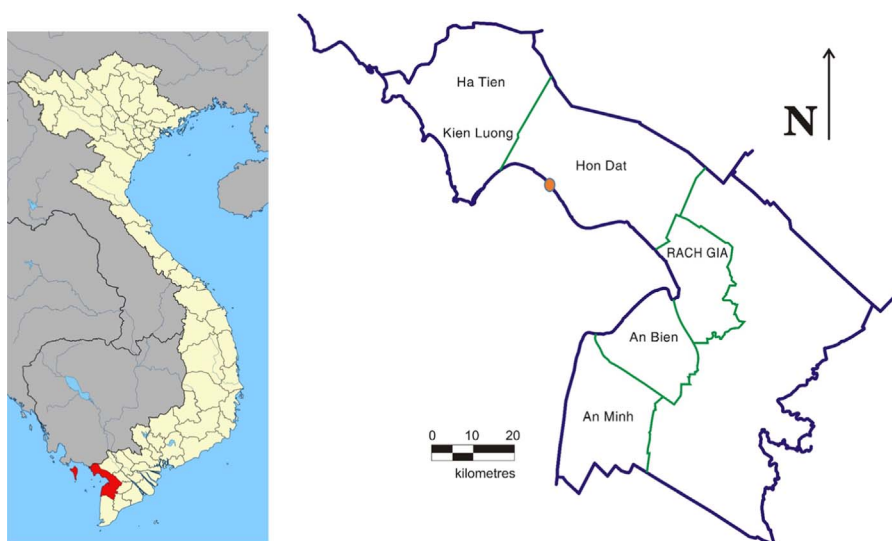


Fig. 1. The location of Vam Ray area, Kien Giang, Vietnam (red dot). The left is Google map. The right is adapted from Nguyen et al. (2016a, 2016b). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Ray, Kien Giang Province, Vietnam (Figs. 1 and 3A). The Vam Ray pilot project was funded by Conservation and Development of Kien Giang Biosphere Reserve Project (CDBRP). CDBRP was funded by the Australian Aid Program, AusAID, and implemented by the German Agency for Technical Cooperation (GIZ).

The donor and government agencies worked in partnership with the Vam Ray community in developing gradual expansion of mangrove areas for controlling erosion in the Vam Ray pilot project. The gradual expansion method involved the use of seven different fences constructed of Melaleuca poles, fishing nets, bamboo mats, and the transplantation of seedlings of five mangrove species, with the treated area gradually expanded seawards (Nguyen et al., 2016a). Between 2009 and 2012, the gradual expansion method was officially recognized to be effective in stabilizing the Vam Ray severely eroded coast (Kien Giang Provincial People's Committee (Kien Giang PPC, 2009), and CDBRP (2012a, 2012b)). The gradual expansion method was a pride for the Vam Ray local community because the community was comprehensively involved in integrating their own knowledge with science for developing the gradual expansion method. However, the gradual expansion method was not sufficiently recorded. The local involvement and capacity was not adequately emphasized during the reporting process. Insufficient recording caused a failure in replicating the gradual expansion method in Nam Thai and Thuan Hoa locations of Kien Giang Province (Nguyen et al., 2016a). Inadequate emphasis of local involvement and capacity probably breached moral rights for the Vam Ray community. Therefore, this manuscript aims to document the gradual expansion method used in the Vam Ray project, and link the finding to the future coastal erosion in Kien Giang and elsewhere in the lower Mekong Delta region.

2. The gradual expansion method

The gradual expansion method is presented below using published reports by CDBRP (2012a, 2012b), Nguyen (2012), and publications by Cuong et al. (2015), Thornton and Johnstone (2015), Nguyen et al. (2016a, 2016b), work previously implemented in Vam Ray pilot project by the first author when working for CDBRP between 2009 and 2011, and inputs from the key Vam Ray community members. The use of different sources of data and information aims to comprehensively demonstrate how effective the gradual expansion method was in stabilizing the Vam Ray severely eroded mangrove dominated areas in Kien Giang, Vietnam. The documentation and discussion of the gradual expansion method are undertaken in the context of previous interventions.

The gradual expansion method was a two stage process. The first

stage involved closing gaps between the established scattered mangrove patches by transplanting mangroves protected by fences, complementing the protection afforded by the scattered mangrove patches. In the second stage, treatments were established using fences for expanding the area seawards, providing additional protection to the previous treatments.

The effectiveness of the gradual expansion method regarding a high survival rate of transplanted mangroves, a high level of sea mud accumulation, natural regeneration, and biodiversity returns was proven in 2011 by Table 1, Figs. 2 and 3 and repeatedly confirmed in 2015 by Cuong et al. (2015), and Thornton and Johnstone (2015).

3. Discussion

3.1. The gradual expansion method and local knowledge and capacity

Local knowledge and capacity have been increasingly acknowledged as a fundamental basis for developing projects that help solve local problems (United Nations, 2012; World Bank, 1998). However, this concept was not well conceived in practice. In aid projects, consultants externally recruited by projects in most cases utilized their own knowledge for analyzing and developing solutions to local issues. Local involvement and capacity in planning, implementation and reporting was frequently limited (Anderson et al., 2012). Similarly, it is a common misconception that local capacity and knowledge in planning, implementation and reporting in developing countries, especially in Southeast Asia are weak. As a consequence, local communities were not provided adequate opportunities to be involved in every single project stage. By contrast, in the Vam Ray project, the Vam Ray community was provided with an opportunity where their knowledge of the distribution and ecology of mangrove species was successfully integrated with the knowledge of hydrodynamics provided by the project staff for developing the gradual expansion method. The gradual expansion method is a good example for how importantly the local knowledge and capacity contributed to developing an effective solution to coastal erosion in Vam Ray, Kien Giang, Vietnam.

3.2. The gradual expansion method and its potential replication elsewhere in vietnam and Southeast Asia

The gradual expansion method is an alternative ecological engineering solution to coastal erosion. In Vam Ray, without intervention, erosion would almost certainly be continuing and natural re-colonization would not have occurred. The gradual expansion method was significantly effective in stabilizing the Vam Ray severely eroded

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