Encroaching Sea and Coastal Erosion: Autonomous Adaptation to Climate Change in a Mekong Delta Community

Nguyen Quang Dung[a*], Le Thi Ngoc Phuc[a], Tran Thi Thao[a] and Nguyen Hoang My Lan[a]

[a]*Faculty of Anthropology, USSH, Vietnam National University Ho Chi Minh City, Vietnam*
[*]*Corresponding Author. Email: nguyenquangdung86@u.nus.edu*

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Abstract

Coastal erosion, induced by climate change, has severely affected local socio-economic and bio-geophysical systems along the 600-km coastline of Vietnam's Mekong Delta, with many communities reporting large-scale damage. Authorities have built defense structures here and there in the hardest-hit areas, triggered by post-disaster emergencies. These measures, usually slow to be enacted, have proved ineffective. Therefore, locals have turned to autonomous adaptation by mobilizing available resources despite great difficulty and uncertainty. This study, based on anthropological research in a coastal community of Ben Tre province, investigates the ways in which locals take their own initiative to counter erosion. It looks closely at values or factors that have enabled or constrained people's autonomous adaptation, offering implications about what authorities as well as residents can do to address the uncertainty in aspects of the current coastal management mechanism. Field research involved formal and informal interviews, participatory observation, and group discussion with 40 households that adapt by building sandbag revetments and switching crops. Ethnographic data show that the autonomous adaptation–a process that reflects both vulnerability and agency of the community–is driven by place attachment and a collective sense of economic insecurity if relocated while constrained by water scarcity, saline intrusion, and loss of agricultural land. There remain unresolved questions concerning the tenability of their seawall system and new crops' productivity. Contextualized understandings of climate change impacts on the community imply that,

in hard-hit areas where autonomous adaptation engenders other socio-economic risks and uncertainties, planned adaptation should be prioritized and the timely implementation of top-down policy is necessary as the poor do not have enough socio-economic resources to continue autonomous adaptation.

Keywords: Mekong Delta, autonomous adaptation, sea level rise, coastal erosion, climate change

Introduction

Climate change has had a severe impact on local socio-economic and bio-geophysical systems along the 600-km coastline of Vietnam's Mekong Delta, in which coastal erosion and saline intrusion are the most frequent hazards.[1] In most coastal areas here, strong winds, together with high sea levels, have created tidal waves with high erosion energy. This has led to substantial loss of mangrove forests and tidal wetlands, together with a significant reduction of sediment deposits by the Mekong discharge regime. Up to 2019, serious erosion occurred in 52 coastal zones, for a total length of 268 km (Nguyen Ba and Thuy An, 2019). Communities along the Mekong Delta shoreline have reported large-scale damage caused by the immediate physical contact of tidal waves on humans, property, livelihood, and the environment, leading to disruption in the economic and social life of residents. High waves tend to produce more erosion during the northeast monsoon season with a rate of up to 50 meters per year in some parts.[2] Average significant wave height fluctuates between 1 and 2 meters, and high-frequency waves are able to cause significant shore erosion along the mud coastlines (Le et al., 2014; Marchesiello et al., 2019). It is predicted that

[1] Up to 2019, more than half of the coast's length has been experiencing erosion, with the most serious level of land penetration up to 50 m/year in some zones. The speed of erosion is approximately 678 ha/year while alluvial deposition covers only 406 ha/year (Nguyen Ba and Thuy An, 2019).

[2] The northeasternly winter monsoon is drier with limited fluvial sediment supply but has stronger wind and wave regime (Tamura et al., 2020). "The wind direction during the wet season is from the West to Southwest with an average speed of 1.6 to 5.4 m/s. From October to February the wind changes to come from the Northeast and is reducing its speed, to 1.6-3.3m/s" (Tuan et al., 2012: 17-18).

sea level rise in the region will reach 30 cm by 2050.[3]

Coastal management strategies by Mekong Delta authorities to control and mitigate coastal erosion are primarily the construction of hard defense structures.[4] Such structures have been built sparsely in the hardest-hit coastal areas, principally on an 'action-reaction,' or post-disaster basis, in which 'initiatives are usually triggered by emergencies, not by prevention.'[5] In other words, most decisions involving coastal erosion management along the Mekong Delta coast are conditioned by emergencies and the levels of immediate damage erosion caused to property and livelihood. The lengths of these structures depend on the availability of funding from the national budget, and the construction is conducted slowly because of slow decision making and slow-to-arrive budget allocation.[6] As reported in mainstream media, the current coastal erosion management strategy in the Mekong Delta is too weak and requires more innovative methods and a larger budget

[3] "Based on the IPCC Fourth Assessment Report, a sea-level rise of 30 cm by 2050 is predicted for the coast of southern Vietnam. More recent predictions based on the Fifth Assessment Report by the IPCC have confirmed this prediction, with a 5-95% uncertainty range of approximately 20-40 cm for IPCC's Representative Concentration Pathway 8.5" (Smajgl et al., 2015: 1).

[4] Up to 2020, the government had allocated 1,500 billion VND (approximately US$ 65,488,271.70) from national budget to handle urgent coastal erosion along river banks and in hardest-hit coastal zones of 13 provinces of Mekong Delta (Minh Duyen, 2019).

[5] Similar coastal management is popular along the Carribean coast of Colombia, where hard structures have been the first management strategy to solve coastal erosion problems-on action-reaction, or post-disaster basis (Rangel-Buitrago et al., 2018).

[6] The Mekong Delta has been granted 11,000 billion VND (approximately US$ 480,247,325.79) from the state's '2016-2020 medium-term public investment' for 34 projects in two schemes: 'Adaptation to Climate Change' and 'Green Growth,' in which 1,500 billion VND (approximately US$ 65,488,271.70) has been spent on coastal and riverbank management (VASS, 2019; Ha and Tran, 2020). However, such financial subsidies for the Mekong Delta localities are approved based on a time-consuming local-central procedure in which, local authorities submit their proposals and demands to the National Assembly for approval, entailing slow-to-arrive funds for emergent adaptation projects. Meanwhile, official development assistance (ODA), mostly from the World Bank, UNDP, ADB, USAID, GIZ and Australian AID, accounts for approximately US$ 764 million, facilitating the implementation of various climate change adaptation projects in the region (Ha and Tran, 2020). Amid the Mekong Delta's huge need of budget allocation, 13 Mekong Delta provinces cannot balance their expenses and revenue of public budget, and so they have to call for subsidies from the central government. However, with public investment being cut back, allocation from national budget reserves for the Mekong Delta can meet only 25 percent of the region's total demand while it is still difficult to mobilize private-sector finance for climate adaptation (VASS, 2019).

(Ngoc Triu, 2019; Nguyen Chau, 2020; Tien Trinh and Nguyen Hung, 2019). Top-down policy to counter sea level rise also involves communication and education to raise awareness among the population about natural hazards. Arguably, Vietnam is lacking a strategy to combat coastal erosion and needs to build a policy system for coastal erosion management, one that is suitable for natural development and appropriate for economic development requirements instead of ineffective frantic measures or quick responses (Nguyen Ba and Thuy An, 2019; Smajgl et al., 2015; Toan, 2014).[7]

The frequency and intensity of extreme climate events associated with climate change have drastically affected the landscape of agricultural cultivation, livelihoods, and even the socio-cultural life of farmers in rural zones of developing countries. Overall, the complex processes of adaptation in these countries are unfolding in various settings and contexts: individual, household, sectorial, regional, national and international polities. They are shaped by national, social, economic, political and institutional factors, demonstrating resilience, vulnerability and flexibility in diverse impacted communities and regions.[8]

Adaptations to climate change in rural areas, whether short- or long-term, can be categorized as autonomous responses by individual farmers and adaptation strategies or interventions by governments (Smit et al., 2000). In other words, adaptations range from relatively small-scale, self-interested, and short-term actions (incremental adaptation) to larger-scale efforts, such as collective actions that aim to

[7] In 2015, Vietnam's Ministry of Environment and Natural Resources and the German Corporation for International Cooperation (GIZ) launched Vietnam's strategy for Integrated Coastal Zone Management (ICZM) to 2020 and vision towards 2030, which was approved by Vietnam's prime minister. The long-term strategy aims to protect coastal natural resource and the environment through promoting sustainable economic and social development. The implementation process involves new legislation, training activities for capacity development, sustainable exploitation of natural resources, nature conservation, and control against climate change and sea level rise. But, evidence from international development initiatives and national institutional structure has shown that "the pathway to the implementation of ICZM seems to be a long and complex process" (Andrea, 2018: 7). However, Ben Tre province is in not on the list and the community in this study is not an example of such a strategy.

[8] Adger et al., 2013; Pelling, 2011; Arun and Stephen, 2012; Dang et al., 2014; Smajgl et al., 2015; Conway et al., 2019, among others.

create or contribute to changes in social or political systems or features of the built or natural environment (transformative adaptation). Both strategies can involve mutually reinforcing relationships between changes in behavior and shifts in culture, norms and worldviews (Adger et al., 2013; Wilson et al., 2020).

Autonomous adaptation spontaneously occurs in the face of climatic impact on the availability of livelihoods, and poor local farmers are identified as the most vulnerable to climate change and their adaptation involves "great difficulty and much pain" (Kates, 2000: 15; Toole, Klocker and Head, 2016). Alternatives to respond to and how to mitigate coastal erosion include "planned retreat options" which seem "an inevitable solution in fast eroding areas and probably the most appropriate solution for human settlements." (Rangel-Buitrago et al., 2018: 14) However, the process of coastal erosion management is complex, and should be based on a holistic approach to finding practical solutions (Cooper and Pilkey, 2012).

Amid increasing climate change stressors, Smajgl et al. (2015: 1-6) argue that central government indecision–"polarized institutional strategies to either invest in soft adaptation or hard adaptation options," and slow-to-arrive budget for current hard options (building long-term sea dyke infrastructures) resulting in an "ensemble of hard and soft policies, is likely to provide the most effective results for people's livelihoods in the Mekong Delta." As Khong, Loch and Young (2020: 27) point out, "If autonomous adaptation strategies reduce overtime–or begin to fail with individual (physical/mental health), private asset (house/land value), community (habitat/environment), and/or regional (food security/economy) impacts–a rise in planned public-policy interventions may be sought as an alternative strategy."

For more insight into the interplay between hard and soft strategies in specific communities that are struggling with sea level rise and coastal erosion, this research looks closely at the hardships and the extent of effectiveness in adaptation efforts at the household level amid slow implementation of top-down policies. Thus, autonomous adaptation

should be questioned in detail to explore its pros and cons for more practical and urgent policy implications as climatic impacts keep intensifying in the Mekong Delta.

This article, based on anthropological research in a coastal community of Ben Tre province, among the areas hardest-hit by sea-level rise and coastal erosion, will provide insight into autonomous adaptation to climate change along the Mekong Delta coastline. It seeks to investigate the ways that locals take their own initiatives to counter erosion. Therefore, the article aims to address the following two interrelated questions: 1) Amid high exposure to erosion and high vulnerability regarding impacts on property and livelihoods, what values or factors have enabled or constrained people's autonomous adaptation? 2) What should be done to address the uncertainty in aspects of the current coastal management mechanism?

Field research was conducted between December 2019 and March 2020, and primarily involved formal and informal interviews with local authorities at communal and village levels. Ethnographic data was also collected through participatory observation, informal talks, and group discussions with 80 farmers from 40 selected households about their agricultural and aquacultural activities, awareness of climatic impact since their early settlement, their opinions about official adaptation strategy, and drivers of their ongoing autonomous adaptation strategy. The selected households are closest to shore, where the distance from houses to their sandbag sea wall system is around 200 to 250 meters. This study's methodology does not aim to quantify adaptation efforts, but instead to identify daily practices and to analyze how socio-economic specificities determine people's decisions in their responses to climate change.

Study Site

The study area (see Figure 1) is located between 10°00'26.3"N 106°40'50.4"E and 10°01'32.3"N 106°41'21.5"E, with an average

elevation of 1-2 meters above sea level,[9] in the eastern part of Bao Thuan commune, Ba Tri county, Ben Tre province. Sediment deposit from the Ba Lai river,[10] among eight deltaic Mekong branches at its estuary led to the formation of more than 3000 hectares of coastal delta plain, along the coastline of Bao Thuan. Fifty years ago, the elevation of the plain, together with its fertile ecosystem, attracted local farmers from inland residences about 9 km away from the coastline to come and settle.[11] Since then, the coastal community's households have increased in number from 10 to 138.[12] The community along a 5 km-long coast[13] was named Thanh Hai hamlet.[14] Community members have cultivated seasonal vegetation on sandy soils while raising clams on saline soils. The current total population is approximately 500 people from 138 households. Most young community members between the ages of 20 and 40, with a high school diploma as the highest education level,[15] are earning a living in the central town of Ben Tre province or in Ho Chi Minh city. They work different jobs, from waiting tables in restaurants to working in factories. Most get married and find their settlements wherever there are job opportunities. The people who remain in the village are mostly above the age of 40.

[9] As reported in Tuan et al. (2012).

[10] The Ba Lai river — with 71-km length, 3-4 meter depth and 25-50-meter width — connects the main Mekong river and the East Sea, opening into the sea at a width of 1km. In the dry season, the flow volume reaches 50-60 m^3/s and five times of that in the rainy season (Tuan et al., 2012: 16).

[11] "A large amount of alluvia is deposited into the sea from the rivers. The average suspended substances in river water are approximately 0.3-0.8 g/liter. Due to this deposition the Mekong delta can extend by 40-60m into the sea each year, forming islets and islands near the river mouth. However, there has also been an increase in riverbank and coastal erosion. The coast in Ben Tre receives silt and other sediments from the Mekong River via its tributaries. The coast's morphological features are strongly influenced by changes within the river and the sea, with erosion and alluvial deposition due to the natural interaction of current flows" (Tuan et al., 2012: 17).

[12] According to the Bao Thuan Communal Committee's census in January 2020.

[13] Part of the 65-km coast of Ben Tren province.

[14] A hamlet, aka an "Ap," is a territory governed as an administrative or political unit of a commune in the Mekong Delta.

[15] Children have to travel 7 km to primary and secondary schools in the central zone of Bao Thuan commune and 20 km to central Ba Tri district for high school.

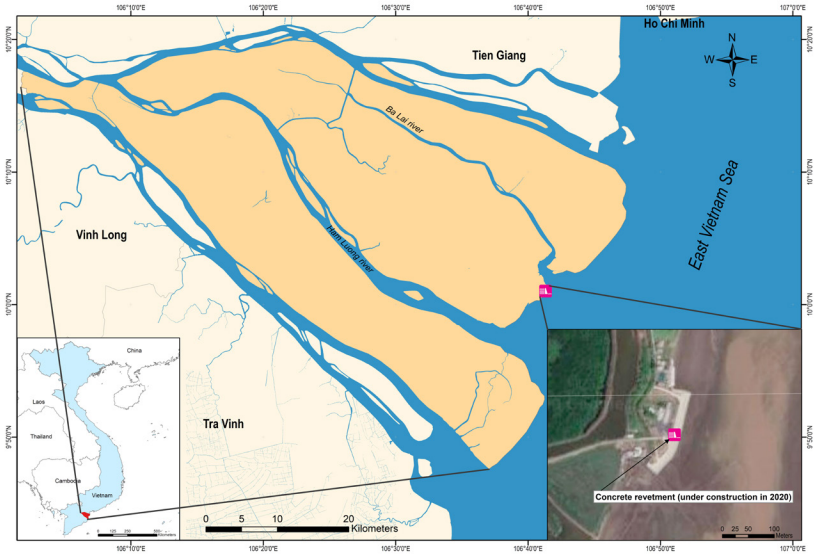

Figure 1 Map of Ben Tre province, showing Bao Thuan commune and Thuan Hai hamlet (as adapted from Google Earth on 24 July 2020)

Seasonal vegetable cultivation, the village's primary economic activity, brings an average income of around US$ 150/month per household. In addition, community members also work for a 50-hectare clam farm in the surrounding intertidal sandbar and mudflat areas which belongs to Bao Thuan cooperative. They work there as collectors for unstable payment from 150,000 to 200,000 VND (approximately US$ 7 to 10) per day, depending on the surface of the farm zone they take care of and the amount of clams they can collect. Locals also collect oysters, mussels, pipis, scallops, and cockles from the wild along the shore. Such irregular coastal foraging can bring them a daily income from 200,000 to 400,000 VND (approximately US$ 10 to 20).

The hamlet currently covers roughly 110 hectares of the farming zone and around 2,000 hectares of surrounding mangrove forest, bordered by the East Sea on the east and mangrove forests in other directions. Similar to many other zones of the Mekong Delta coast, this coastline zone is a complex ecosystem consisting of an alluvial and

sandy intertidal zone with mangroves, mudflats, saline soils and sandy soils, and a near-open water estuary. Intertidal zones are flanked by sand dunes. The annual rising sea level[16] which extends its inland penetration of 10 meters per year has resulted in an apparent coastal retreat of 2.6 km along the coast.[17] The commune's authority officially reported that a total of 115 households are affected by coastal erosion. Until the end of 2019, 28 hectares of vegetation farm, 11 hectares of protection forest, and 10 hectares of aquaculture zone have been lost to erosion. The 40 households under study are the most vulnerable along the coast — from 120 to 200 meters close to the shoreline. In 2019 alone, a total of more than 25000 m² of agricultural and residential land was lost and six houses were destroyed by high tidal waves.[18] In response, a budget of 7.5 billion VND (approximately US$ 324,442) from the provincial authority and the central government was mobilized to build a 200-meter-long concrete sea dyke, which was completed in early 2019. The project is expected to continue to meet a target of 973 more meters, with an estimated expenditure of 45 billion VND (approximately US$ 1,946,653). However, the budget has been slow to arrive, disrupting the second round of the construction process. Over the last five years, villagers have relied on themselves to build temporary embankments with timber pilings from bamboo or white *samet* trees and sandbags.

Changes: Landscape and Livelihood

Changes in habitat and crop cultivation reflect most vividly how coastal erosion and sea-level rise have affected local livelihood (see Figure 2). In the early days of settlement, as a 60-year-old local man recalled, watermelon was the most economically effective crop to grow.

[16] The Mekong Delta is very flat and low, with an average elevation of only about 1m above mean sea level (Toan, 2010); a sea-level rise of 30 cm by 2050 is predicted for the coast of southern Vietnam (IPCC Fourth Assessment Report, as cited in Smajgl et al., 2015:1).

[17] 2019 Report on environmental conditions along Thanh Hai hamlet's coast, by the Bao Thuan Commune Authority.

[18] "Coastal areas of Ben Tre are greatly affected by the uneven dual tides of the East Sea. The tide rises and falls twice each day, every six hours, and has a tidal range of 2.5-3.0 m. Each month, there are two high tide periods (the 2nd-3rd and 17th- 18th of the lunar calendar) and two low-tide periods (the 7th-8th and 21st-23rd of the lunar calendar)" (Tuan et al., 2012: 17).

My father, back in 1954 when I was 10 years old, first grew watermelon on the sand dunes around my house, using organic fertilizer made of leaves and fish carcasses. The watermelon grew well, especially from April to June, and could bring a regular income. Other villagers then started to grow it on all available sand dunes. Starting with 50 square meters of watermelon farm that year, we developed it into a main crop of the whole village (Local Resident A [Pseudonym], 2020).

But for over the last five years, about 28 hectares of traditional vegetation zones have been lost to erosion. In addition, thick rows of whistling pine (aka beefwood) trees demarcating the borderline between the vegetation zone and the shoreline behind each house have been uprooted by high waves. Vegetation crops, therefore, lose their protective layer from strong wind and saline fog. Climate change is also causing saline intrusion and shortage of fresh water, which force local farmers to switch crops to minimize irrigation. Watermelon has become more difficult to grow. Currently, only calabash and pumpkins can withstand extreme weather and soil salinization.

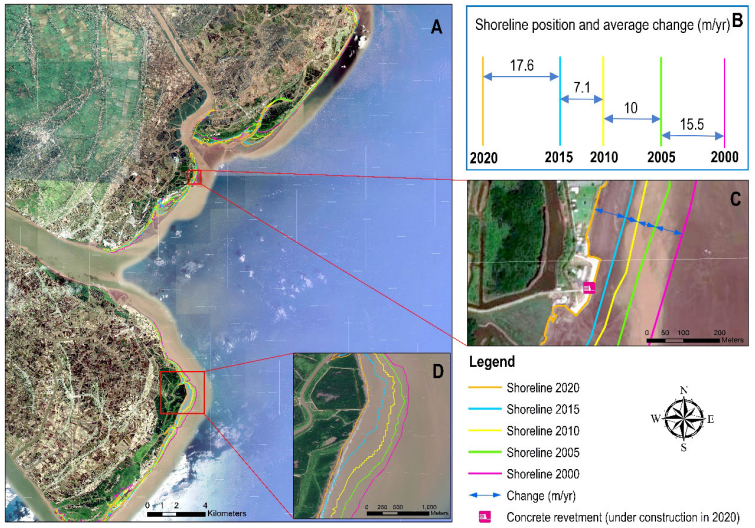

Figure 2 Shoreline changes in Bao Thuan commune from 2000 to 2020 (as adapted from Google Earth on 27 July 2020)

For the last three years, during the dry season from January to April, fresh water both for household consumption and vegetation has had to be bought from other hamlets further from the shore. Fresh water is contained in tanks and transported by tractors, each one having a capacity of 2000 liters maximum. People pay around USD$ 6 per order for two '*khoi*' (2000 liters) of fresh water. There used to be a main canal running across the village, connecting with the ocean. People traversed the canal by boat to transport their yield, around a few hundred kilograms per ride. However, erosion has caused landslide into the canal, obstructing its water circulation. People have to transport their yield by bike, with each ride carrying around 200 kilograms, much less than a single ride by boat along the canal.

Canals that help with water circulation between aquacultural farms and the ocean have been obstructed by erosion, causing deterioration of water quality in farms. It has made shrimp, cockle, and clam farming more difficult and less productive. Five years ago, the clam farm brought efficient yield to ensure farmers' stable extra income of from four to six million VND (approximately US$ 200 to 300) per month. Over the last five years along Ben Tre's coastline, sea-level rise, coastal erosion, long exposure to high temperatures, and increased salinity above 20 ppt have caused high mortality of clams at an average rate from 10 to 20 percent annually (Nhat Truong, 2019). The reduced productivity of the clam farm has adversely affected the extra income of local farmers. Natural aquatic produce in natural habitats, such as ponds and canals, is also decreasing significantly. In the past, people could collect wild products, such as cockles, shrimp, crabs, and fish along the canals, but this practice is rare these days. They have switched to raising saltwater shrimp, but the yield has been less than expected. Despite unfavorable natural conditions, locals still diversify their livelihoods in both agricultural and aquaculture activities in order to ensure enough income for family savings and most urgently for sandbag seawall renovation.

The protection forest zone, including whistling pine and mangrove forests, was still visible in 2017. As recalled by a 50-year-old

local man, at that time villagers were not worried at all about imminent impacts from coastal erosion on their property, and vegetation land as protection forest was shielding the hamlet. The sea was not visible to them as the thick forest obstructed the sight of it.

> We only saw the dark green color of mangrove and whistling pine. To reach the shore, about 200 meters from our houses, we had to go through a slightly dense mangrove zone about 30-meters wide and a 60-meter-wide whistling pine zone. We could sling hammocks between the whistling pine trees for a nap at noon. We felt safe living our life and cultivating our land. However, for the last three years, sea-level rise and coastal erosion have changed everything. All of the mangrove and whistling pine trees that were there are gone. We've lost much of our vegetation land to the ocean. Sea water keeps encroaching ceaselessly. Now there's just us and the ocean, we can see high waves and low waves up close (Local Resident B [Pseudonym], 2020).

The most alarming indicator of the changing landscape, as local people acknowledge, is the disappearance of the mangrove and whistling pine tree forest. The Bao Thuan commune authority calculates that, as of 2016, the total loss of protection forest, farming, and residential land has reached five hectares. As mangrove and whistling pine trees play an important role in protecting people's residence and livelihood, the communal authority plans to re-plant a 100-meter-wide whistling pine zone after the concrete dyke construction is completed. Each household is also considering planting a whistling pine zone of around six meters wide at the edge of their cultivation land, which is close to the shore.

Place Attachment

Climate change threatens cultural dimensions of lives and livelihoods that include the material and lived aspects of culture, identity, community cohesion and sense of place (Adger et al., 2013: 1). Sense of place or

place attachment, as a fundamental cultural dimension, is among the primary driving triggers for the ongoing autonomous adaptations by locals in this study. As our interviews with locals reveal, place attachment significantly influences this small community's decision making to adapt to climatic impacts. It is place attachment that shapes locals' response to climate change.

The conceptual term, 'attachment to place' or 'place attachment,' refers to "the level of connection that individuals have with the people and environments in which they live" (Adger et al., 2013: 2). Local farmers in this study interpret the landscape they have been living in as "offered from nature" ("*thien nhien cho*"), thanks to the decades-long process of coastal low-relief alluvial landforms. Now they consider the ongoing coastal erosion as a sign of "nature taking back" what it offered ("*thiên nhien lay lai*") by means of climate change. The construction of landscape was then followed by the construction of community and identity when the first settlers started cultivation along the coast for a living fifty years ago.[19] Hence, place attachment, and its analysis, are central to understanding the meaning of the whole village's response to coastal erosion.

Place attachment, the primary enabler of adaption, has engendered and motivated people's autonomous adaptation. Place attachment has enabled them to make relentless efforts against coastal erosion. That said, building sandbag revetments is also a process of making meaning-place attachment and identity. The surrounding physical spaces have been given meanings of culture and social life by local people. The community has been rooted in the place for nearly 50 years. However, climate change has been changing their landscape, bringing people great fear of loss. Displacement elsewhere would mean their loss of a 50-year community, associated with other values. The persistence in ongoing autonomous adaptation methods is closely correlated with the level of attachment that local people experience around their settlement or place.

[19] Most of the first settlers of the community do not have close consanguineal ties with one another. Over the years, regarding affinal ties, members of younger generations have married individuals either from within the community, central Bao Thuan commune, or elsewhere.

The nearby neighborhood of central Bao Thuan commune about 7 km from the shore is a possible resettlement zone, as both people and communal authorities have it in mind. However, these farmers consider such migration the strategy of last resort. They are reluctant to migrate from the traditional landscape which provides them with social and emotional support. They believe relocation would inevitably entail uncertainty over new livelihoods. A sense of livelihood insecurity if relocated is the other significant factor driving locals to choose to protect the coast. All households prioritize protection from coastal erosion, and none pursues relocation strategy. All interviewees from the studied households rank their 'place attachment' as a stronger determinant in their decision to protect the coast, in comparison with 'livelihood insecurity if relocated.'

In the Mekong Delta, as discussed in Dang et al. (2014: 12), adaptation intentions and behaviors by coastal farmers are "associated with not only farming activities but also other dimensions of farmers' lives" (e.g. safety of humans and assets, socio-economic and even psychological factors). Place attachment, as studied in many climate-change hit areas worldwide, is "emerging as an important factor for climate adaptation in regions where existing livelihoods are unlikely to be maintained as the impacts of climate change are increasingly manifest" (Adger et al., 2013: 2). For Thanh Hai locals, the sense of belonging to the landscape is vividly portrayed in their memories when they tell stories about their early settlement days in the coastal zone. It is also closely associated with their knowledge about the timing of up-and-down tidal waves and the biological characteristics of small canals running through the village before merging with the ocean. Their strong attachment to the coastal seascape is fundamental to their persistence in the ongoing battle against powerful tidal waves.

Also in other cases, people with a strong place attachment are unwilling to migrate to resettlement zones because they want to maintain their income levels facilitated by social and emotional support groups in their community. In addition, changes in locations of residence and livelihood have significant impacts on people's psychological and

emotional well-being, associated with grief and loss (Raymond, Brown and Weber, 2010). Climate change adaptation decisions by impacted communities depend on various factors, among which determinant factors vary in different local settings.

Autonomous Adaptation: Tenability in Question

Strategic coastal protection planning in Ben Tre province, among other Mekong Delta coastal provinces, as reported in CPMD (2018: 108), has been "very technically oriented and disconnected from other relevant planning processes such as those for the forest, aquaculture, environment, infrastructure and land-use (spatial planning)." Coastal protection, incorporated into the broader agenda of climate change adaptation and mitigation, is under the jurisdiction of the Ben Tre provincial department for irrigation and water management. It is important to point out, however, that the planning, construction, and repair of sea dykes are responsive measures against erosion, primarily after disaster events causing considerable damage have occurred.

In Thanh Hai community, the primary top-down intevention is the ongoing construction of concrete sea dykes; however, the process has been disrupted many times due to a lack of budget (see Figure 3). In addition, top-down policies by provincial authorities for the last five years have involved training activities to instruct people on planting and protecting mangrove forest, switching crops for more produce, and choosing appropriate fertilizers. However, as locals have experienced, while forestry knowledge has been useful, agricultural instructions have been inapplicable amid a constant lack of fresh water sources and saline intrusion, which renders agricultural farming more difficult. In other words, authorities' adaptation interventions through training activities involving new crops do not correspond to local environmental conditions, and thus they could not bring about a functional interplay with autonomous adaptation.

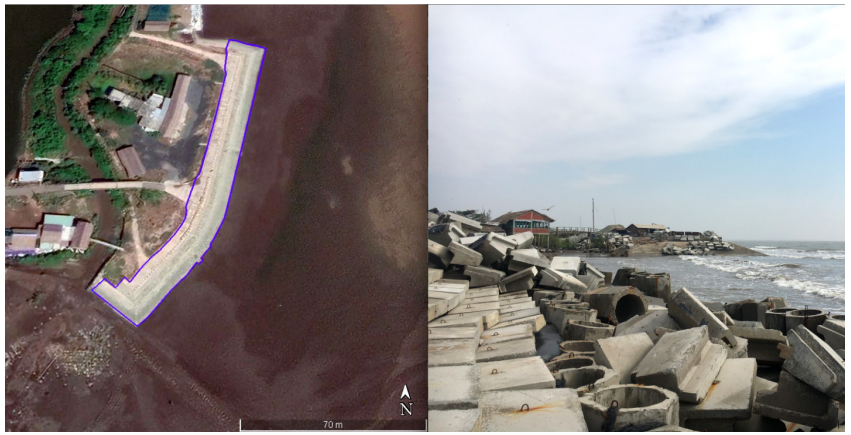

Figure 3 Concrete sea dyke under construction (photo taken on 6 Jan 2020 and image adapted from Google Earth on 5 June 2020)

Locals expect training activities that can help with building temporary emergency sandbag seawalls to protect their assets, but authorities have not responded. Though considered as a spontaneous response, household-made sandbag seawalls have limited the erosional impact of encroaching tidal waves during the northeast monsoon season. Responsible agencies and authorities have not acted to help with their sandbag seawalls. The people we talked to complain that the authorities, in training activities, have never mentioned sandbag revetments. Therefore, they have had to act on their own and learn the technical aspects of maintaining sandbag revetments from each other or from people in other coastal communities.

Mutual help is a great source of support for their autonomous coastal management. For example, many times at midnight during the northeast monsoon season when high tidal waves damage some parts of the community's sandbag seawall system, the entire community works together to repair them, regardless of whose seawall it is. A 50-year-old woman explained,

> Erosion happens very fast, and the seawall can be damaged within minutes. Therefore, we need to help each other. Any household's damaged seawall will weaken the whole community's seawall system. United, we survive (Local Resident C [Pseudonym], 2020).

Apart from mutual help during such critical moments of erosion, locals exchange labor, counted as '*ngày công*'/labor-days. Exchange of labor days is normally used for sandbag seawall construction or renovation on two or more days. To get seawalls built or renovated faster, they also hire more assistants. Households with many adults spend less money on hiring labor from their neighborhood. For some households whose grown-up children are working far from home, they have to pay as much as 2.5 million VND (approximately US$ 120) to hire 10 assistants per day or they spend a longer time fixing their seawall system by themselves. Payment for one assistant is 250 thousand VND (approximately US$ 12) per day.

Five years ago, each household built nearly 80 meters of sandbag seawall with around 40 million VND (approximately US$ 2000). Since then, each household continues to spend around US$ 1000 or more annually on renovation as high waves constantly cause partial damage to these sandbag structures (see Figure 4). "My family's income from agricultural activities for the last five years has been spent on the seawall system behind my house. I had nothing extra to save," recalled a 58-year-old local man. The money was used to buy bags to contain sand and wooden materials such as eucalyptus or white *samet* timber to stabilize the system. People also hire tractors to transport sand and pay other locals to help with the renovation work. "Just buying white *samet* and jute or polypropylene bags to contain sand can impoverish me," said a 45-year-old local woman. For the last five years, each household has conducted two to three renovations per year. Yet, these people have received zero support from the authorities. What they expect the most is financial support while they are still waiting for the concrete sea dyke to be completed.

Figure 4 Local farmers renovating their sandbag revetment system (photo taken on 6 June 2020)

The costs of household adaptations are calculated in the amount of materials used for the sandbag seawall and water supply for farming and family water usage. During the past five years, locals have overused their yearly income, and at times borrow from the bank to renovate their sandbag seawalls. Money has also been spent on water storage tanks and water pumps for farming activities. The average annual cost is 40 million VND (approximately US$ 2000) per house, to adapt to coastal erosion encroaching inland nearly 20 meters/year for the last five years. That said, the available resources that people have mobilized for their autonomous adaptation have been unstable and at times inefficient incomes from a diversified, adaptive livelihood through agriculture, aquaculture, and wage earning. However, lack of fresh water for agriculture and saline intrusion make crop switching difficult and ineffective. Currently, locals try to be more proactive in their livelihood diversification both off-farm and on-farm to be able to hold to their traditional habitat. Future visions for their adaptation will rely significantly on sufficient financial capacity. When asked whether they can prepare financially for more renovations of seawalls, these locals shrug, with their eyes squinting in uncertainty. They hope that the concrete sea dyke will be completed soon.

Their adaptation process has little or nothing to do with public agency. However, labor and money invested to cement the sandbag

seawall prove that self-reliant efforts are not optimal. There is an obvious absence of a synergy of actions and plans between local people and authorities and higher levels of governance. The vision for coastal management here would be a holistic long-term plan to protect people along the coast, economic infrastructure, and marine ecosystems. Authorities need a more robust management framework in which the speed-up of concrete sea dyke construction is the first priority and optimal strategy.

While adaptation is now firmly embedded in the national governmental discourse regarding the management of climate risk, at the local level and in reality, urgent climate actions are basically initiated by local people in their autonomous responses to extreme weather events to protect themselves and adapt. The current situation of adaptation, with its unclear divisions of responsibility-local, provincial, and national, demonstrates that there is an urgent need for more interaction and cooperation between local actors and those at higher levels of governance in shaping response capacity for more equitable and effective allocations of responsibilities for adaptation action. Apart from training activities in adaptive agricultural cultivation, it is necessary for the authorities to enable communities in their autonomous adaptation to protect their assets as concrete sea dykes take a longer time to finish.

Discussion

This coastal community in the Mekong Delta is suffering economic stressors as caused by climatic changes and the lack of financial and technological adaptive capacities. Household adaptation to coastal erosion is poorly designed and hurriedly constructed in order to reduce the erosion process's impact — an "express" coastal defense structure that is not fit for this purpose. Such autonomous adaptation turns out to be maladaptation. There remain unresolved questions of how long people can sustain their autonomous adaptation. Amid high levels of exposure to erosion about nearly 20 meters annually over the last five years, the community can not only count on the sandbag revetment system because

sand bags can only reduce the erosive power of tidal waves in the short term. The more aggressive tidal waves during the northeast monsoon season over recent years have rendered their existing sandbag seawall structure unsound. Autonomous adaptation by these farmers is caught in an uncertain future, calling into question the responsibility of authorities over mitigation and adaptation treatments.

When questions are asked about climate change along the Mekong Delta coast in terms of sea-level rise and coastal erosion, concerns arise about "who adapts" and "how." Case studies like this one would shed light on the reality of both adaptation agendas planned by authorities and autonomous actions of local people who are directly affected by climate change. This study illustrates the creative efforts of vulnerable populations to reduce environmental risks in the context of insufficient and delayed official interventions. While adaptation does not involve policy making and implementation, it should be remembered that affected people are the foremost active agents and actors to react in any way possible within their capacity.

In their responses to anthropogenic climate change, rural households in the developing world are more vulnerable and have weaker adaptive capacity compared to those in the developed world. Analysis of household-scale adaptations shows that "assumed capacities and vulnerabilities may end up being quite different to those imagined or measured at a macro-scale" (Toole et al., 2016: 1). For this case study, concrete hard engineering and a more effective shifting of crops to fit in changing environmental conditions, as local people believe, are the most feasible and stable solutions to reducing their vulnerability and enhancing their adaptive capacity.

For effective coastal management, communities and authorities in the developing world have to invest in high levels of finance, technology, and skill because poor management will lead to devastating results. Consequently, integrated coastal protection measures (hard and soft engineering) need to be adopted simultaneously; these include beach nourishment, mangrove planting and rejuvenation, and concrete seawall construction (Konko et al., 2018; Muhammad et al., 2020: 9). Likewise,

to solve the problems of vulnerability, uncertainty, susceptibility, and limited adaptation capacity in Bao Thuan coastal commune, planned polices at institutional levels together with household efforts could involve more diverse and holistic approaches, using more soft and hard engineering measures.

Given the physical and economic aspects of vulnerability in Vietnamese coastal communities along the Mekong Delta coast, coastal erosion management becomes imperative because the problem becomes more complex on a daily basis and to find solutions requires a holistic view, which considers all factors contributing to coastal erosion. Complex socio-economic, psychological, cultural, and political factors should be examined in an interconnected and holistic way to have effective adaptation strategies. Aspects of coastal management rely not only on people's initiatives but also on timely interventions from authorities. However, the construction, operation, and maintenance of sea dyke infrastructure would depend significantly on public investment, "which Vietnam would struggle to achieve" (Khong et al., 2020: 2). How can Vietnamese policies help manage the coastal erosion issue more effectively? It will take more years to find the answer while the sea levels keep surging year after year.

Conclusion

This ethnographic article has examined how local values, dilemmas, and obsessions shape local people's adaptation intentions and behaviors amid increasing climate-change vulnerability causing financial deficiency and socio-economic uncertainty. Their adaptation stories reflect both the vulnerability and agency of people in the face of climate change impacts. Local agency in the form of people as active agents with adaptive behaviors rather than as "passive recipients of climate change or associated governance"[20] is manifested as self-protection in their efforts to mitigate natural hazards. Therefore, a closer look at the daily functioning of adaption efforts will help explore complex daily assemblages of socio-economic practices and "sites of active agency."

[20] Cornes and Cook (2018).

These people's adaptation efforts by mobilizing all available resources imply that planned adaptation or top-down policies should be prioritized and implemented in a more timely manner as the poor do not have enough financial or other resources for autonomous adaptation. However, the lack of budget, slow-to-act institutions, and ineffective top-down interventions have rendered both autonomous and planned adaptations uncertain. Together with Conway et al. (2019), this study suggests that a close understanding of autonomous adaptation efforts regarding local conditions and tenability can help reconcile top-down and bottom-up approaches in climate-change research and policy. Therefore, research on various forms of adaptation can "generate complementary insights into who and what is at risk, [as] integrating their results is a much-needed step towards developing relevant information to address the needs of immediate adaptation decisions" (Conway et al., 2019: 503).

In addition, to yield greater insight into the holistic understanding of barriers to autonomous adaptation and planned adaptation in the developing world context, researchers may want to seek answers to the following questions suggested by Arun and Stephen (2012): "to what degree can autonomous adaptations reduce the impacts of climate change?"; "what are the common obstacles to autonomous adaptations in low-income countries?"; "what role can governments play in fostering desirable (efficient) autonomous adaptation?" and "what is the interplay between autonomous adaptation and planned adaptation?"

Research on climate change adaptation, especially among rural households, as Elrick-Barr et al. (2014) and Toole et al. (2016) have noted, needs a thorough assessment of adaptive capacity in terms of social, institutional, and individual process, with more attention to the complex and non-linear challenges facing everyday life. As Toole et al. (2016) argued, household adaptation manifests itself in complicated ways that quantitative and macro-scale studies cannot examine. For more meaningful comparisons within contexts of climate change in the developing world, insights from this coastal community in the Mekong

Delta contribute to illustrating "why people are differentially vulnerable and why some people adapt while others do not" (to quote Conway et al., 2019: 505). Such insights offer us a chance to rethink our approach to adaptation in various social contexts and provide critical information and implications for a more practical adaptation agenda, especially for vulnerable communities in the developing world.

This ethnographic account of a coastal community hard hit by sea level rise and coastal erosion-among many others along the Mekong Delta coastline-suggests further fieldwork on a larger scale covering more coastal provinces to inform large-scale policies and offer more practical implications for coastal governance. Despite the limited scope of this study, its empirical evidence on household adaptive behaviors and capacities in a local context indicates that if researchers engage hard-hit locales with care and on a daily basis, more holistic insights would be gained to serve as references for larger-scope research on climate-change adaptation strategies.

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