2013

Factors influencing the capacity of communities to respond to coastal erosion in the upper Gulf of Thailand

Chatchai Intatha
Edith Cowan University

Edith Cowan University

Copyright Warning

Factors Influencing the Capacity of Communities to Respond to Coastal Erosion in the Upper Gulf of Thailand

Chatchai Intatha

October 2013

Factors influencing the capacity of communities to respond to coastal erosion in the upper Gulf of Thailand

Chatchai Intatha

BA (Nursing), Burapa University, Thailand

M.Sc. (Appropriate Technology and Resource Management), Mahidol University, Thailand

M. (Environment), Griffith University, Queensland, Australia

This thesis is presented in fulfilment of the requirements for the degree of Doctor of Philosophy (Environmental Management)
Faculty of Computing, Health and Science
Edith Cowan University

October 2013

USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

Declaration

I certify that this thesis does not, to the best of my knowledge and belief:

(i) incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher degree or diploma in any institution of higher education;

(ii) contain any material previously published or written by another person except where due reference is made in the text of this thesis;

(iii) contain any defamatory material, or

(iv) contain any data that has not been collected in a manner consistent with ethics approval.

The Ethics Committee may refer any incidents involving requests for ethics approval after data collection to the relevant Faculty for action.

Signed

Date 20 October 2013.

Abstract

Local communities must have a capacity to ameliorate coastal erosion impacts. Since coastal erosion operates over long time frames, understanding this capacity, or the abilities of communities to respond to the impacts and recover to maintain community functions, requires analysis of the past and the present. This study explores factors which influence the capacity of communities to respond to coastal erosion and conversely how exposure to coastal erosion itself affects community capacity.

Mixed methods research was used to investigate the views of respondents in seven coastal villages in the upper Gulf of Thailand, three from an area that has experienced low erosion, and four from an area that has experienced high erosion. A questionnaire survey was administered 358 respondents to investigate socio-demographic characteristics, opinions about livelihoods in communities and experiences of losing and responding to coastal erosion. Thirty five key informants for semi-structured interviews were selected from villagers who responded to the questionnaire and volunteered as well as officials, scientists and NGOs. Descriptive analyses were applied to examine differences in socio-demography, opinion about livelihood and coastal erosion experience variables between the two areas, and factor analysis was used to investigate the importance of factors that affect and could build community capacity to respond to coastal erosion.

The physical characteristics of the high erosion area were significantly different to those of the low erosion area. The former was closer to the Chao Praya Delta River, had many shrimp ponds across villages and residents applied materials which were too fragile to prevent coastal erosion. The low erosion area was far from delta rivers, was surrounded by shrimp ponds and hard structures were applied to protect the coastal area. For socio-demographic characteristics of villagers, residents in the high erosion area had less employment, lower education, lower income and lower levels of land ownership than residents in the low erosion area. Residents in the high erosion area reported more experiences of property loss from coastal erosion in the past 30 years than residents in the low erosion area as would be expected. Across the two erosion areas rock placements were applied as a common method to protect the coast in the past, while embedding thin bamboo stems offshore was also used in the high erosion area. The government and other networks had promoted a combination of methods to protect coastal areas by embedding thick bamboo stems offshore and planting mangrove trees in intertidal areas. This combination of methods was yielding positive results.

Residents impacted by coastal erosion migrated landwards from eroded area and those residents lost connection with their neighbours, lacked opportunities for generating their own income or obtaining employment, and spent their savings in mobilising and rebuilding houses. Some residents who felt insecure from erosion sold their land to external landholders and then they moved to live in more secure areas away from their villages, taking their financial resources

with them, thereby effectively removing their financial resources from the original communities. The external landholders held increasingly large areas in these villages. Local communities thereby suffered from a lack of finance and power and diminished rights to build infrastructure for coastal erosion prevention and improvement of their quality of life.

Five main factors were found from multivariate factor analysis. Firstly, villagers having control over their own land (and therefore control over their destiny) provided more opportunities to build structures to prevent coastal erosion in their own communities. Secondly, higher levels of leadership were central to mobilising resources to address coastal erosion problems provided the leaders had the necessary attributes to deal with this challenge. Thirdly, coastal community resilience was necessary for communities to address existing changes, whereas communities needed to maintain their functions to be ready to respond to unpredictable impacts of coastal erosion and other events without diminishing their potential. Fourthly, enhanced levels of sense of community were important to gain collaboration from residents to cope with coastal erosion. Lastly, a positive household socioeconomic element was necessary for residents to have sufficient resources for building natural hazard protection appropriately. These five issues could be highlighted to coastal communities to improving capacities to respond to coastal erosion effectively, whereas local authorities and other organisations with high capability could facilitate and support the communities to build capacities through those issues.

Acknowledgments

Many people have supported me during this research journey. I wish to acknowledge and thank my supervisors, Professor Pierre Horwitz and Associate Professor Andrea Hinwood for their enormous support, guidance and resolve. They have inspired me to develop my critical thinking skills and to understand research processes. In addition, I like to thanks sincerely to Chamlong Poboon who always provided advice during field trips to collect data.

I would like to thank the people, such as villagers, heads of villages, monks, NGOs, scientists and officials, who responded to my questionnaire, sacrificed their valuable time for interviews and shared their interesting experiences and stories for this research.

I would like to acknowledge Dr. Greg Maguire, Dr. Jo McFarlane and Ann Beveridge who work with the ECU research community, for example, by leading extraordinary workshops to improve research and writing skills. Thanks to Anthea Ward who always encouraged and supported me to overcome difficult situations during my study.

I would especially like to acknowledge and thank Ajahn Brahm, an abbot in the Buddhist Society of Western Australia, and a group of eight precepts in the Buddhist Society who helped respond to the questionnaire, encouraged me to cope with my study and supported me to achieve a healthy life balance over the four years.

I would like to thank my head of office and colleagues in the Office of Natural Resources and Environmental Policy and Planning for allowing me to undertake postgraduate studies overseas.

I would also like to thank my dad and my mum who encouraged me to achieve my goals. Finally, my wife Warakorn and son Chawin have been very brave and patient in helping me to deal with the challenges in this Ph.D. journey.

Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter 1: Community responses to coastal erosion

1.1 Introduction

Groups of people living in common areas can have strong relationships because they share norms, values, traditions and common goals. They feel a sense of belonging to places and connect to each other as a community (Bruhn, 2005). People come together to improve skills, share knowledge, support common goods, and link together in order to solve collective problems by operating through informal social activities. Individual residents, groups, organisations and social linkages between internal and external organisations can arrange efforts to achieve the purpose of community well-being (Chaskin, Brown, Venkatesh, & Vidal, 2001). Human experience is such that some environmental problems can impact on communities with inevitable and uncontrolled effects in both the short- and long-term, particularly for natural hazards related to oceanic changes. Oceanic changes affect physical and biological characteristics of the sea and coastal areas at different thresholds, scales and time resulting in altering structures and responses of coastal communities (McLean & Tsyban, 2001). One of the adverse consequences of oceanic change is coastal erosion because it has been impacting coastlines across the world (Watson et al., 1996).

Coastal communities, resources and infrastructure are predicted to be exposed to greater risk than ever before from coastal erosion and coastal retreat (Parry, Canziani, Palutikof, Van der Linden, & Hanson, 2007, p. 6). The major causes of coastal erosion are sea level rise, land subsidence from ground water withdrawal, insufficient sediment supply, storm surge, tsunami, flooding and human activities along coastal areas such as removal of coastal vegetation, aquaculture ponds, commercial forestry, and shoreline protection works (Douglas, 2001; Kleinosky, Yarnal, & Fisher, 2007; Richardson, 1995). Severe coastal erosion can create extreme economic, social and environmental losses for communities and regions, particularly as coastal areas are often densely populated (Nicholls & Tol, 2006).

Population growth has been increasing along coastal areas across the world for living, farming and manufacturing purposes. Approximately 23% of the global population live within 100 km distance from the coastline (Small & Nicholls, 2003; Valiela, 2006, p. 16). Increasingly residents near the coastline have been migrating to live in coastal metropolises and megacities (Nicholls et al., 2007). Rapid population change along the coastline enhances the risks from consequences of flooding, storm surge, wetland damage, coastline retreat and saltwater intrusion (Nicholls & Tol, 2006). As these population trends occur in a coastal megacity in Thailand, the main risks to the population are from flooding and coastal erosion (Durongdej, 2001; Nicholls & Tol, 2006; Saito, 2001).

The upper Gulf of Thailand has been exposed to serious erosion along its 100 km coastline. Bangkok, the capital with a high population density, lies on part of the upper Gulf of Thailand. The Department of Marine and Coastal Resources (DMCR), Thailand (2009) reports that many

coastal subdistricts have been impacted by coastal erosion at various rates, from a few to twenty metres per year. The shoreline has retreated approximately 1,000 metres over 30 years due to erosion which is partly due to a rise in sea level. The coastline in Bangkok is 4.9 km in length having been critically eroded by 2.6 km^2 between 1952 and 2002. As a consequence, households spent on average US$ 3,130 per year or 23% of their household incomes on preventing land loss and flooding using various techniques such as stone or concrete breakwater, dike and bamboo revetment (Jarungrattanapong & Manasboonphempool, 2008). These authors claim that in response, some aquaculture farm owners moved their farms to landward areas and others rebuilt their houses on piles or renovated their houses to prevent flooding.

Land use in the upper Gulf of Thailand has been changed by removing mangrove forests to build aquaculture ponds, salt farms, industrial areas and community settlements (Patmasiriwat, Bennis, & Pednekar, 1999). The major causes of land use change are an unclear policy to improve land and increasing numbers of aquaculture farms. The National Economic and Social Development Plan (1987-1991) increased conflicts among resource users due to the ambiguous and contradictory directions of the national policy. For example, the Department of Fisheries formulated a fishery development plan to promote aquaculture farms, whereas the Royal Forestry Department attempted to support a preservation framework to protect coastal resources (Cicin-Sain & Knecht, 1998).

Mangrove areas in Thailand have declined from 254.25 km^2 in 1979 to 68.37 km^2 in 2004 (DMCR, 2009, p. 8) resulting from expansion of the coastal shrimp farm industry and community settlements (Jenkins, Smith, Tookwinas, & Phillips, 1999). Mangroves provide some protection for coastlines. If mangrove areas are decreased greater than their thresholds of stability, the coastal areas are at risk of damage from flooding and erosion (Gilman et al., 2006).

Communities living near the coast have suffered impacts from coastal erosion which affects community properties through loss of land, roads, electricity and communication systems, aquaculture and farmlands (Jarungrattanapong & Manasboonphempool, 2008; Ohno, 2001). The great manufacturing areas in Bangkok and surrounds have suffered the greatest damage. Ohno (2001) estimated that land loss from 50 cm to 100 cm of sea level rise would result in a reduction of 0.36% to 0.69% of national GDP or US$300 to 600 million per year. Further, erosion decreases the market value of coastal land, causing water intrusion, release of pollutants into the sea and deterioration of mangrove areas; it decreases the breeding and food resources of fish (European Commission, 2004).

The government of Thailand has attempted to prevent coastal erosion by constructing permanent structures such as vertical concrete retaining walls and breakwaters (Vongvisessomjai, 2006b). But these structures are time-limited (Xeidakis, Delimani, & Skias, 2007) and can increase erosion beside the structures or at adjacent properties (Gilman, et al., 2006). Vongvisessomjai (2006b) claims these are often designed without prior study, holistic planning approaches, or environmental impact assessment studies before construction; hence potential impacts still remain.

Coastal erosion is therefore still a critical problem. In practical terms, local communities located on coastlines and impacted from area losses have been attempting to protect their coastal areas, particularly by planting vegetation (DMCR, 2009). Planting mangrove is less expensive and less complicated than other coastal protection works (Gilman, et al., 2006), and local people can plant in coastal areas by themselves. In this way, local communities might be able to develop their own knowledge and rely on their own experiences in dealing with this long term problem.

Some communities are concerned by the impacts of recent land losses and future sea level rises and members of those communities have been assisting by growing mangroves, sharing resources and improving other abilities to reduce threats. In the mid- to long-term, the communities have learned to address the impacts of coastal erosion and there is evidence of limited or less coastal retreat. Other communities with no measures to protect their shorelines have a loss of land at moderate to critical rates. This suggests that some communities have the potential or an ability to adapt to the impacts of coastal erosion (B. Smit & Pilifosova, 2001) and successful adaptation might mean a decline in coastal erosion impacts (Nicholls & Tol, 2006). Communities experience natural hazards in different ways, which vary from area to area, so the less experienced communities need to learn to improve their abilities to address the frequencies and degrees of the impacts (S. L. Cutter et al., 2012).

Community capacity is required in order to mitigate and adapt to the impacts of coastal erosion, and to reduce economic losses for households and communities. Therefore, it is important to investigate the factors that influence the manner in which communities in the upper Gulf of Thailand develop capacities to adapt to coastal erosion to ameliorate the problem. This study integrates a conceptual framework of community capacity with local community experiences in coastal erosion management. This is done in an attempt to identify the potential circumstances which might influence the relative success of response strategies. The results should support recommendations to improve community capacity for dealing with coastal erosion and other natural hazards in the future.

1.2 The upper Gulf of Thailand

The Gulf of Thailand is in the South China Sea with the coastline stretching from the border of Malaysia northwards to the U-shaped apex of the Gulf before turning to the east to the border of Cambodia (The World Bank, 2007). The upper part of the Gulf of Thailand is also shaped like an inverted U.

Coastal areas in Thailand have been developed for tourism, industry, aquaculture, agriculture and urban settlement resulting in critical deterioration of natural resources. The coastal length along the upper Gulf of Thailand covers 5 provincial administrative boundaries: Samut Songkhram, Samut Sakhon, Bangkok, Samut Prakan and Chachoengsao (see Figure 1-1). It includes four river mouths: the Maeklong, Thachin, Chao Praya and Bangpakong rivers. The

characteristic surroundings are muddy delta and tidal flat areas with a surface layer of soft clay about 21 metres deep. Most coastal areas were covered with mangrove forest in the past (DMCR, 2009), but the coastline in Bangkok has been developed intensively for shrimp farms over last few decades (Jarungrattanapong & Manasboonphempool, 2008) which have resulted in some areas being eroded at rates ranging from a few to twenty metres per year (DMCR, 2009, p. 1).

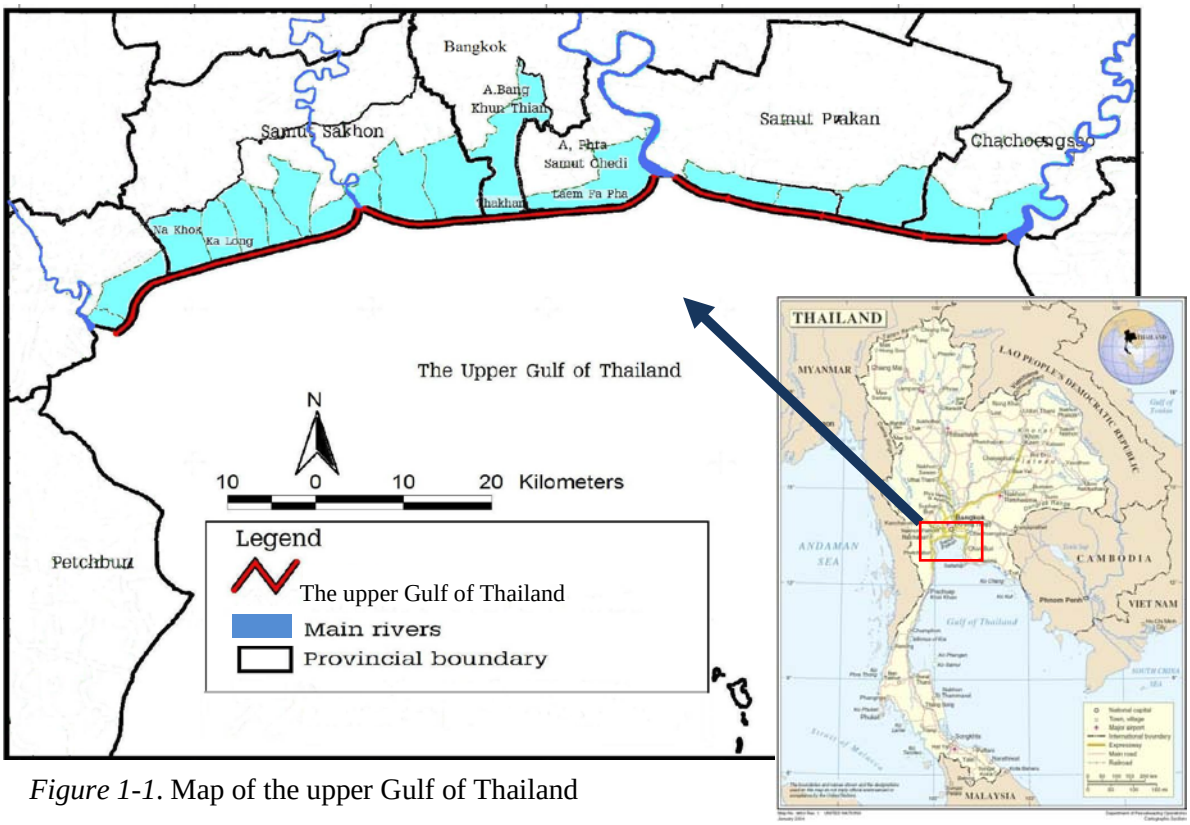


Figure 1-1. Map of the upper Gulf of Thailand

Sources: Department of Peacekeeping Operations, Cartographic Section of the United Nations (2004) and DMCR (2009).

1.3 Coastal erosion and responses

Coastal landform depends on geology, sediments and external forcing in shaping a coast to keep an equilibrium between land and sea dynamics with transportation of sediments (Masselink & Hughes, 2003; Wright & Thom, 1977). Geology refers to boundaries of local or regional areas at a shoreline with wide-flat or narrow-steep shelves. These characteristics affect wave height and wave transformation processes. Sediments depend on volumes of sediment moved from sediment sources to a coastline. External forcing affects and drives a coastline such as waves, winds, tides and currents (Masselink & Hughes, 2003). Coasts can be divided into three types depending on natural processes: wave, tide and wind, resulting in different depositional conditions (French, 1997). Coastlines dominated by wave processes occur under high energy conditions and sediments are taken away from the coast. Wave processes usually build cliff, shore platforms and beach. Tidal processes of varying speeds occur in lower energy conditions

to produce mudflats, deltas and mangrove. Wave action generates energy for erosion, transportation and deposition of sediment thus influencing coastline processes directly and indirectly. Wind processes affect tidal patterns in ways that increase coastal erosion. These influences shape coastal morphology (Hamblin & Christiansen, 2001).

Coastal erosion is an interaction between land and sea systems. The land system consists of geomorphology, the tectonic scheme of the broader areas and the geotechnical characteristics of the coastal materials. The main characteristics of the sea system are sea waves, tides, currents and bathymetry of the sea (Xeidakis, et al., 2007). Other factors involved in coastal erosion include sediment supply and local land subsidence (Stive, 2004). Coastal erosion can be considered as the removal of substance from the beach profile by waves and currents in conditions of insufficient sediment supply (Claude & Marie-Christine, 1989; European Commission, 2004; Ruggiero, Voigt, & Kaminsky, 2000; Xeidakis, et al., 2007). As the coast erodes, sediment will be lost offshore (Leatherman, 2001).

Coastal erosion is probably the most important persistent threat to people who live and benefit from the coastline. Many development plans allow people and property to be located on the coasts and these areas are transformed over time. The small island nations in the Pacific Ocean are particularly prone, and have had increasing impacts of land loss resulting from human activities, coastal protection works, cyclone and sea level change. For example, the shoreline in Funafuti Atoll, Tuvalu, has receded 3-7 metres between 1973 and 1995. Local people have made efforts to prevent land loss by constructing seawalls and revetments (Chunting, 2005). Many communities on other islands grew mangroves to protect erosion and reclaim land such as Rarotonga, Cook Islands and Viti Levu, Fiji (Solomon & Forbes, 1999).

Rapid erosion along the coastline with no effective defence measures in place leads to a loss of coastal ecology, land and infrastructure including aquaculture ponds, houses and villages (French, 1997). From coastal retreat, potential socio-economic impacts may include: 1) loss of properties, life and coastal habitats; 2) damage to coastal protection works and other infrastructure; 3) loss of renewable and subsistence resources; 4) loss of recreation sites and transportation functions; 5) loss of non-monetary cultural resources and values; and 6) impacts on agriculture and aquaculture (McLean & Tsyban, 2001; Nicholls & Lowe, 2006).

Nicholls and Tol (2006) suggest measures to prevent coastal erosion are those of building setbacks, sand supply or nourishment and coastal defences. French (1997) argues that “soft” solutions for coastal defence should be considered in terms of the creation of coastal habitats such as artificial reefs, floating breakwaters, beach nourishment, marsh creation and vegetation planting. Soft solutions can be effective for coastal protection over the medium to long term (Xeidakis, et al., 2007). A permanent structure is an engineering construction to prevent sea water damaging assets on land such as breakwater, geo-textiles, revetments, jetties and seawall (European Commission, 2004). Local authorities usually respond by building fixed solutions

such as seawalls and breakwaters. Seawalls or jetties are long concrete or rock structures installed to decrease wave and current energy so as to defend adjacent eroded land and properties. However, these fixed solutions can also increase erosion rates in the adjacent coastal areas (Hamblin & Christiansen, 2001). The European Commission (2004) provides details for the selection of firm or soft structures to prevent coastal erosion because each has limitations. Coastal defences must be designed in combination with other factors such as purposes for use of the coastline, cost of construction and ecological functions. If structures built are not appropriate, the coastline will be adversely impacted by coastal erosion.

Not all coastal areas are eroded similarly. Some coastal areas may suffer greater adverse changes in the absence of natural features that protect the shoreline. Others have potential for physical changes and coastal retreat. The former means the coastal areas are susceptible to the impacts of natural hazards (Harvey & Woodroffe, 2008). As described above, sand and gravel beaches function as wave energy sinks. Coastal dunes can buffer shoreline retreat during storms, and coastal vegetation can absorb wind or wave energy, slowing down erosion (McLean & Tsyban, 2001). Salt marshes act as a sea defence (King & Lester, 1995) and mangroves function as a sediment trap (Solomon & Forbes, 1999). Mangroves can be planted on mudflats to prevent coastal erosion because they are able to tie and stabilise the shorelines, trapping suspended material from the land and the sea by keeping sediments under their leaves and among their roots. When suspended particles pass the vegetation's roots, these are held in that location (Field, 1995; Thampanya, Vermaat, Sinsakul, & Panapitukkul, 2006).

In terms of potential of individuals and communities, the degree of capability held by a community, organisation or country to deal with all consequences of coastal erosion, including impacts on natural, cultural, social and economic resources, is termed "vulnerability" (Harvey & Woodroffe, 2008; McLean & Tsyban, 2001). A community can influence vulnerability through shared goals and values, local property rights and accesses to various resources at different times (Armitage, 2005). Armitage further contends that human development and social association patterns in communities are important constituents for vulnerability. However, not all people in a community share vulnerability equally (McLean & Tsyban, 2001). They have different socio-cultural factors and capacities to access resources that help to protect them from hazards. Some demographic factors are central features of social vulnerability, for example, age is important, in circumstances when young children and elderly people need to evacuate (Clark et al., 1998; S. L. Cutter, Boruff, & Shirley, 2003; O'Brien et al., 2012). Another example is that racial and ethnic communities may have less opportunity for training in the hazard-preparedness stage of dealing landward completely with environmental stresses; hence they may be more vulnerable (A. Fothergill, Maestas, & Darlington, 1999). Poverty directly influences the vulnerability of residents to coastal hazards (D. S. Mileti & Gailus, 2005) as economically disadvantaged households may have to build sub-standard houses or live in areas prone to flooding or landslides (Adger, 2003). In contrast, higher socioeconomic status groups may lose more in adverse environmental events, but

can also access resources to support recovery (Anderson-Berry & King, 2005; Spence, Lachlan, & Griffin, 2007). This suggests that residents have different abilities to address community issues so it is important to increase the capacity of people and communities to cope with the problems efficiently by building community capacity through the identified potential dimensions (Bopp, GermAnn, Bopp, Littlejohns, & Smith, 2000).

Coastal erosion results from both natural climatic events and human activities and affects communities by creating social and environmental problems. A number of households in communities lose their property and migrate toward inland. Communities need to build capacity by integrating adaptive responses to coastal erosion impacts. Then the heuristics model which is composed of adaptive cycle and multiple connections at different scales of an adaptive cycle is illustrated to help understand how communities cope with changes. After that learning processes are explained by describing patterns of community learning to address changes with their skills, knowledge, resources, experiences and integrated actions. These concepts are useful to respond the research questions and the specific aims of the study and the concepts are applied to describe the relationship between the potential factors and responses of community to coastal erosion impacts.

1.4 Building community capacity

A definition of community capacity has been framed close to community development so it is important to distinguish definitions of both phrases. Community development means community investment in infrastructure and services to improve economy, human capital and businesses in a community, whereas community capacity building is relevant to improvement of capacity within communities by improving services and developing organisations to create social capital and overall capabilities to address changes from within communities (Noya & Clarence, 2009). An ability to address community issues is strong or weak depending on the relevant capacity being built into the affected community (Gibbon, Labonte, & Laverack, 2002). Chaskin et al. (2001, p. 7) define community capacity as “the interaction of human capital, organisational resources, and social capital existing within a given community that can be leveraged to solve collective problems and improve or maintain the well-being of that community”. It is a dynamic state because communities are always developing and eroding their ability to respond to external risks (Chaskin, et al., 2001; Jackson et al., 2003). Various studies have been conducted to investigate the dimensions of community capacity. Goodman et al. (1998, p. 260) state that community capacity is thought to rely on “leadership, participation, skills, resources, social networks, sense of community, understanding of community history, community power, community values, and critical reflection”. Laverack (2005, p. 270) defines nine dimensions such as participation, leadership, organisational structures, problem assessment, resource mobilisation, questioning, links with others, programme management and role of outside agents. Bopp et al. (2000, p. 14) outline seven dimensions: shared vision, sense

of community, communication, participation, leadership, ongoing learning and resources, the latter including knowledge and skills.

Communities need to apply these components to build their adaptive capacity to improve capacity to respond to coastal erosion. Armitage (2005, p. 708) illustrated ten endogenous and exogenous variables to build adaptive capacity in community-based natural resource management such as technical issue (trained personnel skills), resources (financial resource), social issues, institutional issue (legislation), political issues, power, scale, knowledge (western, traditional), community (trust) and culture (norm, value).

The components to build community capacity which were suggested by Goodman et al. (1998), Laverack (2005) and Bopp et al. (2000) and the components to build adaptive capacity in community-based natural resource management which were concluded by Armitage (2005) were illustrated to select and apply in the study. The analysis looks for common factors that have been consistently reported as influencing community capacity building as shown in Table 1-1.

Table 1-1: Common factors identified in the literature that build community capacity to respond to coastal erosion

Goodman et al. (1998, p. 260)	**Laverack (2005, p. 270)**	**Bopp et al. (2000, p. 14)**	**Armitage (2005, p. 708)**	**The selected factors**
Participation	Participation	Participation		**Participation**
	Organisation structures		Institutional issues -legislation	
Leadership	Leadership	Leadership	Political -leadership	**Leadership**
Resources	Resource mobilisation	Ongoing learning and resources	Resource -financial	**Resources (include infrastructure)**
	Problem assessment			
Social networks	External linkages outside agents		Social issues	**External networks**
	Project management			
Critical reflection	Critical assessment			
Skills		Skills	Technical issues -trained personnel skills	**Skills**
Knowledge		Knowledge	Knowledge -western, traditional	**Knowledge**
Sense of community -trust		Sense of community -trust	Community -trust	**Sense of community - Trust**
Understanding of community history				
Community power			Power	
Community values				
		Communication		
		Shared vision		
			Scale	
			Culture -norm, value	

The dimensions found from these studies can be used to identify capacities for serving community well-being. Much research supports leadership as an important factor in community capacity (Hahn, Olsson, Folke, & Johansson, 2006; Pelling, 1998), networks (Provan, Veazie, Teufel-Shone, & Huddleston, 2004), sense of community (Aref, Redzuan, & Emby, 2009; T. Mannarini, S., Fedi, & Greganti, 2006), participation (Dassopoulos & Monnat, 2011; Hung, Sirakaya-Turk, & Ingram, 2011) and trust (Davenport, Leahy, Anderson, & Jakes, 2007; Molyneux, Peshu, & Marsh, 2005).

While some factors that will probably enhance capacity are common in any community, others can be much more specific to the group's situation. Common factors include education, income and health, will to cope with drought, flooding and erosion, infrastructure, resources, knowledge and skills appropriate to the situations. Therefore, a combined list of the potential factors likely to influence community capacity in response to coastal erosion can be developed (see Table 1-2).

Table 1-2: Potential factors likely to influence community capacity in response to coastal erosion derived from the literature on community capacity

Potential Factors	Definitions
Skills	Personal abilities and specialised staff with organisational and political skills, sharing scientific information and seeking information skills
Knowledge	Enhancing ownership of knowledge and bridging knowledge from various sources to support learning experiences to deal with coastal erosion
Participation	Involvement of individual members in local community activities and community development designed to improve local environments
Leader/leadership	Facilitating the sharing of resources by villagers and organisations, presence of experienced, skilled leaders in a community willing to manage and control coastal erosion
Level of trust	Enhancing obvious equality and building relationships between persons and the community by truth telling, sincerity, and displays of fairness.
Sense of community	High level of concern for community issues, sense of connection with place and its people including respect, generosity and service to others.
Resources	Human, social and capital resources accessed shared; sufficient and consistent funding support to address the erosion.
Infrastructure	Building physical infrastructure to improve people's access to facilities and services as well as to prevent future losses.
Networks	Intimate ties between residents and organisations to provide collective resources and allow members to organise resources.

Sources: Modified from Anderson-Berry & King (2005, p. 370), Armitage (2005, pp. 708-709), and Goodman et al., (1998, pp. 261-262)

Community capacity can operate at three levels of the society: individuals, organisations and networks (Chaskin, et al., 2001). Individuals like residents can improve their capacity by increasing their knowledge and skills. When community members need to act to change institutes or mobilise others, the members can work through leadership. Chaskin et al. (2001) maintain that residents associate human capital and leadership in terms of skills, knowledge and resources of members to participate in community activities.

A community's organisations include neighbourhood associations, social groups and informal organisations, and local governments. Neighbourhoods may be planned or unplanned. People who live in planned areas can be closely connected because the areas are appropriate for activities among residents such as accommodation, shopping and recreation. People living in unplanned areas have less connection and rely on participation among people such as rooming-house areas (Horton & Hunt, 1972). Groups are composed of sets of persons and have informal relationships in terms of friendships or common interests (Cox, Erlich, Rothman, & Tropman, 1987). For example, occupational groups have been established in a community to improve household income by helping each other to do dish washing jobs.

Formal organisations in a community are large groups established to implement and to achieve particular objectives (Deane & Davis, 1987). Local government is a formal organisation which has roles for governance, advocacy, providing services and facilities for communities, planning and community development, administration of regulatory systems and management of resources in their areas (Commonwealth of Australia, 2007; Pearson, 1994). When communities have strong organisations in different sectors such as the educational, social and economic sectors, organisations can support residents to access resources and opportunities, and enhance human capital development (Chaskin, et al., 2001).

Linkages mean connection of relationships that tie individuals to other people directly or indirectly (Deane & Davis, 1987). Horton and Hunt (1972) state that weak relationships with others result in isolation, no progression and little development. Linkages within society involve relationships among persons, formal and informal groups, and formal organisations (Chaskin, et al., 2001) that develop trust, connection and normative rule in communities (Zakocs & Guckenburg, 2007). Networks relate to cohesion and centralisation. Coalition means residents have close relationships to each other and they form trust in working together for collective action (Feinberg, Riggs, & Greenberg, 2005; Moody & White, 2003). Centralisation is a pattern which includes a few core residents who are central and have connections with many residents. These residents do not have connections to each other but link through the core residents (Feinberg, et al., 2005). The social ties involve hierarchy and promote efficiency of organisations to function by applying collective actions. Networks will function well if horizontal ties support members in sharing information, improving trust and relationships and cooperating across sectors (Feinberg, et al., 2005; Kegler, Steckler, Malek, & McLeroy, 1998).

From these networks, the building of community capacity in response to coastal erosion can be modelled. In Figure 1-2, each of the three circles represents individuals, local governments and groups, and formal and informal organisations having linkages within society; they support and share the potential factors among them in order to build capacity within a community to cope with a community problem, in this case, coastal erosion. These community components increase their capacities by utilising local resources, improving technical skills and knowledge in coastal erosion management, developing levels of leadership and trust, and a sense of community. Local governments may build coastal protection works to prevent erosion in eroded areas and provide rights to villagers to manage mangrove forest areas. In addition, external organisations and networks at local, regional and international levels may occasionally support communities to improve community capacity. For instance, international development agencies or the federal government provide funding for coastal area protection construction. Specialists from research institutes transfer technical skills and knowledge in coastal management to leaders and villagers. Figure 1-2 shows a dotted rectangle representing community capacity to deal with coastal erosion, where internal or external influences can increase or decrease that capacity. Thicker lines represent where stronger relationship among individual residents, groups and organisations are hypothesised to occur.

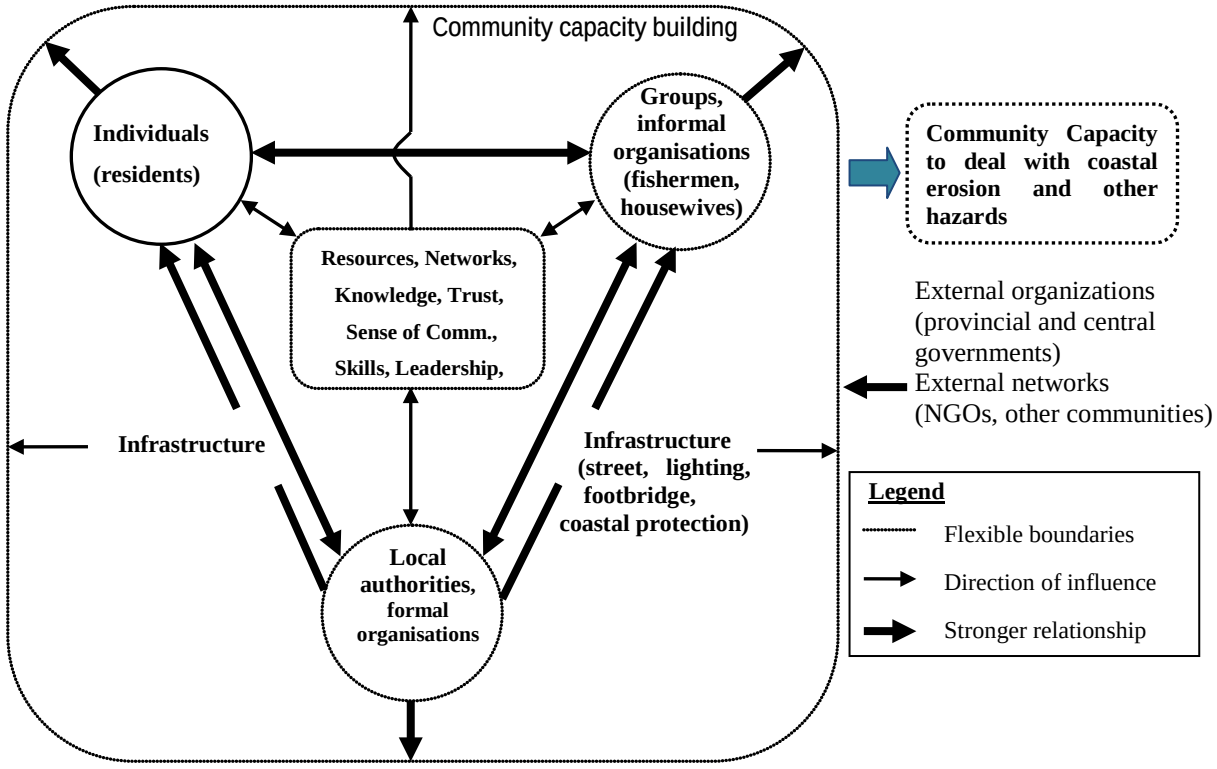


Figure 1-2. Conceptual model showing factors influencing community capacity to cope with coastal erosion

The factors that may influence community capacity to deal with coastal erosion are described in detail below.

Skills are vital to run communities effectively by supporting planning practices, communication and conflict resolution, and implementing specific programs to promote human well-being (Chinman et al., 2005). People having particular skills may have more opportunities to work across broad areas (Wallis & Dollery, 2002). Skills help facilitate groups to achieve the objectives of their activities (Garcia, Lindgren, & Pintor, 2011). Fenwick (2006) states that skills can be improved by training to perform particular tasks. Meanwhile, Dreyfus and Dreyfus (1986) distinguish skills development into five stages including: 1) novice, which means a person learns to recognise activities to be achieved because they lack experiences and practices; the learner needs to be supervised and provided with instructions; 2) advanced beginner, where the learner having knowledge and experiences in some situations, recognises problems and the ways to solve problems and learns the new situations; 3) competence, which means the learner has high capacities and experiences sufficient to cope with complicated problems by learning from success and failure; 4) proficient, which means the learner has a high level of experiences and skills; has a deep understanding in practice areas; has clear perspectives, goals and visions; and 5) expertise, which refers to the learner having sufficient experiences in various situations and problems resulting in skilful making of decisions and managing of problems across areas under consideration.

People who developed skills and knowledge regularly could improve capacities to respond to changes within their areas (S. L. Cutter, et al., 2012). Knowledge is useful to residents to understand causes, effects and possible solutions of coastal erosion. People can integrate knowledge from traditional knowledge, scientific information and personal experience (Adger et al., 2007). Traditional knowledge includes social, cultural and moral aspects in communities, whereas modern knowledge needs to distinguish the different areas and understand causes and effects of events to describe relationships (Banuri & Marglin, 1993). Machlup (1980) and Rich (1981) distinguish knowledge into five major clusters: 1) practical knowledge which is important for working, making decisions and implementing them, and is sub-clustered into professional knowledge, business knowledge, workman knowledge, political knowledge, household knowledge and other practical knowledge; 2) intellectual knowledge which is created by learning and educating in scientific and cultural aspects; 3) small talk knowledge which is created for entertainment and emotional development such as jokes, gossips and news; 4) spiritual knowledge which is related to religion and belief of God and soul; and 5) unwanted knowledge which is non-interest issues. Hisschemoller et al. (2001) conclude that knowledge is related to power. This is because in the knowledge cycle, knowledge is information which is retrieved, used and processed for decision making in policy and allocation of budget, workers, training programs and assessment (Rich, 1981).

Participation means voluntary actions of residents for opportunities to become involved in community improvement (Tosun, 2000). People who participate in community activities promote collective actions by providing social and financial support, education and information (Wickrama & Wickrama, 2011). When residents who have strong sense of community participate in meetings or community activities, participation provides positive effects on satisfaction (Dassopoulos & Monnat, 2011). Participation is more efficient when members from different stakeholder groups such as those housing different socio-economic characteristics, personal interests and awareness participate in decision-making processes (Hung, et al., 2011). Most social analysts understand that participation refers to levels of active involvement in making decision to programs (Few, Brown, & Tompkins, 2006). Indeed, many programs lack real commitment and limit forms of involvement to residents because participation is related to social power between organisations and residents so organisations often allow little decreasing top-down formats of making decisions (Few, et al., 2006; Owens, Rayner, & Bina, 2004). Arnstein (1969, p. 216) argues that "citizen participation is citizen power" and "participation without redistribution of power is an empty and frustrating process for the powerless". Potter (1985) suggests that residents create high levels of participation by building relationships with organisations, having positive experiences of projects in the past, and lacking gaps of knowledge and communication to enable involvement in events.

Leadership is usually viewed as a key person for community structure, networking and collaboration. Popper and Mayseless (2003) report that leaders have roles to guide, direct, lead and serve other residents in communities to feel safe, comfortable and protected when there are community issues. They can improve self-organising processes to promote community interests and support groups not only to address emergency stress but also to improve their capacities (Chaskin, et al., 2001; Hahn, et al., 2006). Nypan (1970) argues that formal leaders in local communities in developing countries have active roles to improve those communities, initiate interesting activities in communities and mobilise all types of community resources for development, but that the boundaries of authority are unclear and broad. For leadership, Alexander et al. (2001) point out that if leadership is related to hierarchical positions, the higher positions have legitimate authority by defining visions, goals and strategies of their organisations, and manipulating lower positions and stakeholders by defining responsibilities, allocating financial resources and making decisions to employ members. Rosenthal (1998) states that different genders have different styles of leadership. Women leaders can successfully improve communities by applying creative strategies and resources, and women leader roles illustrates power equity between genders in communities (Sylvia et al., 2010).

Trust is "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviours of another" (Davenport, et al., 2007, p. 354; Rousseau, Sitkin, Burt, & Camerer, 1998, p. 395). Trust can be created through community participation because the participation builds reciprocal understandings (Molyneux, et al.,

2005). Trust is important for social relationships to achieve organisational success, enhance organisational learning, and promote collaboration. It can also facilitate the resolution of complex situations through sharing information, building relationships, raising honesty, improving conflict resolution and integrating problem solving (Davenport, et al., 2007; Shaw, 1997; Six, 2005). In communities with high levels of trust, communities show varied and new relationships among residents (Goodman, et al., 1998). Strength or weakness of trust depends on experiences, interactions and relationships (Burke, Sims, Lazzara, & Salas, 2007). Trust is about meaningful in communication processes among leaders and residents. Residents may want to communicate with leaders on common issues but if residents and leaders lack trust in each other, the residents do not provide necessary information to leaders, resulting in increasing personal risk (Burke, et al., 2007).

Sense of community occurs when there is sharing of beliefs, ways of behaviour and vision by a group of people in an area with ongoing relationships among relatives and neighbours to support a common goal (Chaskin, et al., 2001). People feel that they are members of a community and they have a good quality of social life and well-being, such as life satisfaction, safety for living in the community and social participation (Chavis & Wandersman, 1990; Terri Mannarini, Tartaglia, Fedi, & Greganti, 2006; McMillan & Chavis, 1986; Prezza & Costantini, 1998). This means people feel their communities like homes. People within communities connect together and they can help each other when they have crises because those people feel they belong to their groups, both family and community which leads to having a sense of belonging (Anant, 1969). When people grow up, they develop this sense of belonging to their families, communities, countries and cultural groups (Kestenberg & Kestenberg, 1988). A sense of belonging aids managing problems about relationships between people in communities. If these people have a weak sense of belonging, they will lack the necessary ties thereby acting on cooperation among groups (Wu, Hou, & Schimmele, 2011).

Local governments seek to support equitably the physical infrastructure which communities need in order to improve their quality of life and the ability of all members to access resources and services. The economic status of local government, however, is an important factor to consider when supporting infrastructure is necessary. The role of local government involves making policy on community development, that is to make arrangements for transportation, recreation, traditions, social welfare service and activities for environmental protection (Lang, 1999).

Individual resources include funding, property, skill and knowledge of individual residents that support and develop individual capacities to mitigate impacts (Chaskin, et al., 2001). Individuals with low resources are at greater risk of serious damage, and they have less capacity to mitigate changes and recover after changes (Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). Collective resources are crucial: financial resources, natural assets and quality staff resources (Hughes, Black, Kaldor, Bellamy, & Castle, 2007). Smit and Wandel

(2006) argue that local communities need various types of resources to undertake adaptation such as funding, technology, information and infrastructure. If local communities had no resources, the communities would obtain basic resources which they needed from outside communities (Freudenberg, 2004; Goodman, et al., 1998).

Networks are composed of a group's family, friends, neighbours and fellow workers (Bruhn, 2005), and are created among individuals who may be within and outside groups and organisations. For instance, residents, peer networks, and public and private sectors can take an active interest in community activities (Grindle & Hilderbrand, 1995). In positive social relationships, networks promote trust for accessing information, resources and opportunities to enhance community capacity (Chaskin, et al., 2001). In addition, external organisations can collaborate with local communities to support resources, knowledge and skills to deal with community problems (Loza, 2004), so strong connections between local groups and external organisations help local communities to build capacity and respond to environmental hazards collectively (E. L. Tompkins, 2005). Similarly, Few and Tran (2010) and Tompkins and Adger (2004) conclude that a community with poor income and low home ownership can improve its capacities by garnering external assistance.

As discussed, possession of these factors is important to build community capacity to address community issues. To respond to environmental stresses and hazards, communities may need to adopt other capacities to cope. For example, if communities are able to adapt to coastal erosion retreat, they can reduce longer term impacts on property and livelihoods of coastal residents (Nicholls & Tol, 2006).

1.5 Resilience and adaptive capacity

When environmental hazards impact on communities with the capacity to absorb disturbances, and maintain their basic functions and controls in relation to the magnitude of a disturbance, they are said to have resilience (Carpenter, Walker, Anderies, & Abel, 2001; Holling & Gunderson, 2002; Walker & Salt, 2006). Adger (2000) and Paton and Johnston (2001) conclude that human communities have abilities to manage external stresses which impact on their infrastructure, such as environmental, social, economic and political forces. To adapt to these challenges, communities need to: (1) understand previous crises to help deal with uncertainty and learn from smaller incidents; (2) nurture diversity for reorganisation, renewal and innovation; (3) combine different types of knowledge and experience for learning and integrate scientific knowledge and traditional knowledge across multiple levels; and (4) provide opportunities for organisation, scale, governance and external factors required to achieve sustainability (Folke, Colding, & Berkes, 2003). Building successful community resilience means enhancing a community's ability to adapt to changes. Resilience is usually used together with adaptive capacity and it is occasionally noted as a consequence of vulnerability (Buckle, Marsh, & Smale, 2000).

Adaptation in cultural ecology means the process that individuals undergo as they change to meet the circumstances of human society. Adaptation of communities is not just an individual change, but it is the mixed and broader cultural group adjusting to live in the new environment or social system (Head, 2009). Meanwhile, Sexton et al. (2010) argue that adaptation is a successful strategy for people to respond to changes. They need to consider a holistic geographical area for adaptation because people may need to migrate to other areas. Armitage (2005, pp. 703-704) defines adaptive capacity as "a critical aspect of resource management that reflects learning and an ability to experiment and foster innovative solutions in complex social and ecological circumstances". Adaptive capacity strongly affects the vulnerability of communities and regions to hazards through active social, economic, technological, biophysical and political processes which cross time, area and group (Kates, 2000).

To adapt to impacts of coastal erosion, coastal communities may have various options for adapting to land loss. They can: protect their lands from the sea by constructing seawalls or by growing coastal vegetation; build their houses on piles; or grow salt tolerant crops. They might choose not to protect their lands from the sea particularly in extremely vulnerable areas (Bijlsma et al., 1996). The main community features involved in adaptive capacity could be "economic resources, technology, information and skills, infrastructure, institution and equity" (B. Smit & Pilifosova, 2001, p. 895). Coastal communities lacking physical, economic and institutional capacities will not have the adaptive capacity to deal with sea level change impacts (Luers & Moser, 2006). In practical terms, adaptation requires an understanding of previous experience with coastal erosion problems in order to respond to future events (Resilience Alliance, 2010).

Experiences in environmental hazards help understand threshold, frequency and tendency of changes to occur (Resilience Alliance, 2007). They have happened and impacted on the ecological and social-ecological systems for a long period of time so these systems have changed, resulting in increased complexity of changes and responses (Folke, 2006). Adaptive cycle as "a metaphor" is applied to portray changes of the system; how the social-ecological system is established and developed to cope with changes because it is similar to other systems which are dynamic and shift through four phases (Resilience Alliance, 2007). The four phases include exploitation, conservation, release and reorganisation (see Figure 1-3) (Holling & Gunderson, 2002, p. 34). The adaptive cycle normally proceeds through these four phases but it does not follow a fixed direction. All phases are able to change to other phases, the only exceptions occur at the release phase or the reorganisation phase to the conservation phase (Walker & Salt, 2006). A resilience system can repeat these four phases again and again (Berkes, Colding, & Folke, 2003).

The exploitation or rapid growth phase (r phase) occurs at an early stage in the cycle because the system is established with high growth rates by exploiting available resources. Compositions in the system are weakly connected and regulations in the system are weakly applied (Walker & Salt, 2006).

The conservation phase (K phase) is relevant to strong connections and regulations, increasing numbers of new actors, and improving the high efficiency in the system (Walker & Salt, 2006). The system accumulates and stores energy and materials with slow growth rates; thus high capacities for competition are generated so resources are separated and used. In social and economic systems, the system has a high potential for application of skills, connections with other organisations, and trust which accumulates and increases gradually while the system is changing from release phase to conservation phase (Holling & Gunderson, 2002).

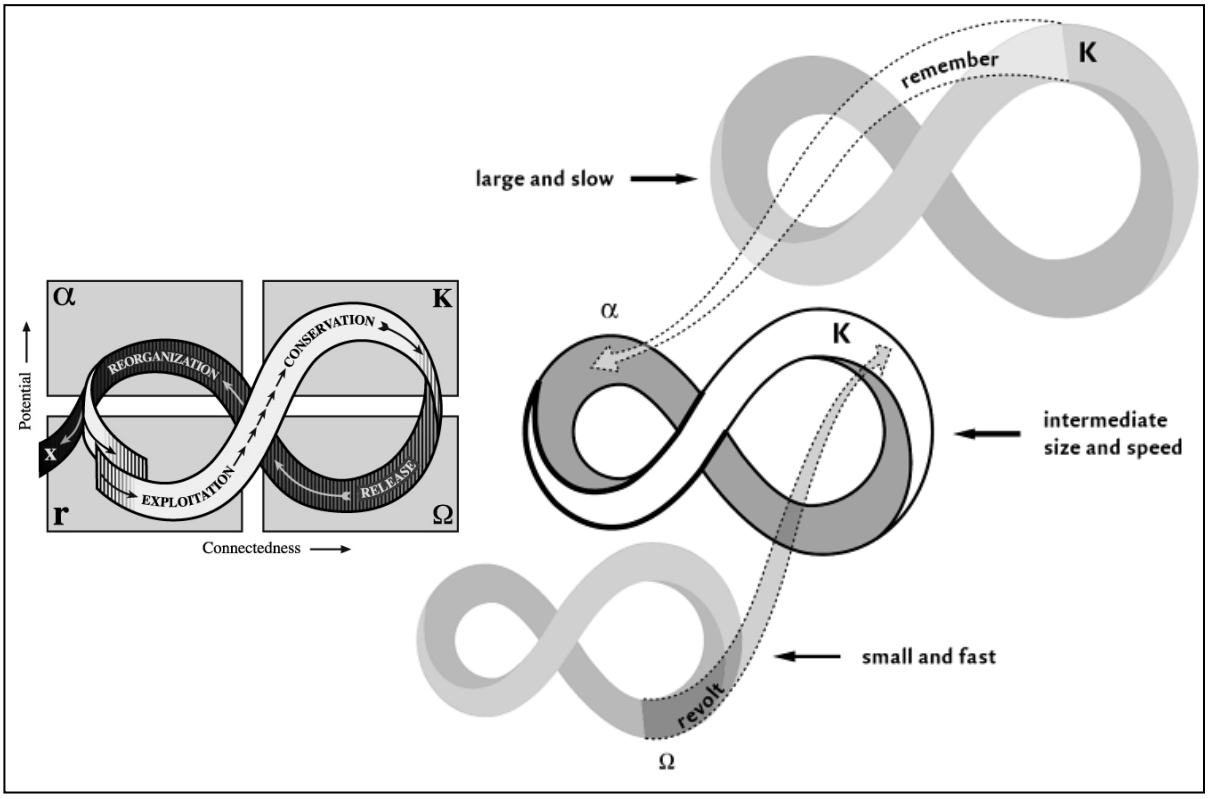


Figure 1-3. The heuristic model of multiple connections at different scales of an adaptive cycle
Source: Berkes et al. (2003, p. 18) and Holling and Gunderson (2002, p. 34)

The release phase (Ω phase) can happen very quickly. The system becomes vulnerable when there are disturbances of the social and ecological systems (Resilience Alliance, 2010). In the complete system, capital and resources leak out. Additionally, linkages are broken and regulation in the control system becomes weak (Walker & Salt, 2006). The system's potential weakens until resources in the system are reorganised to move to the last phase (Holling & Gunderson, 2002).

The reorganisation or final phase (α phase) means the system commences to restructure itself (Resilience Alliance, 2010) with new groups taking control of the system. Each sector which has high skills, experiences and knowledge in the system establishes a new group together with new opportunities. At the completion of the reorganisation phase and during the early period of the exploitation phase, compositions in the system are modified to new attractors and identities (Walker & Salt, 2006).

Social and ecological systems can be viewed through the four phases of the adaptive cycle, but surprise and change, which are uncertain and unpredictable, occur in human and natural systems (Holling, 2001). Surprises happen when the change caused has very different results than have been conceived (Holling, 2010). Changes can occur in the subsystem and the external system; they are triggered by surprise (Holling, 2001). After some unexpected characters of disturbance trigger changes, resources which have accumulated leak out and the connectedness of organisations is decreased (Holling, 2001). Holling maintains that disturbances occur in a system at multiple space and time scales with conditions of uncertainty (see also Resilience Alliance (2010)). A social system comprises a small part as a family to a large part as a country. When changes occur in a small part, the impacts can affect other larger parts (Wesley, Carpenter, Brock, Holling, & Gunderson, 2002). The larger parts may support resources for the smaller parts to address the impacts; thus the connections of adaptive cycles can be illustrated to help understand changes and the patterns to control changes (Resilience Alliance, 2007). A social system in a village is divided into 3 levels: household, group and village. The smallest entity is an individual household or family. The next level is a group of interest like those involved as a group making a dish-washing liquid, or a group of fishermen or a group of housewives. The largest part is a village with a leader.

The adaptive cycle happens in each hierarchical level; there are a minimum of three levels (Holling, 2001; Kirkby, Imeson, Bergkamp, & Cammeraat, 1996). A focal level associates with a particular place for a period of time involving the objective of research; a higher level accounts for broad and slow scales during which disturbances happen very slowly; and a lower level is related to rapid changes which have occurred on a small or sudden scale (Dorren & Imeson, 2005; Kirkby, et al., 1996). The relationships of the three selected levels from smaller and faster to large and slow and to larger and slower are necessary for ecosystems to create adaptive capacity to cope with changes (Holling, 2001). An example of the three levels of communities is individual household, village and district; for knowledge management, they are traditional knowledge, practice and worldview (Berkes, 1993); for a boreal forest, they are needles, tree crowns and plot of areas (Holling, 2001). A cycle in each level operates and controls by its own cycle, whereas a larger cycle may support a smaller cycle by helping the system function (Berkes, et al., 2003; Folke, 2006).

Multiple connections between phases at one level and phases at other levels happen in a set of adaptive cycles, the connections being labelled as revolt and remember (Holling, 2001). The revolt connection happens when the adaptive cycle in its alpha phase at the lower level collapses and influences the K phase in the higher level which is larger and slower to change. The K phase connects at a higher level because a lower level is more vulnerable and less resilient (Holling, 2001). When a lower level surprises an upper level, a crisis occurs at the higher level. In terms of the remember connection, memory is composed of long-term history and a high level of experience of the system. This higher level provides support to address problems at the

lower level (Folke, 2006). When changes occur in the lower level, the reorganisation phase of the cycle is facilitated by resources in the K phase at the higher level which has been gathered in a larger and slower cycle (Gunderson, 2008; Holling, 2001). Changes happen in cycles of a system and the system has opportunities to exercise resource management for renewal, resulting in improved learning and adaptive capabilities of the system (Berkes, et al., 2003; Gunderson, Holling, & Light, 1995). The long-term changes and responses reward communities for learning by experimenting to adapt and mitigate the impacts (Carpenter, Brock, & Ludwig, 2002).

Learning is an important part of the adaptation process; experiences in the past allow people to know how they can modify their practices to address hazards efficiently (Lavell et al., 2012). Environmental hazards occur in some particular areas and people who live in those areas must learn to live with these changes they bring (Berkes, et al., 2003). Pahl-Wostl (2009) suggests that learning refers to an exploratory and stepwise process by applying innovation to understand constraints and frames of an experiment. Diduck (2010) attempts to distinguish learning into five levels: individual, action group, organisation, network and society. Learning can occur at the individual level and individual learning means the results of the observation and the experience alters beliefs and improves beliefs, skills, knowledge and procedures (Diduck, 2010; Levy, 1994). Additionally, the model of the learning process is depicted to help understand the patterns of community learning which address natural hazards by creating a set of understanding to integrate actions and resource allocation (Wesley, et al., 2002). Learning can happen in a three loop process: single-loop learning, double-loop learning and triple-loop learning as shown in Figure 1-4 (Hargrove, 2008; Lavell, et al., 2012; Pahl-Wostl, 2009).

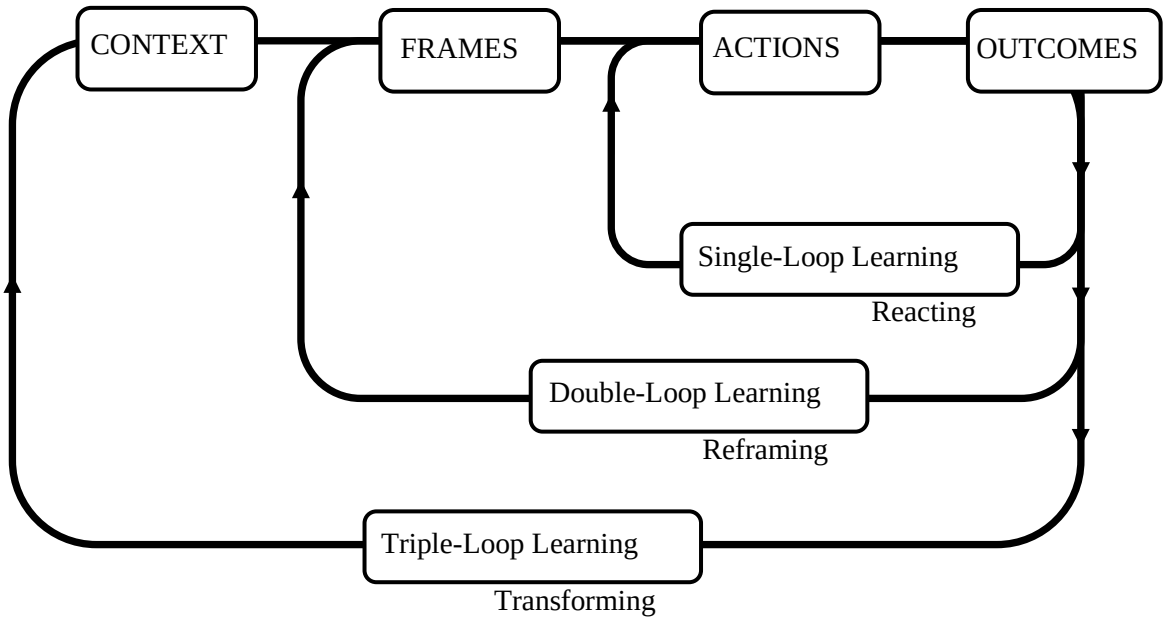


Figure 1-4. Conceptual models of learning processes
Sources: Lavell et al. (2012); Hargrove (2008); Pahl-Wostl (2009)

In a single-loop learning process, people understand hazards in their areas based on their observations. They can initiate techniques and strategies to tackle changes by integrating skills and memories of a particular environment. In addition, they assume that their strategies achieve their objectives (Lavell, et al., 2012). In a double-loop learning process, people assess the achievement of the strategies by considering target and result relationships within a normative frame (Pahl-Wostl, 2009). Lavell et al. (2012) assert that when people find the strategies are achieved, they promote the successful strategies to others, relating how the strategies are correctly created, improved and applied.

In a triple-loop learning process, the structure and the components are transformed by paradigmatic change. In transitional processes, new groups form networks to play key roles; power relationships are altered; and new rules are promoted (Pahl-Wostl, 2009). Yohe and Tol (2002) suggest that double- and triple-loop learning processes are appropriately related to coping with a range of new changes and adaptation processes. People take periods of time in learning processes because it is needed in order to understand and improve knowledge under conditions of environmental hazards (O'Brien, et al., 2012). Environmental hazards have different risks and impacts so local people have different methods and resources to address them (S. L. Cutter, et al., 2003).

Learning processes are explained to show how people learn to understand natural hazards (which include disasters and risks) and initiate strategies to respond appropriately to natural hazard impacts. Learning processes are relevant as an approach to disaster risk assessment and management.

In terms of severe coastal erosion impacts, local people lose their property (McLean & Tsyban, 2001). Their land is not protected from the retreat (Bijlsma, et al., 1996) so those people have to relocate to live in safe areas or to look for new work with a higher income. Migration is a mechanism of rural households to evacuate from disasters or to live in areas where residents can gain higher income (O'Brien, et al., 2012). The International Organization for Migration (2007, pp. 1-2) identifies environmental migrants as those people or groups of people who are affected by environmental changes on their lives or livelihoods and need to migrate temporarily or permanently within or outside countries. O'Brien, supported by Piguet (2008), says that when climate change impacts take place in developing communities, most migration occurs within individual countries because the victims' intention is to return to restructure their houses after extreme events.

Climate change impacts have a high potential to drive migration from original communities where people otherwise would not want to relocate (Adger, et al., 2007; Mendelsohn, Basist, Kurukulasuriya, & Dinar, 2007). Forced mobility has a significant effect on local people. Hwang et al. (2010) studied groups of people who were forced to live in an unfamiliar area

because the largest dam in China would be constructed, stating that forced migration created depression and other mental disorders for those migrants. This is because people are forced from their home lands to live in an unfamiliar environment thereby leading to loss of material and cultural resources (Cardona et al., 2012; Low & Altman, 1992).

People in local communities do not want to move to live in another area because they have strong relationships with their neighbourhood (Adger, et al., 2007) and good historical family connections (Sanders, Bowie, & Bowie, 2003). For example, people who were forced to migrate after Hurricanes Katrina and Andrew expressed their desire to return to their homes when those dwellings were finished being repaired (Levine, Esnard, & Sapat, 2007; Sanders, et al., 2003). Feldman (1990) explains that people create psychological ties with their previous home places and environments. In some cases, residents decide to relocate to live in safe areas voluntarily because they may have children (Levine, et al., 2007). Kolmannskog (2008) claims that people make a decision to evacuate to live in another area by first considering their re-exposure to the impacts of natural hazards; and also the vulnerability and resilience of local people and their ability to adapt. Bardsley and Hugo (2010) argue that migration is applied when people are not able to adapt to impacts of environmental change. McLeman and Smit (2006) conclude that when households are vulnerable to impacts of natural hazards, they "adapt" by evacuation, if their communities cannot deal with the hazard.

Cernea (1996) studied involuntary population displacement from infrastructure development such as dam and road construction and how impoverishment relates to relocation. Cernea suggested that migration creates eight main impacts: (1) Landlessness occurs when people migrating to live in areas where they have less land holding than before relocation, move to live with less infrastructure and have insufficient land for farming resulting in decreasing household income. (2) Joblessness refers to losing jobs from relocation such as losing the ways to access to their land and opportunities to develop their work. (3) Homelessness for general migrants is temporary but loss of houses for the homeless creates chronic homelessness. People who are forced to move and do not provide new houses or sufficient compensation for rebuilding houses tend to be at risk of homelessness. (4) Marginalisation occurs when households cannot meet their income resulting in losing economic power; middle farm household income becomes small farm household income. (5) Increased morbidity and mortality occurs when residents are forced to migrate. The residents are exposed to severe illness from social and psychological stresses, vector-borne diseases and poor hygiene of water supply. (6) Food insecurity is related to increasing the risk of insufficient food intake and undernourishment. (7) Loss of access to common property occurs with poor people who cannot access non-individual property in their communities resulting in decreasing income and quality of life. (8) Social disintegration occurs when people move to live in scattered areas. This affects relationships among kinships, local labour and local cultural identity.

1.6 Studies about building community capacity

Over the last 18 years, the term "building community capacity" has been introduced (Noya & Clarence, 2009). Studies about building community capacity have been applied to investigation of the ways to solve environmental health problems (Adebowale & Bhullar, 2009; Noya & Clarence, 2009; Parker, Eng, Schulz, & Israel, 1999), and to examining relevant dimensions in the area of health issues (Freudenberg (2004), Gibbon et al. (2002), Jackson et al. (2003), Lempa et al. (2008), Smith et al. (2003)). Goodman et al. (1998, p. 259) suggest two definitions of community capacity: "(1) the characteristics of communities that affect their ability to identify, mobilize and address social and public health problems; and (2) the cultivation and use of transferable knowledge, skills, systems and resources that affect community- and individual-level changes consistent with public health-related goals and objectives." Freudenberg (2004) argues that the first definition of community capacity described by Goodman et al. looks like an outcome of community capacity and is used to measure and compare capacity between communities. The second meaning Mileti (1999) refers to the processes to build community capacity and the guidelines for intervention to increase capacity. In addition, the dimensions of building community capacity were not examined empirically.

Since then some researchers have studied building community capacity to address social environmental issues. Adebowale and Bhullar (2009) identified eight dimensions of "environmental capacity building" such as shared concerns, community identity, participation, inclusion, leadership, access to accessible information and rights, skills and resources (financial, human and social) and political influence. The study aimed to establish the dimensions of environmental justice and sustainable development rather than community capacity building for addressing environmental hazards. These dimensions were identified by considering a few case studies in developed countries in Europe, the United States and Australia.

Meanwhile, Bowen et al. (2000) applied community capacity concepts to strengthen families so they have well-being and good relationships with neighbourhoods. In addressing the issue of family violence it was suggested that community capacity was possibly created and tested in circumstances of encountering other environmental events. They believed that community capacity was built from the accumulated experiences of local residents to respond to natural hazards, and the cumulative responses by groups were more effective than those by individuals. Norris et al. (2008, p. 136) proposed that "community capacities become adaptive capacities when they are robust, redundant, or rapidly accessible and thus able to offset a new stressor, danger, or surprise." Major findings about elements of community capacity building are described in the context of the capacity of the community to cope with environmental changes.

From a literature review of community capacity, two items of literature focused on an assessment of community capacity in Thailand. Building community capacity for locally

managed ecotourism in Northern Thailand was studied by Laverack and Thangphet (2007) and PLAN Thailand: Community assessment was researched by Chantarasombat (2009).

The former reported that two tourism communities in the Northern region of Thailand evaluated levels of community capacity by considering nine dimensions and formulated a strategic plan in order to cope with the weaknesses. These dimensions were taken from the literature as "participation, leadership, organisational structures, resource mobilisation, external linkages, problem assessment, project management, critical assessment and outside agent" (Laverack & Thangphet, 2007, pp. 176-177).

The latter explained that PLAN International Development Agency supported programmes to improve health, education and source of income for children in order to improve quality of life for children in rural areas in Thailand. The study was conducted in 12 communities supported by PLAN project to assess the community capacity, develop a strategic plan and support community self-reliance. Community capacity was evaluated by considering 11 dimensions: "participation, leadership, organisational structure, problem assessment, resource mobilisation, critical assessment, networks, roles of external agencies, program management, assertiveness and advocacy" (Chantarasombat, 2009, p. 443).

Verity (2007) analysed components of community capacity from other studies such as Bush, Dower and Mutch (2002), Labonte and Laverack (2001) and Goodman et al. (1998). Verity concluded about the composition of common component of community capacity was composed of: community was relevant to power, history, profile, conflicts, leadership and participation; institutional referred to policy to support communities, resource allocation and facility investment; linking meant formal and informal networks and collaboration; knowledge related to critical thinking abilities, understanding of community needs and awareness of power; skills and abilities were involved with leadership skills, problem solving and conflict management; and resource mobilisation was social infrastructure, funding and property.

Regarding the capacity of communities to respond to coastal erosion, much research has studied causes of flooding, erosion and sea level change and effects on coastal areas and economy along the Gulf of Thailand (Engkagul, 1993; Ohno, 2001; Saito, 2001; Vongvisessomjai, 2006b). Only one study (Jarungrattanapong & Manasboonphempool, 2008) has been conducted to seek the adaptive strategies of households for coastal erosion and flooding. The study showed that when coastal households were exposed to inundation from rising sea levels, people had attempted to apply various types of adaptation to mitigate impacts by themselves. While some households built breakwaters or bamboo revetments to protect their lands, others built aquaculture ponds and houses on piles and rebuilt their houses to mitigate impacts of flooding and erosion.

1.7 Rationale

The above studies illustrate the technical approaches that are used by local households to adapt to coastal erosion and flooding, where their own knowledge and resources are employed. Households have different characteristics and abilities to respond to the impacts, dependent on age, gender, knowledge and economic status (Gaillard, Maceda, Stasiak, Berre, & Espaldon, 2009; Tanner & Mitchell, 2008). Responses by individuals to coastal erosion and other natural changes are hindered by regulations and rules of organisations, property rights, poor capacities and difficulty of assessing resources (Adger, Arnell, & Tompkins, 2005).

For communities, coastal erosion and other natural hazards directly affect them, and they learn and store knowledge to respond to those impacts thereby resulting in an improvement from experience (H. C. P. Brown, 2009; E. L. Tompkins & Adger, 2004; Walker et al., 2006). In addition, communities can create capacities to adapt to changes by exercising collective action, since they have frameworks to address problems (Adger, et al., 2005). Communities have different approaches, stakeholders, social factors, and adaptation opportunities to cope with changes. Above all, their approaches are local first. If communities cannot address those natural hazards properly due to limited resources, they can apply for assistance from other organisations at higher hierarchical levels such as district, province and national levels to manage the hazards (S. L. Cutter, et al., 2012; Matthews & Sydneysmith, 2010). Therefore, the focus of this study is at the community level: to investigate the factors that influence the capacity of communities to deal with coastal erosion.

In this study, the researcher investigated 'when', 'how' and 'why' local people responded to the problems of coastal erosion in the first place. The capacity of the community depends on the ability of individuals, groups and organisations, and local governments to learn from change, uncertainty and crisis by altering their behaviours and environments to manage and control hazards (Folke, et al., 2003; Ford & Smit, 2004). This investigation is based on residents' experiences of impacts and responses to coastal erosion.

1.8 Research questions

Two questions are investigated in this thesis.

How do environmental hazards like coastal erosion and experiences of them influence community capacity?

Are a community's socio-economic characteristics, when combined with influential factors described in the literature, sufficient to explain the capacity of that community to respond to an environmental hazard like coastal erosion?

1.9 Specific aim

The study sought to understand socio-economic and environmental characteristics of communities impacted by coastal erosion and how the communities responded to those impacts through human knowledge, experiences and resources.

The study aimed first to derive a set of common factors drawn from the literature, which were deemed to be important for community capacity.

The aim was then to apply these factors to the context of local experiences of coastal erosion, the socio-economic characteristics of communities, and community capacity building.

Finally, the study aimed to analyse these factors, to prioritise them and to understand which were the most significant to the community for dealing with coastal erosion impacts. In doing so the study sought to make recommendations for successful management interventions that could support the building of community capacity.

1.10 Hypothesis

If the researcher compares community capacity from the literature for villagers when the physical geography, culture and political organisations are essentially the same, but the hazards (in this case coastal erosion) are markedly different, then the researcher will be able to see clearly the effect of the hazards on the critical components of community capacity and expose where and how to intervene the system.

1.11 Terms and definitions

Some critical terms often applied in this study are explained here.

Matthews and Sydneysmith (2010) and Walker and Salt (2006) suggest that ‘adapt’ is broadly defined as responses to change. Adger et al. (2010) define ‘adapt’ as action which is appropriate to reduce vulnerability of communities in the future. A few studies state that ‘adapt’ refers to the adjustment required in responding to actual and expected impacts in social and environmental systems (Lin & Chang, 2013; B. Smit, Burton, Klein, & Wandel, 2000). Adger et al. (2005) state that ‘adapt’ relates to building ability of individuals, families and groups to address changes and making decisions to respond to changes by transforming capacity into action. In this study, ‘adapt’ is used to mean the adjustment made by residents, groups and communities to respond to impacts by applying their skills, knowledge and resources.

In terms of ‘mitigate’, Adejuwon et al. (2001) and Anderson-Berry and King (2005) define it to avoid more severe future damage. Cutter and Emrich (2006) argue that ‘mitigate’ refers to decreasing vulnerability and increasing resilience of community. Anderson-Berry and King (2005) contend that ‘mitigate’ is lessening impacts through improving knowledge, awareness and preparedness including changing people’s behaviour. Therefore, ‘mitigate’ in this study will

be used to refer to addressing impacts to avoid severe damage through improving education, awareness and preparedness.

Rosenzweig and Casassa (2007) describe that 'respond' means to react to a change in the environment and is dependent on time, location, method, livelihood and cultural identity of a community or individual. Few and Tran (2010) define 'respond' as coping with threats when people perceive they are exposed to hazards. Drawing from these definitions, 'respond', in this study will be used to refer to the reaction of individuals, groups and communities (in the specific context of threats when they perceive that they are exposed to hazards).

Environmental hazard, as pointed out by Ewing et al. (2010), means a biophysical matter which seldom occurs but leads to property and resources loss. Marfai et al. (2008) argue that environmental hazard is an event threatening the environment and capable of damaging it. Rosenzweig and Casassa (2007) state that environmental hazard refers to the potential causes of property destruction where the hazard changes in frequency, geography and severity of occurrence. In this light, environmental hazard is used in this study to refer to the rare potential biophysical events that result in damage to property and loss of resources.

This use of environmental hazard embraces other types of hazard described in the literature. Marfai et al. (2008, p. 335) state that natural hazards "are threatening events capable of producing damage to the environment". For Me´heux et al. (2007), natural hazards are where natural events become hazards when the events threaten local residents with their impacts negatively. Boruff et al. (2005) describe coastal hazards as the potential for hazards from natural events to occur along a coastal area.

1.12 Overview of the thesis

This thesis is composed of seven chapters. In chapter 2, a method to select the study areas is explained including research design and mixed methods research applied to investigate the results of responses to research questions. In chapter 3, an overview of physical characteristics of the study areas is given describing areas which are experiencing different rates of coastal erosion. In addition, socio-demographic information of villagers who responded to the questionnaire are detailed and compared with the census data related to the study area.

In chapter 4, experiences of impacts and responses to coastal erosion of villagers in the low and the high erosion areas are analysed and compared, and the ways in which villagers explained the advantages and disadvantages of structures to prevent coastal erosion are examined. In chapter 5, responses of villagers to the questionnaire regarding community capacity are described, analysed and compared to investigate the differences between communities exposed to low and high erosion areas. The significant and non-significant differences of responses in each variable are supported by applying information from the semi-structured interviews. In chapter 6, significant variables are investigated to find the influential factors which build community

capacity to respond to coastal erosion by applying factor analysis. In chapter 7, a synthesis is provided by drawing on community history, adaptive cycle models, patterns of migration and a positive feedback loop of coastal erosion. Additionally, the influential factors to build community capacity to respond to environmental hazards are concluded and recommended for other communities and relevant authorities.

Chapter 2: Methodology

This chapter explains the research methods which are based on the research questions and the specific aims mentioned in Chapter one. It is divided into three sections: research design, data collection, and data analysis. Research design is the way in which the research is planned to answer research questions at different stages by describing the processes of the study and reasons for specific approaches (Frankfort-Nachmias & Nachmias, 1999; Kumar, 2005). The data collection section explains the methods used to recruit villagers and conduct the research. The data analysis section outlines the data processing and statistical analysis techniques for quantitative and qualitative data collected to answer the research questions.

2.1 Research design

Two major phases of research were implemented (see Figure 2-1). In the first phase, a survey questionnaire was designed to investigate the demographic characteristics of a range of villagers, their attitudes on building community capacity and the perceptions they held about coastal erosion. The survey questionnaire is a widely used technique to examine attitudes of respondents (Wilkinson & Birmingham, 2003).

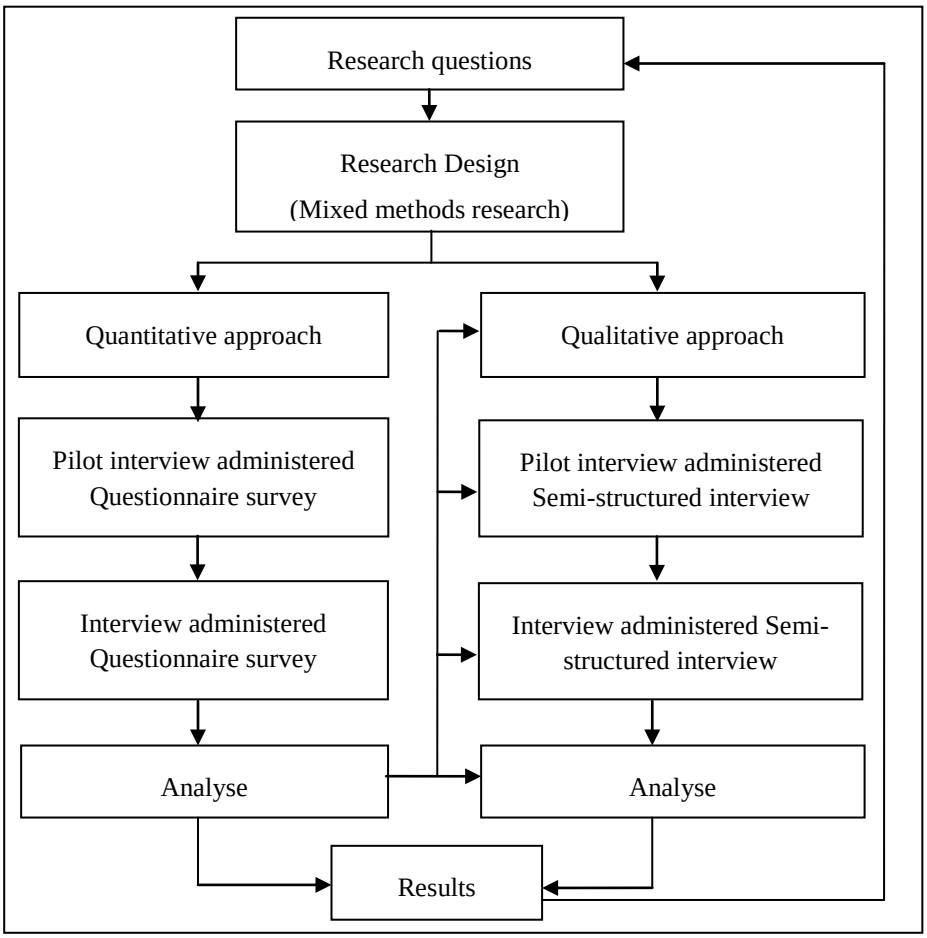


Figure 2-1. Mixed methods research design

In the second phase, a qualitative approach was used to obtain unknown information that could not be derived by a formulaic survey in building community capacity, and the community's experiences of coastal erosion and coastal protection by exploring the views of villagers through semi-structured interviews. These were used to frame questions about villagers' experiences, lives and viewpoints (Morse & Richards, 2002).

The mixed methods research approach can support a greater depth of understanding of the research question by merging qualitative and quantitative methods at various stages. In addition, this research method is commonly employed in the social sciences. The mixed methods design utilises the different strengths of quantitative research which has larger sample sizes, predictions and generalisations, and qualitative research which has small sample sizes but provides more detailed understanding of villagers' perceptions (Creswell & Clark, 2007; Teddlie & Tashakkori, 2009).

2.2 Selection of study area

The study areas were selected from subdistricts affected by erosion in the upper Gulf of Thailand. The Department of Marine Coastal Resource (DMCR) in Thailand (2009) released a master plan on coastal erosion management for the upper Gulf of Thailand, detailing the degree of coastal erosion. Coastal subdistricts in five provinces were reported to have suffered various degrees of erosion. The DMCR illustrated the rate of coastal erosion in each subdistrict in the upper Gulf of Thailand by utilising aerial photographs and satellite images over a period of 54 years between 1952 and 2006 (see Appendix 2-1). Most subdistricts lost their areas with different rates between 0.5 and 11 metre a year. Areas to be targeted in this study were selected from the DMCR (2009) report, based on degrees of erosion.

The study aimed to select two study areas: a low and a high coastal erosion areas to compare two population means. Peck and Devore (2008) pointed out that two population using independent samples could be applied to examine the differences of those population means or hypothesis. Buckingham and Saunders (2004), building upon Durkheim's (1982) study stated that a comparative method in a social science scholar could be applied to test the differences in social variables between the two groups before explaining the differing variables. Those results needed to be described to understand why similar or different societies, in terms of human beliefs, ideas and behaviours, arise (Roscoe, 2008). In this study, some physical and social characteristics of coastal communities of the low and the high erosion areas were compared to understand the differences of physical geography changes, socio-demographic information of coastal residents, responses to coastal erosion impacts and factors to build community capacity.

Changes to the physical geography were relevant to the environmental history of communities by comparing between the past and the current environment within the erosion areas to understand impacts that have occurred in each area so that comparison between the areas could

be made. Socio-demographic characteristics of coastal residents between the two erosion areas were compared to test the differences because different socio-demographic characteristics might affect different abilities to apply effective methods for preventing coastal erosion. People with high resources and socioeconomic status could prepare to respond to environmental hazards better than others (Brooks & Adger, 2004; Spence, et al., 2007). In terms of community capacity building, residents in the low and the high erosion areas were assessed according to the degrees of factors to build community capacity to compare and analyse their different community capacity which affected abilities to respond to coastal erosion.

The criteria used to select the low degree of erosion were a coastline which had been continuously exposed to erosion, but only to less than 5 metres a year (Jarupongsakul, 1999). Only villages located close to a coastline in the selected sub-districts were chosen to be study areas. In addition, the low erosion area was chosen to be located well away from high erosion areas because the presence of coastal protection projects in high erosion areas might influence the selected subdistrict or vice versa.

In the upper Gulf of Thailand, 12 out of 18 coastal subdistricts had areas which suffered erosion between 1952 and 2006. For most coastal subdistricts, the erosion was less than 5 metres a year, but three subdistricts had significantly higher erosion rates of around 10 metre a year (see Figure 2-2).

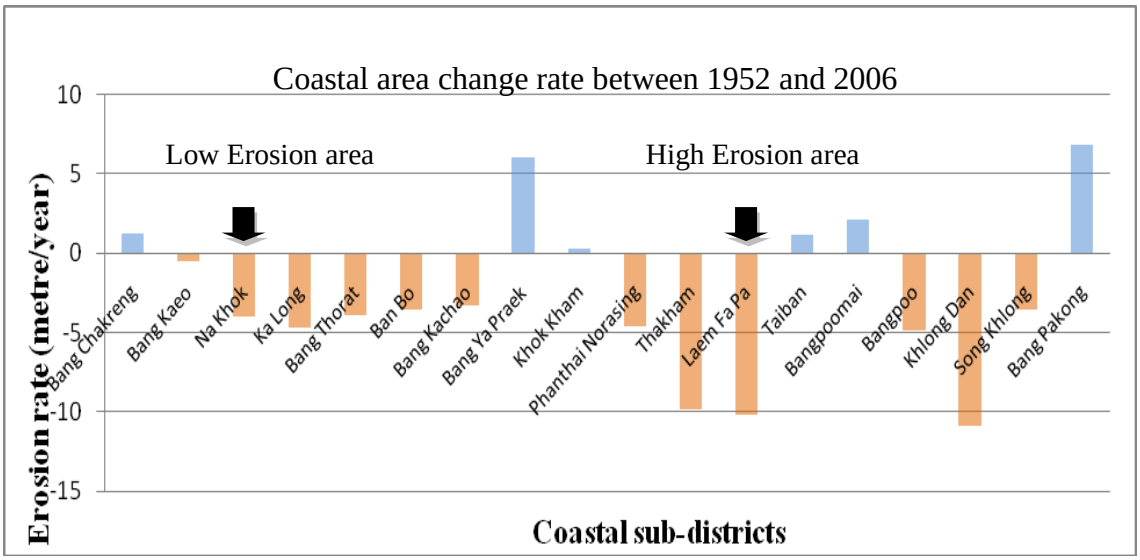


Figure 2-2. Coastal area changes in each subdistrict based on coastline in 1952

Note: Minus values indicate the coastal erosion

Source: Applied from Department of Marine and Coastal Resources, Thailand (2009)

A purposive sampling technique was applied to select the study areas. Nakhok subdistrict in Samut Sakorn province met the criteria and was selected to be the low erosion area (LEA) for the study. To be selected as a subdistrict with a high degree of coastal erosion, the research required an erosion rate of more than 5 metres a year which had severe impacts on residents or properties. Laem Fa Pa subdistrict met these criteria; it was selected as the high erosion area (HEA) for the study.

Under the administrative structure of Thailand, a subdistrict is composed of several or many villages. In a coastal subdistrict, some villages are located at the coastline, but others are not. Only villages located at a coastline in the subdistricts were selected to be the study areas. In terms of village number, the villages are numbered by local authorities and approved by local laws. Villagers in local authorities made plans and decisions to divide villages within their local authorities themselves.

In the low erosion area, Nakhok subdistrict is composed of six villages but only two villages are located at the coastline such as village 4 and 5. In the high erosion area, Laem Fa Pa subdistrict is comprised of 13 villages, but only four villages are located close to the coastline such as villages 8, 9, 10 and 11.

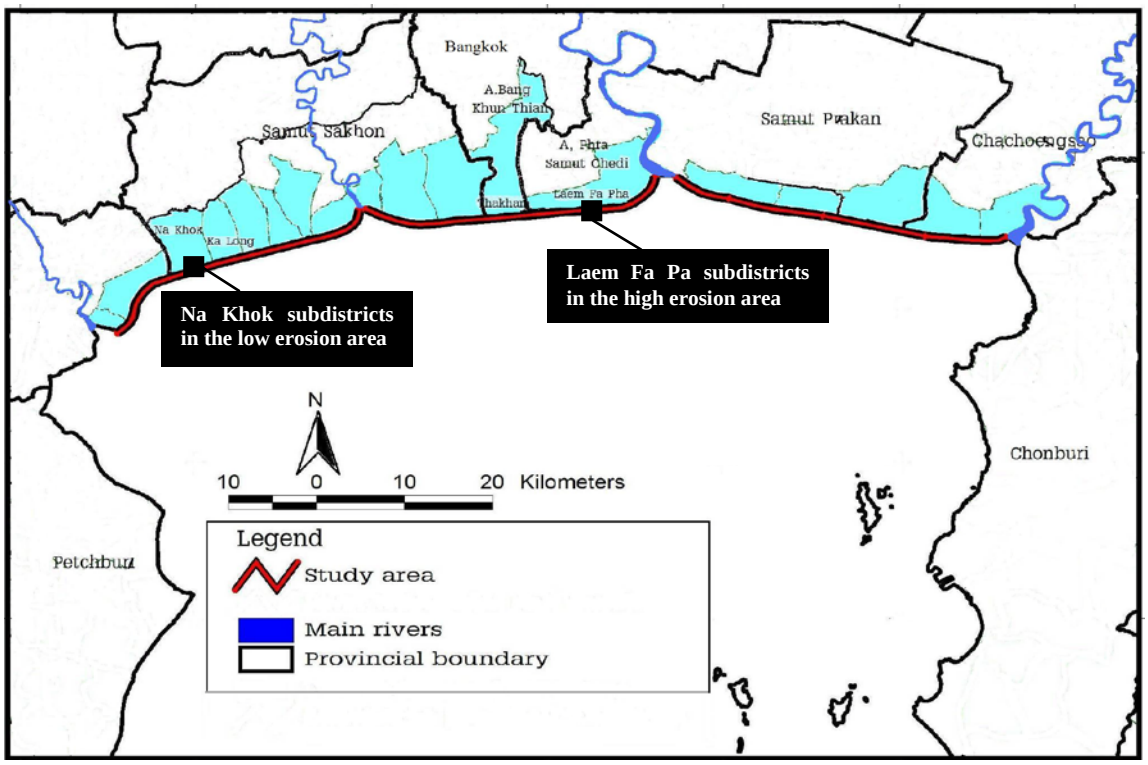


Figure 2-3. The low and the high erosion areas in the upper Gulf of Thailand
Source: Department of Marine and Coastal Resources, Thailand (2009).

2.3 Study population

After the coastal villages in the low and the high erosion areas were selected numerous households in those study areas were investigated from each local government simultaneously. The total number of registered households from the six selected villages was 677 and there were 156 and 521 houses in the low and the high erosion areas respectively (see Table 2-1). However, the number of occupied houses differed from these registered ones - in the case of the low erosion area either more or less, in the case of the high erosion area there were always less occupied homes (households) than registered houses (Table 2-1). This study concerned itself with occupied houses as a measure of "households".

Table 2-1: Number of households in low and high erosion areas informed by local governments

Coastal erosion area	Number of	
	Registered houses	**Occupied houses**
Low erosion area	**156**	**151***
Nakhok Local Authority		
Village 4	73[1]	60[3]
Village 5	83[1]	91[3]
High erosion area	**521**	**208**
Laem Fa Pa Local Authority		
Village 8	165[2]	20[3]
Village 9	166[2]	95[3]
Village 10	69[2]	11[3]
Village 11	121[2]	82[3]
Total	**677**	**359**

[1] Primary data from Nakhok Local Government Administration Office

[2] Primary data from Laem Fa Pa Local Government Administration Office

[3] Primary data from heads of villages

* A further 86 households in village 7 within Nakhok subdistrict were added to balance the number of households sampled.

Prior to the major study, a pilot study was undertaken to evaluate the effectiveness of the methodology. The coastal villages for the pilot study were the villages adjacent to the low and the high erosion areas. The adjacent village selected in the low erosion area was Kalong subdistrict because it was located close to Nakhok subdistrict and had experienced erosion of between 1 and 5 metres a year, similar to Nakhok subdistrict. The chosen adjacent village in the high erosion area was Bang Khun Tian subdistrict near Laem Fa Pa subdistrict; it had experienced impacts of coastal erosion greater than 5 metres a year.

After the pilot study was conducted in Kalong and Bang Khun Tian subdistricts, the researcher went to the six villages in the study area to be introduced to heads of villages and explain the purpose of the research. The researcher found that the number of households with residents living in existing houses was much lower than expected particularly in the high erosion area (see Table 2-1). Many houses in the high erosion area had been damaged by coastal erosion so the house

owners had moved further away from the coastline. Most of them did not inform the local governments of these decisions. The number of households actually living in each village was provided by the village heads.

Although the number of households in the high erosion area had decreased, more houses were occupied than in the low erosion area. The researcher wanted to increase the number of households in the low erosion area to keep a balanced sample size between the areas to enable appropriate comparison of factors between the erosion areas. Village 7 in Nakhok subdistrict was considered to be in the low erosion area category. Creswell and Clark (2007) explained that increased sample size strengthened the power of the statistical analyses. For example, if the study was planned to apply factor analysis, the suitable number of samples should be increased to at least 300 villagers to reduce the significant level of loading on factors (J. E. Bartlett, Kotrlik, & Higgins, 2001, p. 7; Tabachnick & Fidell, 1996, p. 613). In addition, the larger sample size resulted in better characterisation of the population (Kumar, 2005; Walliman, 2006).

To increase the size of the sample, 86 households in Village 7 were included in the low erosion area. The total number of available households across both areas was 445, 237 households being in the low erosion area and 208 in the high erosion area. A sample size calculation was performed based on Krejcie and Morgan's (1970) Table at a 95% confidence level; the required sample size was a minimum of 423 villagers across both areas.

2.3.1 Recruitment

Recruitment for the questionnaire survey

The intention was to administer the questionnaire face-to-face to every household in the two study areas. Some villages were large and had many residences. Before conducting the questionnaire, maps of each village were downloaded and printed. Areas in the villages were clustered to help the researcher recognise geographical characteristics and locations of houses. Attractive places in the villages such as temples, schools and shrines were also highlighted. This approach was applied to help ensure that every house was door-knocked and responded to the questionnaire. Clustering of the physical characteristics was considered in each village such as roads, canals and shrimp farms. From one to four clusters were used depending on the distribution of houses in these villages.

Generally, the villagers in the sample were heads of households. If heads of households were at homes, they were invited to complete the questionnaire. If persons met at homes were not the heads of households, they were asked about their relationship with the head of household and subsequently recruited if they were a spouse or parents living in the same house. Villagers over 20 years old could be recruited on behalf of the household because they had sufficient knowledge and experience in the community.

However, if the head of household was not available, the spouse or relative who lived in the same house was questioned. When a resident was not home, the home would be revisited until someone answered and was asked whether they would answer the questionnaire. If no residents were met or the door was always locked, the presence of someone at that house would be rechecked by consulting the head of the village. A total 358 resident were recruited for the questionnaire survey.

Recruitment for the semi-structured interview

Before finishing the questionnaire interview, all residents were asked to volunteer to provide in-depth information by consenting to a semi-structured interview termed key informants. If residents volunteered, they provided their information to facilitate future contact. This information about such volunteers was separated from the sets of questionnaires and kept in a locked filing cabinet. Additional recruits were targeted to provide a breadth of understanding of communities and responses to coastal erosion. The roles and duties of each key informant were investigated, the criteria for selection their being utilised in coastal erosion management or building the capacity of a community for at least 3 years.

Villagers who volunteered to respond to the in-depth interviews were termed key informants, the intention being to recruit 35 of them. They were recruited from two groups; 21 key informants living in villages and 14 from outside of the villages. Key informants in villages were heads of villages and villagers themselves. Seven heads of villages directly involved in building the capacity of communities and understanding community history were selected. Two monks, one from each of the low and the high erosion areas, were selected by purposive sampling as leaders in communities. Key informants from outside villages were selected based on their roles and duties about coastal management or community development.

The key informants volunteering were chosen by stratified sampling into male and female to give gender balance in each village before random sampling was applied in each subgroup. Each volunteer from each gender group was given a number from one to the final number in the gender group. The researcher applied a table of random digits from the research method manual to finalise the sample (Frankfort-Nachmias & Nachmias, 1999). By these processes, a proportionate number of key informants based on gender characteristics corresponded to the samples (Creswell & Clark, 2007).

When a large number of volunteers had agreed to be key informants, one male and one female were randomly selected from each village to represent the entire number of residents. Consequently, two key informants were selected in each of village 4 and 5 of Nakhok subdistrict, in village 7 of Kalong subdistrict and in village 9 and 11 of Laem Fa Pa subdistrict. In addition, in villages 8 and 10 of Laem Fa Pa subdistrict, there were fewer volunteers so that a key informant was chosen from each village by simple random sampling - a male from village 8 and a female from village 10.

Key informants from outside of the villages, scientists, non-government organisations (NGOs) and officials from local, provincial, regional and national levels were also targeted to participate in in-depth interviews. This occurred because the researcher understood the purposes of the study, knew functional characteristics of the key informants, and judged them capable of providing useful information for the study (Punch, 1998; Tranter, 2006). After the key informants were identified, they were interviewed to provide information about activities, responsibilities and plans relevant to their roles and organisational activities in response to coastal erosion and community capacity building.

An NGO leader was involved in building networks among coastal villages in the upper Gulf of Thailand and another collaborated with coastal villages to protect coastal resources and prevent coastal erosion. The scientists conducting research in the study area were invited to provide information about building the capacity of the community and coastal protection operations in the study area. The scientists transferred knowledge about coastal protection and data collection for basic research to help residents manage their communities. Local, provincial, regional and national officials promoted and formulated strategic directions to improve the capacity of communities and/or to protect coastal areas.

Before conducting a semi-structured interview with each resident, the researcher went to volunteers' houses or places of work to invite them to be key informants by giving invitation letters and information sheets. When they agreed, they made an appointment for an interview with the researcher. The key informants living in the villages allowed the researcher to conduct interviews at their houses. The NGO staff and officials preferred to be interviewed in their offices. Before starting the interviews, consent forms were signed and the interviews were recorded. This study received ethics approval from the Edith Cowan University Human Research Ethics Committee. Data collection was conducted by considering adequate information provided by the villagers who had the right to decline participation, withdraw involvement, and refuse any questions. All data and findings from residents were kept in conditions of anonymity and confidentiality. A total of 35 key informants were recruited.

2.4 Development of Instruments to be used in this study.

2.4.1 Questionnaire

Punch (1998, pp. 95-97) considers that an appropriate questionnaire is an efficient instrument to investigate diverse variables and information such as demographics, attitudes, opinions and behaviours. It is not necessary to construct a questionnaire, if an existing questionnaire can achieve good measurement of or provide data in response to research questions. However, if existing questionnaires are not appropriate to measure variables, a new instrument can be developed. In this study, a questionnaire was constructed by adapting questions from other

studies where some validation had taken place, and including new questions to obtain appropriate data.

Constructing the questionnaire

The questionnaire was constructed and divided into four sections; demographic and socio-economic information, attitudes about community capacity, perception of coastal erosion, and open-ended questions (see Appendix 2-2). The demographic and socio-economic section was designed to obtain such background information of residents as gender, age, time of residency, living arrangements, income, occupation, house and land ownership and distance from their home to a coastline. Answers to these questions can be analysed to identify characteristics of residents that may explain the relationship between groups of residents' attitudes, opinions, behaviours and knowledge (Frankfort-Nachmias & Nachmias, 1999).

In the community capacity building section, the questions were framed so as to seek residents' attitudes about close relationship and trust, participation, relationships, leadership, sense of community, skills, knowledge, resources and infrastructure in their villages. Thirty-one statements to measure attitudes were adapted from the questionnaire formerly implemented by Zwicker and Marlin (2009). Residents were asked to rate their response by using a rating scale with 6 degrees such as strongly agree, agree, neutral, disagree, strongly disagree and do not know. The card with 6 rating scales was prepared for each of the residents. When asked questions, residents replied by pointing at the levels of agree, disagree or others on the card which related to their opinions. 'Neutral' was the middle option which attracted residents who were not sure whether to choose options of agree or disagree. 'Do not know' was provided for residents when they could not find any possible alternatives (Schuman & Presser, 1981).

Another 11 statements to test residents' opinions on particular activities in the community were adapted from Bullen's study (2004). Questions 41 to 51 asked residents to indicate their experiences as 'yes', 'no' and 'do not know'.

The questions for examining villagers' perceptions of coastal erosion were adapted from Rickard (2008). Questions in an open–ended format were asked about coastal erosion knowledge and experiences of coastal erosion and coastal protection.

Permission from authors of questionnaires in other studies was sought to enable the use of applicable questions in this research.

Checklist format questions were also included to understand residents' knowledge about causes of coastal erosion in their areas. Contingency questions were designed for those residents who had particular experience or more information about coastal erosion impacts in villages. For example, within the contingency questions on page 6 of the questionnaire, question 54 asked residents to outline their experience of property loss from coastal erosion and question 55 measured what method was applied to deal with erosion (see Appendix 2-2). Scalar questions

were also included to ascertain residents' attitude to coastal management in their communities (see Appendix 2-2).

To obtain information of residents' views about their community and community leaders, residents were asked to explain the meaning of community and leader from their understandings by using open ended questions. The definition of community was deemed to illustrate characteristics or groups within the community; and that of leader could clarify the characteristics of formal or informal leaders in the community. Question 74 was asked residents to outline their views, stories or other experiences about community development and coastal management.

Developing the questionnaire

The first draft of the questionnaire was established by sourcing the questions as outlined above. The researcher translated them from English to Thai before sending to three Thai PhD students in the Faculty of Computing, Health and Sciences for checking, ECU because they had the same background knowledge with the research topic and could provide comments on questions in Thai.

From their comments the questionnaire was edited to ensure the questions were easily understood by the potential village respondents. Ten Thai people, members of the Buddhist Society in Perth, were then asked to review the questionnaire for their understanding of the questions because they had been in rural villages in Thailand before migrating to live in Perth. In addition, they communicated in Thai. Finally, ten interviewees responded to two sections in the questionnaire; demographic information and community capacity building. In the open-ended section, they could respond to two questions: explaining definitions of community and outlining experiences in the community respectively. However, these individuals could not answer questions in the coastal erosion section because they had no experience of it.

After further editing, the Thai questionnaire was compared with an English version and was further evaluated by the senior environmental management specialist at the National Institute of Development Administration, Thailand in regard to language and meaning, given his experience of rural communities. The final draft was issued for piloting with members of a coastal community in Thailand.

Piloting the questionnaire

A pilot study was employed to test the questionnaire to ensure it was appropriate and clearly understood by residents (Sarantakos, 2005, p. 255). The instrument was examined for the flow of questions, the correction of skipped questions, the estimated time for its completion, and evaluating residents' level of interest in responding to a long questionnaire (see Appendix 2-3). Furthermore, villagers in the pilot study were a group of persons who were similar to the residents of the main survey in terms of geographical, socio-demographic and cultural characteristics as recommended by De Vaus (2002) and Walter (2006). The aim was to recruit 30 residents to assess the suitability of method, instrument and sampling frame (Pallant, 2007, p. 204).

2.4.2 Piloting the semi-structured interview

Semi-structured interviews were administered to seek individuals' experience in factors relevant to building community capacity, living conditions, socio-economic concerns and impacts from coastal erosion. An advantage of the semi-structured interview is that of flexibility because this method encouraged residents to describe information and respond to questions from their perspectives and concerns (Wilkinson & Birmingham, 2003). A small number of key informants were appropriate to investigate in-depth information because a large number of interviewees would result in the loss of main ideas and the specific views from the key informants (Creswell & Clark, 2007).

Constructing questions in the semi-structured interview

Questions used in the semi-structured interview were constructed by revising information from a review of community capacity and coastal erosion. In addition, information from the last open-ended questions in the questionnaires was considered before final drafting of questions on the interview protocol. In this case, the researcher knew the prevailing situations and the main purpose of the inquiry in order to construct the questions for interview (Sarantakos, 2005).

The semi-structured interview protocol was trialled in the pilot study. The questions in the protocol's schedule were open-ended and broad, thereby allowing residents the freedom to respond and provide information. In addition, follow-up, prompt questions were employed to encourage key informants to clarify answers (Travers, 2006). The semi-structured interview schedule was integrated with information collected from this quantitative approach (see Appendix 2-4). Two key informants were invited to participate in the semi-structured interview of the pilot study: a villager and an official (see Appendix 2-3).

2.5 Data Collection

2.5.1 Conducting the questionnaire

The full questionnaire survey was undertaken from 29 June to 2 September 2010 between 9.00 am. and 6.30 pm. The questionnaires were administered in the range of 2 to 7 sets per day, this mainly depended on distribution of residences, time spent at homes of villagers, weather conditions and announcement of information through loudspeakers from the heads of the villages. Three hundred fifty-eight villagers responded to the questionnaire or 80% of the total households available for this study, 177 from the low erosion area and 181 from the high erosion area (see Table 2-2).

Table 2-2: Coastal villages and number of households in the low and the high erosion areas conducted in the research

Coastal erosion area	Number of households		Survey conducted per living houses (%)
	Existing houses	Survey conducted	
Low erosion area	**237**	**177**	**75**
Nakhok sub-district	*151*	*111*	*74*
Village 4 (9 – 16 Jul. 2010)	60	44	*73*
Village 5 (17 Jul. – 2 Aug. 2010)	91	67	*75*
Kalong sub-district			
Village 7 (29 Jun. – 8 Jul. 2010)	86	66	*77*
High erosion area	**208**	**181**	**87**
Laem Fa Pa sub-district			
Village 8 (3 – 5 Aug. 2010)	20	20	100
Village 9 (8 – 21 Aug. 2010)	95	87	92
Village 10 (6 – 7 Aug. 2010)	11	10	91
Village 11 (22 Aug. – 2 Sept. 2010)	82	64	78
Total	**445**	**358**	**80**

2.5.2 Conducting the semi-structured interview

In the questionnaire survey, 319 volunteers (89%) agreed to participate in the in-depth, semi-structured interview phase of the research, 181 male and 138 female (see Table 2-3). Semi-structured interviews were carried out from 21 September to 12 November 2010. The time of the interview varied between 9.00 am. and 7.30 pm. 7 days a week because key informants provided their convenient time, date and place variously. Each interview took between 30 and 50 minutes.

Table 2-3: Number and gender of residents volunteering in the semi-structured interview

Study areas	No. of respondent	Volunteers				Random Sampling
		Male	***Female***	**Total**	**%**	
Low erosion area						
Village 4	44	*24*	*16*	40	91	2 (male, female)
Village 5	67	*33*	*24*	57	85	2 (male, female)
Village 7	66	*32*	*18*	50	76	2 (male, female)
High erosion area						
Village 8	20	*10*	*10*	20	100	1(male)
Village 9	87	*43*	*36*	79	91	2 (male, female)
Village 10	10	*7*	*3*	10	100	1 (female)
Village 11	64	*32*	*31*	63	98	2 (male, female)
Total	**358**	***181***	***138***	**319**	**89**	**12**

The researcher normally arrived at the interview locations around 30 minutes prior to the commencement time. It was important to observe and record the places and circumstances before interviewing so as to understand the interviewees' relationships with their environment. During conducting and recording each interview, some key informants preferred not to explain details of some events until the interview was finished and the audio recorder was switched off. They then described some events in greater detail; these were sensitive issues which helped the researcher understand particular information. In this case, the researcher gave the key informants an assurance that the information would be in confidence and kept in a safe place. In addition, after transcription of the interview data, each respondent received copies of their transcripts so they could vouch for the accuracy of the data recorded. Pseudonyms were applied for all key informants; and their names were not published.

The officials interviewed included NGO personnel and scientists, persons working and experiencing coastal erosion and community capacity building. Officials from governmental organisations were involved in plans and policies to prevent coastal erosion and to improve the target capacity of communities. In addition, their responsibilities were relevant to coastal protection and the well-being of residents. Therefore, information from them regarding their experiences was important as was the views they gave about the future direction of coastal management and capacity building of communities.

Three officials were recruited from local government, for example, two officials from Kalong Tambon Administrative Organisation and Nakhok Tambon Administrative Organisation and one official from Laem Fa Pa Tambon Administrative Organisation.

Four provincial officials from both provinces were selected, two officials from the Office of Community Development and others from the Office of Natural Resource and Environment.

A regional official was chosen from the Office of Coastal and Marine Conservation where duties included oversight of the coastal areas in several provinces in the upper Gulf of Thailand.

Three national officials were selected from the Department of Marine and Coastal Resource (Ministry of Natural Resources and Environment), Department of Community Development (Ministry of Interior) and Department of Harbour (Ministry of Traffic).

A representative from an NGO was involved in coastal protection and coastal resource management. Two scientists relevant to building capacity in local communities were invited to participate in the interviews.

A letter of invitation was dispatched to each potential recruit informing them of the research details. Two weeks later, the interviewer visited their offices to seek permission from the managers of the organisations recommended or from other senior officials to provide in-depth information. Before the conduct of the research, the consent forms were signed and those recruited provided a convenient time and place for implementation of the interview protocol.

The two scientists who agreed preferred to respond to the questionnaire by writing answers because it was more convenient for them. Morse and Richards (2002, p. 94) stated that key informants could write answers on the prepared open-ended questions if they were more comfortable writing because some issues could be sensitive.

The interviews were recorded and transferred into the computer each day to check whether it was a clear and complete recording by comparing with details recorded in an accompanying note book. The researcher listened to all records before making three CD copies. Transcription was a time consuming process so that an external typist was employed to do them. The typist had experience in transcribing, had graduated with a bachelor degree in social science, and lived away from the study areas (> 700 km). The typist did not know the key informants and had never been to the study areas. Gibbs (2007) suggests that if typists have a general knowledge about the topics of study, they can transcribe information in an accurate and easy to read format.

2.6 Data analysis

In mixed methods research, data analysis involves the use of appropriate quantitative and qualitative methods. Before data from both methods were analysed, they were prepared in a suitable format and scrutinised to eliminate data entry errors. Processes to prepare and explore the data were distinguished because the procedures differed for both methods (Creswell & Plano Clark, 2007).

2.6.1 Quantitative data analysis

1) Data handling

In preparing quantitative data, a codebook was developed. It was used to explain numerical codes which were assigned for questions in the questionnaire to ensure consistency with data collection. In addition, it helped define and label variables with a format that could be applied for statistical analysis (Pallant, 2007). Answers to the open-ended questions were categorised into broad subject headings after which they had been coded (Kumar, 2005). The codebook was tested with several questionnaires to examine for problems in coding. The raw data were then converted and coded in the coding sections of the questionnaire. After coding, data were entered into a database using Microsoft Access version 2007 as a database. The data were double-entered and checked to eliminate data entry errors and inconsistencies.

The database was transferred into SPSS version 19.0 for Windows for analysis. The coding and input data were checked for accuracy by applying frequency distribution tests which presented frequency of score values for each variable (Coakes, Steed, & Ong, 2009; Walliman, 2006). Measures of central tendency and dispersion values were a useful check when seeking incorrect data. When the researcher finished entering and checking data, the questionnaires were safely stored in the locked cabinet in the researcher's room, School of Natural Science, ECU.

2) Statistical analyses

Descriptive statistics of the variables were undertaken on the questionnaire by using SPSS version 19. Variables were presented in the form of graphs and frequency distributions such as mean, median, standard deviation, skewness and kurtosis. Variables were tested by using descriptive statistics to prevent violating any assumptions before calculation of other statistical analyses (Pallant, 2007). The chi-square test was applied to help analyse for any significance in differences between responses from low and high erosion areas. In addition, factor analysis was applied to explore the crucial factors retrieved as significant data from socio-demographic characteristic, coastal erosion and the community capacity sections in the questionnaire.

Chi-square test

The chi-square test was applied to explore the distribution of frequency data (Brace, Kemp, & Snelgar, 2000; Pallant, 2007) by testing the relationships or differences between numbers in cells in the table (Burns & Grove, 2001). The chi-square test was used to test the significant difference between responses in the low and the high erosion areas in terms of socio-demographic information, opinions about respondents' livelihoods and experiences in coastal erosion. In a table of the chi-square test, numbers in any cell were expected to have a frequency of at least 5 (Burns & Grove, 2001, p. 518; Howell, 2002, p. 159; Pallant, 2007, p. 214).

If responses to scale questions of respondents' livelihoods and experiences of coastal erosion showed frequency of responses in tables lower than 5, some responses were combined across rows or columns to increase numbers of responses in cells to meet the criteria. For instance, the five scale responses were strongly agree, agree, neutral, disagree and strongly disagree, so strongly agree and agree were merged, and strongly disagree and disagree were combined. Five scales were thus transformed to three scales (agree, neutral and disagree) (Siegel & Castellan, 1988). The comparison of each statement between the two erosion areas was therefore computed in a 3×2 table.

If the frequency of responses in tables was still lower than 5 after combining data, three scales would be transformed to two scales for analysis. Neutral and disagree were combined to present 2 scales (agree and does not select agree). The frequency of responses was calculated in a 2×2 table. Where the frequency of responses in a 2×2 table was still less than 5, Fisher's exact test was applied because "it calculates exact probabilities of obtaining the observed results if the two variables were independent and the marginals were fixed; it was most useful when the total sample size and the expected values were small" (Norusis, 1993, p. 209).

In the questionnaire, two statements which had similar meanings were asked in the questionnaire to test validity of those questions. The questions were in the leaders and leadership section, where villagers were asked about informal leaders in communities (questions 29 and 33). A 3×2 table was used to compare responses between disagree, neutral and agree

responses. The results showed four of nine cells had low expected frequencies or less than 5. Therefore, the chi-square test was computed manually (see Appendix 2-5). The calculation of the chi-square value was 2.04, less than the critical value ($\chi^2_{0.05}$= 5.99, df = 2). Both questions had similar responses. Only one of the statements was used in subsequent analysis of leaders and leadership section (see 6.2.5, Chapter 6).

Factor analysis

Factor analysis is a multivariate technique to explore the possible structure in a group of correlated variables (Child, 1990; Punch, 1998). It is used to find factors which are composed of appropriate data (Leech, Barrett, & Morgan, 2011). Factor analysis is applied to reduce a large number of related variables to a smaller number of latent variables before analysing the variables in other processes (Pallant, 2007). Exploratory factor analysis (EFA) is applied with this study to describe and summarise information which is grouped together where the information has relationships (Pallant, 2007; Thompson, 2004).

In this study, the number of variables in dichotomous format of responses had 25 scale items which were analysed by applying EFA to reduce the number of variables to a set of factors (Coakes, et al., 2009). Those variables were selected from three areas of data: the socio-demographic characteristic, exploratory factor analysis in greater detail in chapter 6. EFA was used because a set of items could show strong relationships among a number of variables utilising a small number of items. A sufficient sample size for factor analysis was defined to be at least 300 cases (Pallant, 2007, p. 181; Tabachnick & Fidell, 1996, p. 640); the sample in this study was 358.

2.6.2 Qualitative data analysis

Qualitative data analysis is a process implemented to increase understanding of a large amount of information by seeking and managing that collected in transcripts and field notes to explain clear, important and trustworthy findings (Bogdan & Biklen, 1998, p. 157; Gibbs, 2007, p. 1). Data collected from the semi-structured interview schedule were analysed to search for historical, cultural, traditional, economical and environmental changes in communities including coastal erosion impacts. In addition, data gathered from officials, scientists and an NGO leader were analysed to understand the roles of the external organisations which influence community capacity, administrative processes to manage community problems, cooperation of networks, policies and perspectives from each section to strengthen local communities.

1) Managing data

After receiving all transcripts, the researcher reviewed the outputs against the recordings to edit mistakes (Braun & Clarke, 2006, p. 88; Gibbs, 2007, p. 17). When the transcripts were correct, the audio records were deleted. Three copies of the transcripts were printed: two copy sets were

kept with the researcher and a copy set was sent to each key informant for confirming the veracity of the content. They were allowed one month to read and edit the document.

Only two key informants edited and returned transcripts to the researcher. The edited transcripts had minor changes such as typing errors and incorrect spelling. The researcher telephoned the other key informants who did not return their transcripts; they had decided not to edit their transcripts. The researcher read over finalised transcripts again for familiarisation, before the next process, coding and categorising.

2) Coding

Coding is a part of the analytic process wherein the data are organised into meaningful clusters (Braun & Clarke, 2006; Liamputtong, 2010). Codes show interesting and typical elements of the data. In this research the intentions of coding were to explore the crucial factors from internal and external communities influencing community capacity; therefore content coding was applied to all data sets to identify the factors which were related to community capacity building.

The data sets were coded by labelling words, phrases, sentences and paragraphs which were related to particular aspects of the questions in the semi-structured interview schedule (Green et al., 2007, p. 548). In the coding process, the researcher used NVivo version 9 to code free nodes. Coding the data could also be done by using a manual technique or a software programme (Kelle, 2004). In this research, manual coding was applied by making labels in the margin of each transcript. Data related to coastal erosion, coastal protection and activities in communities were coded prior to creation of the sub-categories and categories. Several basic questions were used as guidelines to select data which were broadly categorised to commence coding (Charmaz, 2003, pp. 94-95; Gibbs, 2007, pp. 41-42). Such questions used were: what was happening; what villagers were doing; what key informants were saying; what resulted from their actions or statements; and how situations supported, hindered or changed the actions or statements?

Three methods can be employed to increase the reliability of qualitative data: explaining reasons of changes when modifying plans of data collection; setting up an audit trail by explaining how the conclusions were achieved; and using a second opinion from experienced researchers to interpret data (Henderson, 1991, p. 191). In this study, a second opinion was sought to increase the reliability. Four out of 32 transcripts were coded by the researcher who created free nodes before clustering and ordering in a hierarchy as parent nodes. Four transcripts and a parent node set were sent to the Edith Cowan University's Support Opportunities Advice Resources (SOAR) to check for reliability in coding; where there was a Thai researcher experienced in qualitative approach and employed in the consulting research centre. The researcher coded in the margin of transcripts by using a set of parent nodes provided. From the response, only two new free nodes were established because the existing free nodes were accurate and clear in their meaning.

3) Creating themes

In this research, the descriptive data were categorised across the documents to sort out the similar and different aspects of issues that villagers conveyed. The coded data were analysed by searching relevant codes or codes which had close meaning for clustering before identification of potential themes. After themes were identified, they were checked across the documents for consideration in relation to the coded data and missing codes in an initial process. Consequently, themes were defined and refined to have clear definitions and capture all aspects of the coded data (Braun & Clarke, 2006; Green, et al., 2007; Liamputtong, 2010).

4) Managing data

The software program helped the researcher sort out a large amount of data and organise it when carrying out the analytic process (Fielding & Lee, 1998; Gibbs, 2007). To deal with the coded data in the computer, NVivo provides a function for coding of the documents by tagging the texts at a node (Braun & Clarke, 2006). A node in NVivo identifies a named issue, topics, sub-categories and categories identified to be applied for organising data. In this study, there were 29 sub-categories and 5 categories (see Appendix 2-6). However, the researcher reorganised these nodes as often as required by connecting them with other nodes or texts (Bazeley, 2007). The nodes and texts applied to support or argue findings from the questionnaire were approved by supervisors, research consultants and a language expert who was a lecturer in Bangkok, Thailand and understood the context of the research. The quotes under nodes and categories were selected for inclusion in the analysis of this study by considering their meanings relevant to issues which were being discussed. The discussion always sought to compare information and reasons between the low and the high erosion areas.

Chapter 3: Description of coastal communities and study population

3.1 Introduction

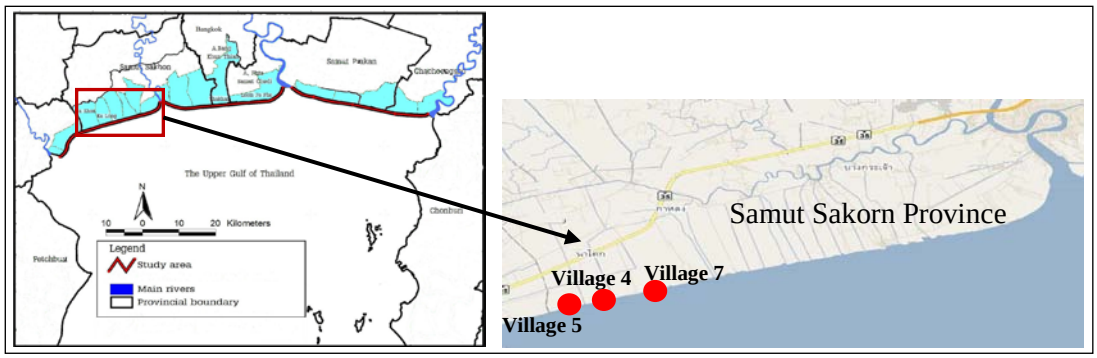
The research was conducted in two coastal areas with different degrees of coastal erosion impact. This chapter presents information about these coastal communities to illustrate their physiographic characteristics, environmental changes and socio-economic information on residents, the general physical features of the coastal areas like types of land use, infrastructure and distribution of residences. Socio-economic information about the residents helped to highlight the potential of economic status, occupation, educational level, and their resources that might influence the way they can address change. In addition, the socio-economic information of residents helps classify similarities or differences of characteristics of residents living in the adjacent areas as homogenous or heterogeneous groups.

The first section of the chapter outlines the physical characteristics of the coastal villages in both areas. The second details the socio-demographic status of the respondents in the selected villages. Descriptive information is presented in this section to compare respondents' characteristics of physical socio-economic and demographic variables based on where they live. In addition, the socio-demographic characteristics are compared with the census data in the upper Gulf of Thailand. Additionally, the information is used to assess the influence of socio-economic characteristics affecting community capacity to deal with natural hazards.

In the final section of the chapter, characteristics of key informants who participated in semi-structured interviews are described before the opinions of key informants about community characteristics and environmental changes between the past and the present are presented. Information about the alterations experienced by communities helps an understanding of reasons for the manner physical characteristics were impacted by coastal erosion and the reasons for residents having settled in environmentally hazardous areas (Flora, Flora, Spears, & Swanson, 1992).

3.2 Characteristics of coastal villages

Characteristics of communities and surrounding areas are important to help understand how residents connected to places with different types of landscape architecture, land use and folklore (Low & Altman, 1992). In the low erosion area, locations of the villages were on the outskirts of Bangkok (50 km to the west). Travelling to the west of Bangkok by a main road, Kalong and Nakhok subdistricts were close to the border west of Samut Sakorn province. The coastal villages were to the south of the main road, and streets were constructed and connected from it to all coastal villages. At first, from the main road, small communities and retail services existed on both sides. Next, salt fields were made along the streets to the villages. Shrimp farms have been constructed surrounding the villages. Residents' houses are made of various types of good permanent materials such as woods, bricks and concrete. The locations and geographical features of the low erosion area are shown in Figure 3-1.



A: The low erosion area

B: Village 7 in Kalong sub-district

C: Village 4 in Nakhok sub-district

D: Village 5 in Nakhok sub-district

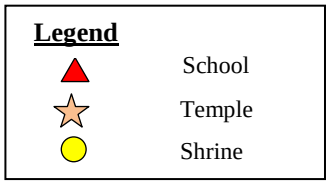


Figure 3-1. The low erosion area: village 7 (Kalong sub-district), villages 4 and 5 (Nakhok sub-district)
Source: Downloaded from http://maps.google.co.th, access by 20 May 2011

There are three villages in the low erosion area; village 7 in Kalong Subdistrict, villages 4 and 5 in Nakhok subdistrict. For village 7 in Kalong subdistrict, most residences and retails are located on both sides of the street in a village. A primary school and a temple are located at the centre of the village and far from the coastline approximately 200 metres. A seawall and sand sausages are built to prevent impacts of coastal erosion on residential areas. A jetty and two shrines are established in the village.

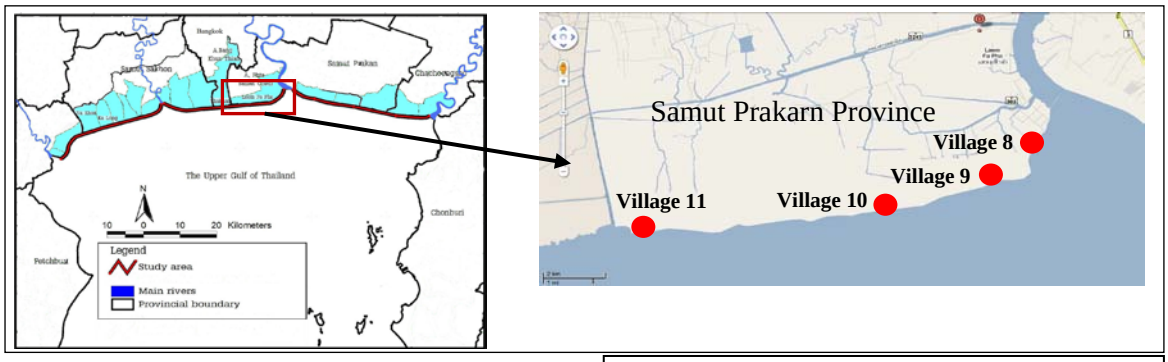
For village 4 in Nakhok subdistrict, most residences and a temple are located close to the coastline. A street is parallel to the coastline. A shrine is in the middle of the village. One side of the village is closed to the coastline and others are surrounded by shrimp farms. A seawall is constructed to protect housing areas approximately 600 metres long. In addition, a flood gate is near the temple to protect floods from high tides.

For village 5 in Nakhok subdistrict, residential areas are divided into three clusters because shrimp ponds are in the middle among the clusters: the first cluster is close to a coastline and near the border of the province, the second cluster is close to a coastline and far from the main area 2 km east and the third cluster is away from coastline and far from the main area 1 km north. There are a primary school, a temple, a shrine, a jetty and a seawall in the first cluster of the village.

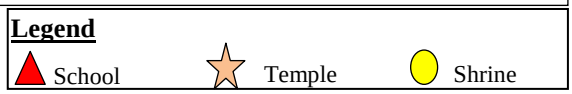
In the high erosion area, Laem Fa Pa subdistrict is located in Samut Prakarn Province or approximately 30 km to the east of Bangkok. There are no roads to access the coastal villages and residents travel to outside their villages by taking boats through canals or the sea. Public access to the coast is possible through canals in villages where the parcels of privately owned land are abutting the water. Mangrove trees, shrimp ponds and residences occur along both sides of the canals. Most houses in this area are made of local materials such as wood, bamboo stems and palm leaves. Krongkaew (2002) explains the characteristics of houses of low socio-economic status generally in rural areas in Thailand: they are houses of one story in which the floor are constructed above the ground and the roofs are made of palm leaves or grass. Locations and geographical features of the high erosion area are shown in Figure 3-2.

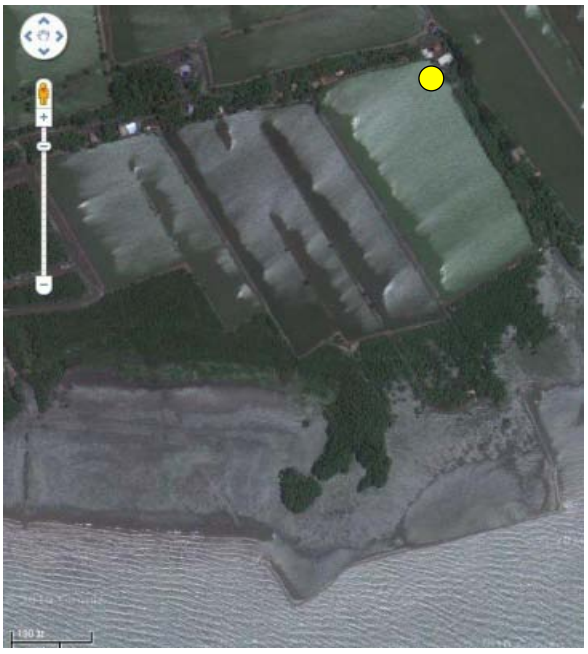
Villages 8, 9, 10 and 11 in Laem Fa Pa subdistrict, Samut Prakarn Province are in the high erosion area. For village 8, residents usually walk on tracks in their villages. A residential area is located far from the coastline approximately 500 metres because there are shrimp ponds between the coastline and residential areas. A large area of the coastline is covered with mangrove forest.

For village 9, a residential area is divided into two areas: a large and a small residential areas. A large residential area is in the middle of the village and there are various facilities such as a shrine, a school, a village museum and a clinic. A small residential area is in the east of the large residential area. A temple is in the south. Another shrine is in the minor residential area. Footbridges are built to connect from the large residential area to other areas.



A: The high erosion area





B: Village 8 in Laem Fa Pa sub-district

C: Village 9 in Laem Fa Pa sub-district

D: Village 10 in Laem Fa Pa sub-district

E: Village 11 in Laem Fa Pa sub-district

Figure 3-2. The high erosion areas, villages 8, 9, 10 and 11 in Laem Fa Pa sub-district
Source: Download from http://maps.google.co.th, access by 20 May 2011

For village 10, a residential area is in the middle of a village surrounded by shrimp ponds. A canal and a pier are on the west of the village. A wood footbridge is built for local residents to journey between village 10 and village 9. There is a shrine in the village.

For village 11, a residential area in the village is far from village 10 approximately 6 km to the west. Most residences are built on the canal banks close to a mouth of the canal. There is a shrine in the middle of the village. Footbridges are constructed to help residents walk in the village conveniently.

Coastal villages have different types of, and relevance of, infrastructure and services. Information about these in the low and the high erosion areas helps understand local activities in the study locations, such as street access to urban areas, schools, temples, shrines and food shops (see Table 3-1). Some facilities contribute to the local economy such as the number of retail outlets and food shops, or social connections such as schools, temples and shrines (Flora, et al., 1992).

Table 3- 1: Infrastructure and services that support community activities in the study areas (see text for explanation)

Village/ Subdistrict	Access to a village	Inform data in a village	School	Temple	Shrine	Retail, Food shop	Coastal protection	Others
Low erosion area								
Kalong sub-district								
Village 7	street	loud speaker	1	1	2	8	seawall sand tubes	
Nakhok sub-district								
Village 4	street	loud speaker	-	1	1	4	seawall	The Scout Learning Centre, Flood gate
Village 5	street	loud speaker	1	1	1	5	seawall	-
High erosion area								
Laem Fa Pa sub-district								
Village 8	canal	-	-	-	1	-	-	-
Village 9	canal	loud speaker	1	1	2	7	-	a clinic
Village 10	canal	-	-	-	1	-	-	-
Village 11	canal	loud speaker	-	-	1	2		-

Perusal of Table 3-1 reveals that residents in the low erosion area seem to have more infrastructure and services in their communities than residents in the high erosion area. Every village in the low erosion area has temples, shrines, grocery stores, food shops and hard engineering structures to prevent coastal erosion. Every village has installed a seawall to prevent coastal erosion in residential areas; the federal government also set up sand tubes in one low erosion village. In terms of infrastructure in the low erosion area, villagers have streets to access urban areas, and heads of villages distribute community information to residents through loud speakers.

Of the high erosion area, only village 9 has various types of infrastructure compared with other villages. Villages in the high erosion area have no streets to connect to other areas and residents commute to external areas by boats through canals and coast in their communities.

In the next section, the socio-demographic characteristics of respondents in the low and the high erosion areas conducted by using the questionnaire survey are illustrated. The characteristics of respondents include gender, age, time of residency, living arrangement, education level, monthly income, employment and house and land ownership. Then the characteristics of respondents in the study area are compared with census data of population in the upper Gulf of Thailand.

3.3 Socio-demographic characteristics of the study population

Three hundred and fifty eight respondents to the questionnaire, as representatives of heads of households (see Table 3-2 and Appendixes 3-1), answered questions for their families. Fifty five per cent of respondents were male with similar percentages of males and females observed in both low and high erosion areas (see Table 3-2).

The overall mean age of residents was 47 years with most respondents being aged between 40 and 49 years (see Table 3-2). The age ranges of respondents between the low and the high erosion areas were different. In the low erosion area, most respondents aged 40-59 years, whereas age ranges of respondents in the high erosion area were more varied. In the high erosion area, most respondents in villages 8 and 9 were aged over 50 years, but most respondents in villages 10 and 11 were aged 30-40 years (see Appendix 3-1). The median time of residency for respondents was 42 years with some long-term respondents of around 78 years. Some new respondents had resided in a village for a little as four months (see Table 3-2). Most respondents had lived in their villages since they were born. In terms of the length of time of residency, there were no significant differences between the areas ($\chi^2 = 0.10$; df = 1; $p > 0.05$).

In both areas, most respondents lived with their spouses and children. (see Table 3-2). Village 8 in the high erosion area was significantly different, where respondents were couples without children, comprising 45% of the residents surveyed (see Appendix 3-1). Respondents who lived alone made for a small proportion in both areas; this percentage of residents was similar in both areas.

Most respondents in both areas had a low level of education finishing at primary school (see Table 3-2). More respondents in the high erosion area completed primary school (84% of respondents), but more respondents in the low erosion area finished higher levels of education than those in the high erosion area; this difference was significant ($\chi^2 = 9.85$; df = 2; $p < 0.05$).

The most common types of employment of respondents were fishermen, vendors, housewives and factory employees (see Table 3-2). More respondents in the high erosion area were fishermen (89% of respondents) whereas 55% of respondents in the low erosion area were fishermen. In addition, more respondents in the low erosion area were vendors and housewives. A higher number of factory employees were noted as originating from low erosion area when compared with the high erosion area. The differences between areas were significant ($\chi^2 = 55.87$; df = 4; $p < 0.05$).

Table 3-2: Demographic information of respondents in low and high erosion areas

Units: numbers of residents

Variables	Total		LEA		HEA		x^2- *Test** p, *level of significance1*
	n = 358	**%**	*n = 177*	**%**	*n = 181*	**%**	
Gender							p= 0.23
Male	197	55%	103	58%	94	52%	
Female	161	45%	74	42%	87	48%	
Age							p= 0.54
Mean (years)	*47*		*47*		*47*		
Range(years)	*21- 78*		*23 - 78*		*21 - 76*		
20 - 29	35	10%	20	8%	15	11%	
30 – 39	66	18%	29	20%	37	16%	
40 - 49	98	27%	48	28%	50	27%	
50 - 59	96	27%	52	24%	44	29%	
60 +	63	18%	28	19%	35	16%	
Time of residency							p= 0.75
Median (years)	*42*		*40*		*43*		
Range(years)	*0.3 - 78*		*0.3 - 78*		*1 - 76*		
> 10 years	328	92%	163	92%	165	91%	
Living arrangement							p= 0.78
Live with family and children	217	61%	106	60%	111	61%	
Education							p= 0.01*****
None	30	8%	19	11%	11	6%	
Primary school level	276	77%	124	70%	152	84%	
Higher than primary school level	52	15%	34	19%	18	10%	
Monthly income							p= 0.00*****
< 10,000 Baht	205	57%	84	47%	121	67%	
≥ 10,000 Baht	152	43%	93	53%	59	33%	
Employment							p= 0.00*****
Fishermen	259	72%	98	55%	161	89%	
Vendors	40	11%	31	18%	9	5%	
Housewives	22	6%	15	8%	7	4%	
Factory employees	23	6%	23	13%	0	0%	
Other	14	4%	10	6%	4	2%	
House ownership							p= 0.26
Owned house	344	96%	168	95%	176	97%	
Land ownership							p = 0.00*****
Owned land	116	32%	97	55%	19	10%	
Residents told distance to coast							p = 0.00*****
Median (metre)	*200*		*120*		*220*		
Range(metre)	*5 - 2,000*		*5 - 2,000*		*5 - 1,500*		
0 - 200	216	60%	126	72%	90	49%	
> 200	142	40%	51	28%	91	51%	

* *Probability*

Fifty seven percent of residents had a low monthly income of less than 10,000 Baht (or approximately $335) (see Table 3-2). More respondents in the high erosion area had low income (67% of respondents) compared to respondents in the low erosion area (47% of respondents). The proportion of those with income of less than 10,000 Baht and income of more than 10,000 Baht was clearly significantly different when comparing the low and the high erosion areas (χ^2 = 14.26; df = 1; p < 0.05).

Almost all respondents lived in their own houses with one third of respondents having built their houses on their own land. More respondents in the low erosion area built their houses on their own lands (see Table 3-2). However, a higher percentage of respondents in village 10 in the high erosion area and villages 5 and 7 in the low erosion area owned land compared with other villages. No respondents of village 8 in the high erosion area owned land. While house ownership was similar between the villages, there was a significant difference in land ownership between the areas (χ^2 = 80.20; df = 1; p < 0.05).

The distance of respondents' houses to the coastline was categorised into two groups: less than 200 metres and more than 200 metres. More respondents in the low erosion area estimated their houses were located closer to the coastline by less than 200 metres than respondents in the high erosion area (see Table 3-2). The median distance of houses from the coastline was 120 metres in the low erosion area compared with 200 metres in the high erosion area. In the low erosion area, most respondents' houses in every village were located close to the coastline, less than 200 metres, because the villages built hard structures to prevent coastal erosion. Distances of respondents' houses in the high erosion area were more varied, often located far from the coastline. More respondents' houses in villages 8 and 9 were close to the coastline less than 200 metres than respondents' houses in villages 10 and 11 (see Appendix 3-1). This was because villages 8 and 9 were located on the west of the Chao Praya Delta River where land in the villages was severely eroded resulting in less land inland, and less opportunity for residents to move to inland. There was a significant difference in distance of house to the coastline between the two areas (χ^2 = 17.23; df = 1; p < 0.05).

3.4 Comparison of data between respondents and census data

To consider whether the respondents in this study were representative of the population in the upper Gulf of Thailand, some socio-demographic characteristics of respondents in the study areas were collected and compared with the relevant national statistics from the census data of 2007 (see Appendix 3-2). The census data were collected at the provincial level and conducted by the National Statistics Office of Thailand.

The upper Gulf of Thailand is composed of 5 provinces but in this study the census data are collected in 4 provinces, namely: Chacoengsao, Samut Prakarn, Samut Sakorn and Samut Songkram provinces (National Statistical Office of Thailand, 2007). The census data not

included were from Bangkok because Bangkok had a greater number of households in urban areas whereas this study had been undertaken in rural areas. If the census data in Bangkok were included, this might bias the comparison because of the wider range of socioeconomic characteristics between data of the study areas and the census data from the richest urban area of the country (Yiengprugsawan, Carmichael, Lim, Seubsman, & Sleigh, 2010). The indicators used included age, living arrangement, household income, educational qualifications and types of housing and land ownership. The data from 4 provinces were summed, averaged and calculated in a percentage form thereby enabling comparison with the percentage data across all villages and two study areas (see Table 3-3).

Table 3-3: Comparison of socio-demographic information between respondents in the study areas and the census data from 4 provinces in the upper Gulf of Thailand

Variables	Study area	The census*
Age (median categories)		
20 - 29	10%	11%
30 – 39	18%	19%
40 - 49	27%	24%
50 - 59	27%	20%
60 +	18%	26%
Living arrangement		
Live with a spouse and children	61%	68%
Educational qualification (%)		
Finish primary school	77%	49%
Finish higher than primary school	15%	47%
Household income(median categories)		
< 10,000 Baht	57%	32%
Owned house (%)		
Own	96%	61%
Owned land (%)		
Own	32%	51%

* The census data were calculated by applying 4 provincial sources, Chachoeng Sao, Samut Prakarn, Samut Sakorn and Samut Songkram provinces in 2007.

Sources: National Statistical Office of Thailand (2007); survey data for the study area

Table 3-3 shows the percentages of the census data and the combined responses of the low and the high erosion areas. The living arrangements of respondents who lived with a spouse and children were slightly different between the census data and the study population where the census data had a higher percentage of residents who lived with a spouse and children; but again the differences were not significant ($\chi^2_{0.05}$= 1.07; df = 1).

A higher percentage of respondents in this study had completed primary school compared with the census data (see Table 3-3); however, more people in the census complete higher levels of education than the residents overall (probably because the government had supported

educational opportunities to adults in workplaces and factories (World Health Organisation, 2007)). The differences between the study areas and the census data were significant for this composition ($\chi^2_{0.05}$= 24.07; df = 2).

In terms of household income comparisons, a higher percentage of respondents in this study had lower incomes than populations in the census data. WHO (2007) stated that most populations with low socio-economic status were in rural areas. In addition, the census data were collected in urban and rural areas so villagers in the census had significantly higher incomes than respondents in the study areas ($\chi^2_{0.05}$= 12.65; df = 1).

When comparing house ownership, the study population had a significantly higher percentage of house ownership than those socially comparable in the census data by approximately 35% ($\chi^2_{0.05}$= 36.29; df = 1), whereas the study population had lower percentage of land ownership by approximately 19%, significantly different than that between the study and the census data ($\chi^2_{0.05}$= 7.43; df = 1).

From the comparison of several categories between respondents in the study area and the general population in the upper Gulf of Thailand, two categories had similar characteristics such as age groups and living arrangement in households. Other categories were different such as educational qualification, household income, house ownership and land ownership. The results from the study area were different from the census data because the focus of this study was on rural coastal communities, whereas the census data were collected from both urban and rural areas across the four provinces. Therefore, respondents in this study had lower household income and lower degrees of educational qualification. Additionally, respondents in this study were impacted by coastal erosion and experienced land loss so they had lower percentages of land ownership than those in the census data.

3.5 Socio-demographic characteristics of key informants

The socio-demographic characteristics of key informants who participated in the in-depth interviews were explored further to understand their various roles in villages and in community activities. Characteristics of key informants were important to interpret results from their interviews because information obtained would be related to key informants' backgrounds. There were two groups of key informants: key informants living in the selected villages and key informants from external organisations as depicted in Table 3-4 and Table 3-5 respectively.

There were 21 key informants from the selected villages (see Table 3-4). They were separated into 2 groups: leaders and volunteer residents. Of the leaders, 6 were male, 1 female and 2 were monks; while for villagers who volunteered, 6 were male villagers and 6 were female. Most key informants were fishermen who lived with their spouses and their children. Most key informants had been living in their villages since they were born excluding 5F, 10F and 11M.

Table 3-4: Characteristics of key informants in each village in low and high erosion areas

Village key informants	Characteristics of key informant				
	Gender	**Age**	**Years in a village**	**Occupation**	**Living arrangement**
Low erosion area					
Village 7, Kalong					
7M*	Male	54	54	Fishermen	Family, children
7F*	Female	46	46	Vendor	Live with daughter
H7*	Male	56	56	Fishermen	Family, children
Village 4, Nakhok					
4M*	Male	57	57	Fishermen	Family, children
4F*	Female	36	36	House wife	Family, children
H4*	Male	55	55	Fishermen	Family, children
Village 5, Nakhok					
5M*	Male	32	32	Factory employee	Family, children
5F*	Female	36	20	House wife	Family, children
H5*	Male	52	52	Employee	Live with spouse
Monk	Male	53	12		
High erosion area					
Village 8, Laem Fa Pa					
8M*	Male	54	54	Fishermen	Family, children
H8*	Male	36	36	Fishermen	Family, children
Village 9, Laem Fa Pa					
9M*	Male	58	58	Fishermen	Family, children
9F*	Female	27	27	House wife	Family, children
H9*	Female	54	54	Vendor	Family, children
Village 10, Laem Fa Pa					
10F*	Female	36	8	Fishermen	Family, children
H10*,	Male	52	52	Fishermen	Family, children
Village 11, Laem Fa Pa					
11M*	Male	37	10	Fishermen	Family, children
11F*	Female	40	40	Employee	Live with cousin
H11*	Male	39	39	Fishermen	Family, children
Monk	Male	54	16		

* shows pseudonym of key informants

Fourteen key informants from external to the villages were interviewed; they comprised 1 member of an NGO, 2 scientists, and 11 officials from local, provincial, regional and national government organisations (see Table 3-5). Nine of 14 key informants are male. The ages of key informants were in the range of 31 to 54 years. Six of the 14 key informants were in charge of their offices, the remainders were officials. All key informants were important, providing information relevant to their responsibilities, and policies they proposed to increase community capacity and provide coastal protection in the future.

Table 3-5: Socio-demographic characteristics of key informants who work in organisations

External organisation key informant	Characteristics of key informant		
	Gender	Age	Position in organisation
Officials from local government			
1. Kalong Subdistrict Office	Male	34	Official
2. Nakhok Subdistrict Office	Male	42	Manager
3. Laem Fa Pa Subdistrict Office	Male	31	Official
Officials from provincial government			
Samut Prakarn province			
4. Natural Resource and Environment Office	Male	54	Official
5. Community Development Office	Female	50	Manager
Samut Sakorn province			
6. Natural Resource and Environment Office	Male	52	Official
7. Community Development Office	Female	53	Manager
Officials from regional government			
8. Coastal Resources Conservation Office, Ministry of Natural Resource and Environment	Male	49	Manager
Officials from national government			
9. Coastal Resource and Marine Department, Ministry of Natural Resource and Environment	Male	38	Official
10. Community Development Department, Ministry of Interior	Female	47	Official
11. Harbour Department, Ministry of Traffic	Male	32	Official
12. Scientist 1	Female	54	Official
13. Scientist 2	Female	52	Manager
14. Non-Government Organisation	Male	49	Manager

3.6 Changes in the low and the high erosion areas

The key informants described village changes in comprehensive matters including: land loss from the erosion, alteration of environmental circumstance, and improvement of social and economic aspects of the communities.

3.6.1 Land loss from the erosion

The key informants explained their observations of loss of land from their childhood to the present day, all referring to the changes in the coastal area of their villages.

Key informants in the low erosion area

Key informants in the low erosion area discussed the characteristics of their lands' topography approximately 30 years ago. In addition, the past impacts of coastal erosion in their areas were aired.

> *"In the past, there was Krasa. "Krasa" which was fine particles of crust-shell and soil accumulated gradually on the coastline as layers in winter. In summer, it was dry and hard resulting in increasing accretion of the landform." H5 (village key informant)*

"When I was a child, I ran to a coastline where it was very far from the existing coastline and it was in the sea. Land on the coastline was hard and we could walk on the land. Now, the land is eroded." 4F (village key informant)

"The coastline has eroded approximately 200 metres in the past due to no support from any organisations. In 1995, the government started placing rocks to prevent the erosion." 7M (village key informant)

Key informants in the high erosion area

All key informants explained the situation of coastal areas which had eroded in the past 30 years. The area has been continuously eroded to the present day.

"30 years ago, this area was covered by thick mangrove forest. Oh, when looking at the forest, it was dark green mangrove. Now the forest is eroded and it is completely changed to be the sea." 11F (village key informant)

"In the past, a coastline always altered between accretion and erosion. Power line poles were installed in the village. In the past 30 years, the coastline has eroded. The village has completely eroded into the sea. Now we can see the power line poles far apart in the sea." 9M (village key informant)

"Thirty years ago, the residential area was far from the coastline, approximately 1 kilometre away. The temple was inland more than a kilometre from the coastline. Now, the temple is surrounded by the sea." H9 (village key informant)

Scientific data of environmental changes in the high erosion area

A key informant from local authority described scientific data concerning land loss in the high erosion area. The key informant had access to the aerial photographs and satellite images of village 9, Laem Fa Pa subdistrict to investigate the severity of coastal erosion impacts between 1952 and 2002 (see Figure 3-3). The figure shows land loss from the erosion over time.

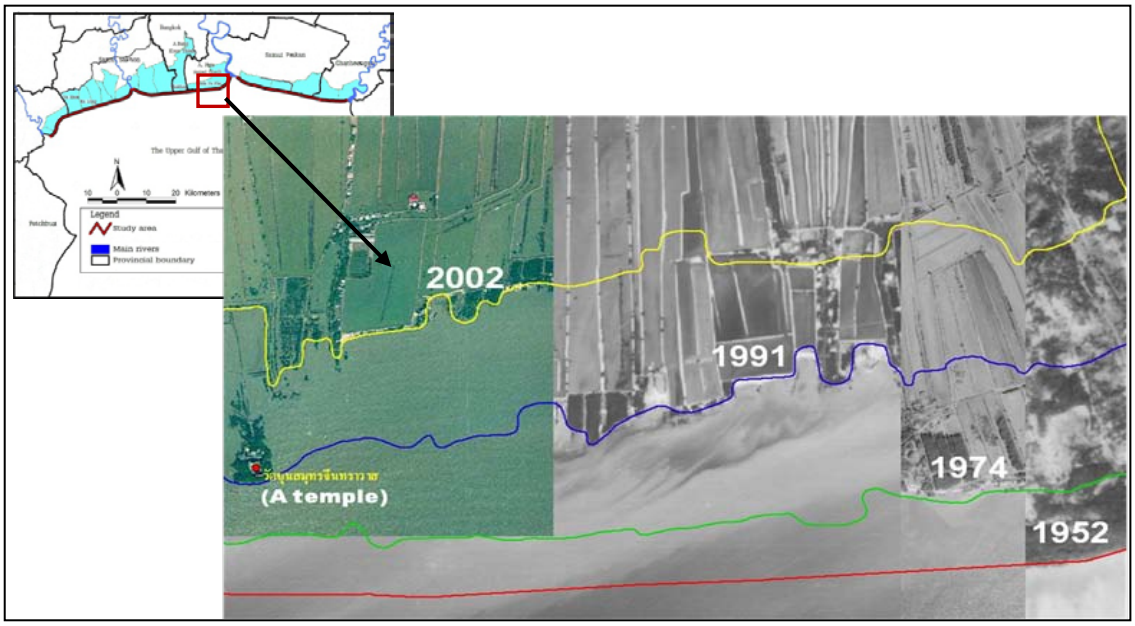


Figure 3-3. Coastal erosion in Laem Fa Pa subdistrict between 1952 and 2002

Source: Laem Fa Pa Tambon Authority Organisation, 2010.

From 1952 to 1991, the map showed a temple located in land. This was because the red, green and blue lines which indicated the coastlines in each year (1952, 1974 and 1991 respectively) were lower than the location of the temple. By 2002, the temple had become surrounded by the sea.

Overall, the physical characteristics of the low erosion area in the past were accretion to form land. The accretion was hard, composed of fine particles of shell and sediment. In the last 30 years, the coastline eroded continuously a distance of approximately 200 metres. In the high erosion area, the coastline fluctuated between accretion and erosion in the past but it eroded continuously to a distance of more than a kilometre in the last 30 years.

3.7 The nature of work and lifestyle

Key informants illustrated the characteristics of residents who lived and worked in low and high erosion areas in terms of employment, educational qualification and house and land ownership.

3.7.1 Employment and income

The results from the questionnaire showed that most respondents in low and high erosion areas were fishermen. In the low erosion area, some respondents were factory employees. The key informants described the characteristics and occupational expectations of residents in both areas.

The low erosion area

"Most people in the village are fishermen and employees in factories. Some housewives who have no income work in factories. Other housewives work together after men catch fish from the sea and help men prepare fish by classifying and cleaning before sending to local markets." 7F (village key informant)

"In the last 10 years, factories often discharged wastewater into the sea resulting in low quality of sea water. Fishermen caught low yields of marine animals. They did not make enough money for fuel cost of their boats." 5F (village key informant)

"Some residents have started working as employees in factories. In the future, the number of local fishermen will decrease considerably due to low quantity of seafood. Income from fisheries, now, is uncertain." 4M (village key informant)

"Members in almost every household work in factories. Factory employees can get regular salaries every month but the salaries are low." 5M (village key informant)

The high erosion area

"In the past, no residents wanted to culture cockles in farms because the pay from yields was very cheap or 2 Baht per kg. Now the cost is high or 8 Baht per kg so farm owners are culturing cockles. Many residents are employed to collect cockles in farms for periods of time and they regularly collect cockles from the coastline." 8M

"In terms of catching marine animals from the sea, if they are lucky, they can catch a great number. Regularly, residents sufficiently catch marine animals for their families. Residents are familiar with this living pattern and they do not want to work in factories." H8 (village key informant)

"If residents have a skill in gathering cockles and take only a few hours to gather them, they will gain a thousand Baht. This is a comfortable life pattern which is better than work in factories." H10 (village key informant)

"If we are diligent in working, we will not suffer from starvation because we do not pay money for buying food. We catch fish from the sea. Working as a fisherman helps us have a warm family. Returning home, we can see families and siblings." 9F (village key informant)

"Receiving 100 Baht in any day, we do not lose out because our only investment is our effort. Shrimps, shells, crabs and fish are caught from the sea. We have self-sufficient lifestyles." H9 (village key informant)

Overall, respondents in both areas were fishermen whereas some respondents in the low erosion area worked in factories to get more revenue. Fishermen in the low erosion area were impacted by low quality seawater and unreliable quantities of marine animals, and many fishermen sold their boats and worked in factories. Fishermen in the high erosion area still earned sufficient income from gathering cockles and other marine life along the coast in their communities.

3.7.2 Educational qualification

The findings from the questionnaire illustrated that most respondents had completed primary school. The key informants in both areas compared reasons of finishing only low educational qualification in the past with opportunities for young villagers graduating at a higher level currently.

The low erosion area

"I think it is okay for residents' knowledge in our villages. Now, most young generation finish at least grade 9." 4F (village key informant)

"In terms of knowledge, educational qualification of residents is not that high. In the past, residents finished grade 4 because it was a compulsory study program at that time. Young residents finish grade 9 or a vocational degree now." H5 (village key informant)

The high erosion area

"When I was a child, I finished grade 4 similar to other residents. I did not learn at a higher level because the school for our village was too far - approximately 20 km for walking the round trip from home to school." H9 (village key informant)

"We finished the low educational qualification and most residents finished grade 4. Now, the younger generation graduated at higher levels at least occupational education levels." 11F (village key informant)

Overall, in the past, many residents in the high erosion area did not study higher levels because schools were far from their villages. Now, most young adults in both areas finish graduated at least grade 9 or with a vocational qualification.

3.7.3 House and land ownership

The data from the questionnaire showed that almost all respondents in both areas owned houses. Only half of respondents in the low erosion area built houses on their land. Meanwhile, a small

number of respondents in the high erosion area owned land. The key informants described information about land ownership and proportion of residents who owned land in their communities.

The low erosion area

"A half of residents have land ownership. The others rent areas for building houses and farming because large areas in villages belong to wealthy landholders." H4 (village key informant)

"After relocating to build this house, I have rented land from the temple. In this village, most residents have rented land from the temple or occupied public spaces for building dwellings so most residents do not own land." 5M (village key informant)

"Most residents own land in a village. Some residents occupy public areas for building houses. Approximately 12-13 households rent temple land for building a house." H7 (village key informant)

Most respondents in village 5 did not own land compared with respondents in villages 4 and 7 because large area in the village 5 was occupied by landholders and some areas belonged to a temple in the village. Therefore, many respondents in the village 5 rented areas from landholders and the temple for building their houses and some respondents built their houses on public space such as banks of a canal.

The high erosion area

"In this village, residents do not own land. All areas are sold out and belong to wealthy landholders even areas in the sea could be sold." H8 (village key informant)

"The land, now, belongs to few residents because many residents sold their area. Over the last 20 years, the land became very expensive. Local residents who owned land sold the land and migrated to live in urban areas." 9M (village key informant)

"There were 177 households in village 8. Presently, there are only 10 households in the village and another 10 household evacuated to rebuild houses in village 9." H9 (village key informant)

"After landholders had bought land from local residents, they did not allow residents to build houses on the land. The residents migrated to other areas because there was no land for them to build houses." H10 (village key informant)

"Residents built their houses on banks of canals because there was no ground or area for building houses." 11M (village key informant)

Most residents in the high erosion area did not own land. Some residents sold land to wealthy landholders and the residents left their villages. Others who were impacted by coastal erosion migrated to live in public spaces or on banks of canals within villages and safer areas (in terms of coastal erosion) in different villages.

3.8 Discussion

It was reasonable to regard respondents from villages in the low erosion area, and respondents from villages in the high erosion area, as belonging to relatively homogeneous population. Park

(1995) pointed out that villagers who were homogeneous had similar ethic, cultural and linguistic characteristics. Ethnicity was relevant to having an identity of beliefs, attitudes and behaviours (Adger et al., 2009; Birkmann & von Teichman, 2010). Respondents who lived within villages 8, 9, 10 and 11 in Laem Fa Pa sub-district had similar socio-demographic characteristics. Almost all respondents in those villages had completed finished a primary school, were fishermen, had low income, spoke in Thai and were Buddhist. Meanwhile, respondents who lived within village 7 in Kalong sub-district and villages 4 and 5 in Nakhok sub-district had similar socio-demographic characteristics. Respondents in those three villages had similar characteristics of occupation; most respondents were fishermen, vender, housewives and factory employees respectively. In terms of an educational qualification, most respondents had completed a primary school level and a secondary school level respectively. In addition, all respondents spoke in Thai and were Buddhist. Therefore for the purposes of this study, the villages were combined to allow one specific population (low erosion area villagers) to be compared with another (high erosion area villagers).

Residents and communities utilised infrastructure and resources to create a capacity to adapt to naturally occurring hazardous impacts (Paton & Johnston, 2006). In the low erosion area, various types of infrastructure and services were built and supported to facilitate local resident action. There were, however, a limited number and type of infrastructure and services in the high erosion area. Streets, and seawalls to prevent coastal erosion, were built in the low erosion area but not the high erosion area.

Transportation infrastructure played a key role in supporting residents of coastal communities wishing to access safe places when there were extreme events, to commute to get jobs and services and to increase educational opportunities for the young (Hallegatte, 2011; World Bank, 2012). All these elements appeared in the study area. In the low erosion areas, streets of access were available to communities and residents who migrated to live outside of their usual habitat; thus the low erosion area received external assistance more readily than the high erosion area where no roads existed.

Residents in the low erosion area also accessed jobs and services in external communities. Residents in almost every household in the low erosion area worked in factories. Residents who were fishermen work in factories when they suffered from low income after catching small yields of sea creatures. Revenue from the fishery was less certain than regular work in the factories.

In the high erosion area, residents had limited occupations available in their community; most were fishermen. The fishermen in the high erosion area had sufficient income from gathering cockles and fishing in their communities. In addition, the fishermen who had good skills in fishing gained a high income. Kishore et al. (2006) conducted research in the Wider Caribbean which showed that in a community where fishing was a major source of household income, male children finishing primary school preferred to work in the same occupation as their elders.

This inferred that the young in the high erosion area tended to rely on natural resources in their communities in the future by being fishermen. This was because those residents had low educational qualification, high fishing skills. Additionally, there was no land based transportation to commute to urban communities.

Residents in the low erosion area finished a higher level of education compared with residents in the high erosion area. A key informant in a high erosion area suggested that residents had lacked opportunity to access appropriate transportation to go school in the past. The water–based transportation available limited the abilities of rural residents to benefit from receiving external assistance, accessing jobs and services, and improving educational qualifications.

Education is one of intrinsic values for increasing economic opportunities of rural communities with a low income status because it helps improve personal abilities to build assets (The World Bank, 2001; Yohe & Tol, 2002). Young residents in the study areas finished higher levels of educational qualification compared with elder residents within their communities. In the low erosion area, for almost every household, members worked in factories to earn a monthly salary. Bardsley and Hugo (2010) studied migration and examined thresholds of change to guide decisions in the adaptation to climate change in Thailand. This revealed that residents in rural communities with low resources tended to migrate to work in factories because they believed they received more income.

Yohe and Tol (2002) suggested that people who had sufficient income could pay for preparation to enable adaptation to extreme events because those with high income status had more revenue and resources to build resilience. Residents in the low erosion area built seawalls to defend residential areas from coastal erosion. Meanwhile, residents in the high erosion area did not sufficiently protect coastal areas, and land in this area had been continuously eroded over the past 30 years. The scientific evidence showed massive areas of land in the communities to have been eroded into the sea. Since 1952 erosion has been greater than a kilometre.

Low income residents were more often impacted by natural hazards compared with those who had high income status due to materials used and the unsafe locations when houses were built (Handmer, 2007). Most houses in the high erosion area were built with local materials which were not able to withstand winds of severe force and storm surges (Norris, et al., 2008). Additionally, those houses were built on the banks of canals because residents could not find appropriate new public areas to rebuild their houses due to large areas being eroded and the sale of land to wealthy landholders. Therefore, respondents in the high erosion area lived in houses built of fragile materials located on hazard prone land where they risked houses-collapse because of strong winds and river bank erosion.

Many residents in both areas sold their land at high prices to wealthy landholders over the past 20 years. Although eroded and potential inundation areas were sold, coastal areas were also in great demand. Jenkins et al. (1999, p. 16) reported that coastal shrimp aquaculture in Thailand

had sharply increased by approximately 21% per year between 1976 and 1991; this resulted in the changing of coastal areas from agricultural land to shrimp farms. In addition, average shrimp yields from farms quickly has surged from 0.45 to 2.81 ton/ha/year since 1987 due to the application of intensive shrimp farming techniques (Jenkins, et al., 1999, p. 16; Szuster, 2006, p. 88). This resulted in increasing the value of shrimp ponds. Other authors argued that the economic development in Thailand accelerated in the 1980s – 90s (Collyns & Senhadji, 2002; Krongkaew, 2002). These authors document the changed price throughout the real estate sector in Thailand which soared because of general growth in the economy (Wong, 2001). The price of house and land was sharply increased with land investors buying large areas of property. Land investors expected the growth in land prices to keep increasing enabling them to profit by selling the land they acquired at the new higher price (Collyns & Senhadji, 2002). Therefore, residents in coastal areas sold their land at high prices.

3.9 Summary

The findings in this chapter had shown that physical characteristics of coastal villages between the two erosion areas were different. Some variables of socio-demographic characteristics in both erosion areas being similar, but other variables were significantly different. Residents in the low erosion area had more types of infrastructure in their communities than residents in the high erosion area, such as streets, schools, temples and strong structures to prevent coastal erosion. No villages in the high erosion area had built streets and firm structures to protect residential areas.

Respondents in both areas had some similar socio-demographic characteristics. Those respondents were mostly male having lived in their communities for a considerable period with a spouse and children. There were significant differences in the two areas in education qualification, occupation, income and land ownership. More respondents in the low erosion area had higher education qualifications, household income, differing types of occupation and land ownership than residents in the high erosion area. Members in almost every household in the low erosion area worked in factories to gain regular revenue because income from their local fishing pursuits was uncertain. Meanwhile, most villagers in the high erosion area received sufficient income by catching marine animals in their villages.

Villagers in the high erosion area lost their land through coastal erosion; many residents sold land to wealthy landholders during the periods of high demand for land; this resulted in a lower proportion of land ownership than did the residents in the low erosion area. Concerning the lack of streets connecting the high erosion area with urban areas, it was apparent that residents had difficulty attaining quality higher education and achieving better opportunities to access jobs and services to increase their income. Road systems were able to alter socio-economic formats of local residents (Flora, et al., 1992).

The findings showed that residents in the high erosion area seemed to be more vulnerable in all aspects which were the concern of this research than residents in the low erosion area. Communities in the low and the high erosion areas were unequally impacted by erosion and had unequal opportunities to mitigate the impacts. In the next section, causes of coastal erosion in both areas were investigated. In addition, the impacts of erosion on individuals, their responses to this erosion, and their perceptions of coastal erosion were examined.

Chapter 4: Impacts and responses to coastal erosion

4.1 Introduction

Extreme impacts of coastal erosion depend on the physical characteristics or resilience of locations and methods applied to mitigate the impacts of this erosion (Köhn & Gowdy, 1999). The methods to prevent coastal erosion are diverse. This chapter presents information of coastal erosion extracted from respondents' opinions, and explores respondents' experiences of impacts and responses to coastal erosion between low and high erosion areas. The findings have been derived from both the questionnaire and in-depth interviews.

In this chapter, the survey data are divided into five sections. In the first section, meanings and major causes of coastal erosion are outlined so as to illustrate respondents' understandings about coastal erosion. In the second section, respondents' experiences of property loss and frequency of loss are described to understand the proportion of respondents impacted by coastal erosion in the past, and the differences in the frequency of the loss between the low and the high erosion areas. The respondents' concern for coastal erosion impacting on their houses is investigated by reporting their views of whether erosion would affect their assets in the future. In the third section, the respondents' interest in improving their knowledge of coastal erosion is investigated; and in the fourth, respondents' behaviour involving coastal erosion issues is explored in order to understand their responses to coastal erosion impacts. The respondents' interest in solving coastal erosion problems in their communities by using different coastal protection strategies is also investigated (see section 4.5). Finally, support from external organisations to address coastal erosion by considering the role, extent of collaboration and extant policy of the organisations is considered.

Data from the in-depth interviews have been included in each section to support and offer different perspectives of the questionnaire results when the results from both approaches deal with the same topics. Other results of the in-depth interview describe details of coastal erosion experiences, responses to the erosion, advantages and disadvantages of the responses, constraints of coastal protection and support from relevant organisations to address erosion.

4.2 Definition and causes of coastal erosion

Respondents were asked an open-ended question to define coastal erosion. Respondents seemed to recognise coastal erosion but they described it using different words. These meanings were divided into three clusters (see Table 4-1). Nine respondents explained the issue of coastal erosion in a long and complicated manner which covered two or more of these clusters. Most respondents described the meaning of coastal erosion as the process of eroding and degrading the coast by being struck with waves and wind.

Table 4-1: The meaning of coastal erosion described by coastal respondents is divided into 3 clusters

Definition of coastal erosion	Frequency of responses
1. The coastline is eroded and degraded being struck by waves and winds.	226
2. Land in a village is replaced by the sea, and could not be reclaimed.	96
3. Sediments and soils are taken from land into the sea.	45
Total	367

From a list of the main causes of coastal erosion gained from the questionnaire, respondents were asked to tick four alternatives according to their understandings and experiences of coastal erosion in the upper Gulf of Thailand. Respondents indicated wave, wind, storm and natural as the major causes (see Table 4-2). Other causes respondents selected were sea level rise, tidal movements, decreased sediment deposition, mangrove area loss, human activity, land subsidence, big ship transportation and water-gate protected flooding at river mouths (see Appendix 4-1). Indeed, respondents understood both natural and human-induced causes of coastal erosion impacted on coastal erosion, but the respondents could select only four major causes which were most relevant to coastal erosion in their area. Most respondents therefore believed that the four natural causes were more relevant to coastal erosion than these other human-induced causes.

Table 4-2: Four major causes of coastal erosion as perceived by respondents

Causes of coastal erosion	Frequency of responses
Wave	356
Wind	351
Storm	249
Natural cause*	170

* 'Natural cause' refers to a cause of coastal erosion in which respondents cannot clearly define a specific cause of nature. In this case, wave, wind and storm are natural.

In the past, the shoreline was covered by mangrove forests, important factors in protecting a coastline from erosion by trapping sediments and forming the coast (Mazda, Magi, Kogo, & Hong, 1997). Over approximately the last 20 years, areas of these forests have been quickly reduced by both human activities and natural causes (Masselink & Hughes, 2003). The activities

stemmed commonly from economic activities such as shrimp farms, dwellings, tourism and factories (Jarupongsakul, 1999). Other causes included rising sea level, land subsidence, low sedimentation and cyclonic activities (Chotiyaputta, 2007).

From the interview, key informants reported that the main causes of coastal erosion in coastal villages were not the result of human activities. This information was related to a study of erosion and rehabilitation of mangroves in the upper Gulf of Thailand which found that wave and wind were causes of coastal erosion by degrading mangrove trees which resulted in the loss of sediment from the coast thereby rapidly increasing the erosion (Winterwerp, Borst, & de Vries, 2005). The daily tidal current was not extreme excluding the cyclone events (Vongvisessomjai, 2006a). The key informants said that:

> *"Causes of coastal erosion are wave, wind and natural disaster rather than other causes." 11F (from a High Erosion Village)*

> *"When there is typhoon (cyclone), the coastline is severely eroded." 4M (from a Low Erosion Village)*

A key informant 5M, who had been affected by flooding every year, said flooding this current year was higher than during the past year, new evidence of flooding being a stain on the wall showing it to be the highest ever recorded. The evidence was supported by the Winterwerp (2005, p. 226) study which showed there was land subsidence of approximately 1 to 2 centimetres per year at a coastline in the upper Gulf of Thailand due to over-withdrawal of groundwater. The key informant said that:

> *"The combination of two main causes, sea level rise and land subsidence, are the main reasons for coastal erosion." 5M (from a Low Erosion Village)*

In addition, human activities such as making aquaculture ponds, cutting mangrove trees, building dams, and widespread construction of strong structures to protect the coastal area were also described by key informants as causes. A key informant in the high erosion area was a shrimp pond owner who related that villagers did not destroy the mangrove forests, but the shrimp farmers had been accused of causing the erosion because the farms were close to the sea.

> *"Everybody understands that a cause of existing erosion is shrimp farmers who cut mangrove forests to build shrimp ponds. It is wrong. Residents use mangrove forest as a buffer zone against waves and residents do not cut the forest. The forest is eroded by strong wave until the erosion reaches shrimp ponds." H9 (from a High Erosion Village)*

This explanation was offered by one national official.

> *"Local residents know how far they build their shrimp ponds from a coastline to protect their ponds from erosion. In the past, the ponds were not close to a shoreline but the coastline was continually eroded to the ponds."*

However, shrimp culture might be a current contributor to coastal erosion, according to the same national official. In culturing shrimp, marine water is drained into the pond at high tide and the water is stored in the ponds before being discharged into the canal at low tide (Tookwinas, 1996). While the water is stored in the ponds, particles settle on the pond floor.

When the water is drained out of the ponds into canals or the sea at low tide, the mass of water cascades with a high velocity and momentum. The water takes particles into the canals and to the coastline into the sea resulting in low sedimentation on the coastline (Tookwinas, 1996).

In addition, a large quantity of sediment in ponds dries before being dug and put into trucks for transportation to land fill at low lying areas where new townhouses are being built. Add to this, mangrove forests had been cut to build aquaculture ponds. The ponds are designed in a rectangular shape with a short one side being closest to the sea causing this pond shape to support coastal erosion (see Figure 4-1). Key informants recognised these issues:

> *"Shrimp farming, now, is the cause of coastal erosion because residents sell sediments in the ponds. The sediments are dried, excavated and put into trucks for transportation to fill up land and build new villages." An official (external organisation key informant)*

> *"Shrimp farming increases coastal erosion rates because at low tide, sea water in the ponds is drained out resulting in increasing a velocity of the water flow." H5 (from a Low Erosion Village)*

> *"In 1992, the government promoted shrimp farming. After that mangrove forests disappeared because every local resident cut mangrove forests to build shrimp farms." NGO (external organisation key informant)*

> *"One man owned shrimp ponds close to a coastline. When there was an accretion close to his ponds and the accretion formed into the sea for 400 metres length, the owner would extend their ponds by digging the accretion area for those 400 metres." 9M (from a High Erosion Village)*

> *"From the satellite images, shrimp ponds can be seen as designed as a rectangular shape. If one side of the pond closed to the sea is eroded, the pond will lose 40 to 50 metres." An official (external organisation key informant)*

Figure 4-1. Aquaculture ponds are a rectangular shape

Source: http://www.google.com retrieved on 5 October, 2011.

H10 who had been living in a village for longer than 50 years, established a small group to protect marine resources along coastal areas. He described the two main causes of coastal erosion as being from external trawlers and internal community activities. The trawlers were fishing boats with nets specially designed to pull and drag trawls along the seabed surface. The trawlers caused adverse impacts on juvenile marine animals and physical impacts on the seabed surface (UN, 2006). In addition, H10 mentioned that human activities were causes of coastal erosion. This information was related to the destruction of mangrove trees from human activities by making charcoal for cooking and for exporting to other countries (Gilman, et al., 2006; Winterwerp, et al., 2005).

> *"Boats with trawl nets damage natural resources by breaking up the mud surface resulting in the increased depth of the sea floor and coastal erosion. ... Residents cut mangrove trees to trade for rice and to make firewood for cooking. Some residents cut mangrove trees to make charcoal for selling." H10 (from a High Erosion Village)*

In the past, sediments were gradually accumulated and accretion of sediment extended into the sea over a very wide area. H11 described the accretion which occurred in his village in the past. Currently the village had no accumulation due to low sediment supply. This experience was supported by an official because severe erosion areas were commonly found in the middle and the east of the upper Gulf of Thailand. Villages in the high erosion area were near the Chao Praya river delta. On the Chao Praya river, two dams, Bhumibol and Sirikit dams, were constructed upstream of the river in 1965 and 1975 respectively resulting in reduction by approximately 75% of (withdrawal of) sediment yields at the river delta after the construction of the dams (Winterwerp, et al., 2005, p. 228).

> *"Accretion does not happen in the same way as the past. When I was a child, the accretion was huge." H11 (from a Low Erosion Village)*

> *"Sediments have disappeared because they are probably stored upstream resulting in increasing coastal erosion in this area."An official (external organisation key informant)*

In addition, the national official indicated that a number of strong structures to prevent coastal erosion in the Gulf of Thailand were one main cause of coastal erosion. This was because the structures transferred coastal erosion to both sides of, and in front of, the structures (Gilman, et al., 2006). In addition, hard structure solutions could affect coastal areas by adjusting to the new equilibrium condition of the coastal area (French, 1997).

> *"The coastline in the Gulf of Thailand is over 2,000 kilometres long. Hard structures were built to prevent coastal erosion. Approximately 80 structures or one structure in every 25 kilometres resulted in increasing coastal erosion in adjacent areas and coastal area with no structure protection." A national official (external organisation key informant)*

In summary, human activities that contributed to coastal erosion included: constructing aquaculture farms; draining water into canals to increase the flow-speed of water; digging sediment from ponds to fill in low lying land for building new villages; cutting mangrove forests to expand shrimp farms and to make charcoal and firewood; expanding aquaculture

ponds by digging from deposit area; designing aquaculture ponds in such a way as to enhance rather than inhibit the erosion; catching shellfish with inappropriate equipment resulting in damage to seabeds and coastline; decreased sediment from upstream; and building a large number of permanent structures in the upper Gulf of Thailand.

4.3 Experience in coastal erosion and adaptation

Respondents living in areas with different degrees of erosion were asked about their experiences with loss of houses and land. Respondents who had experienced property loss were asked about methods they had used to prevent the hazard. The results were summarised and shown in Table 4-3 and Appendix 4-2.

Nearly three-quarters of all survey respondents experienced property loss from coastal erosion (see Table 4-3). Almost all respondents in the high erosion area experienced losses whereas approximately half of the respondents in the low erosion area had experienced losses. When considering the frequency of property loss, 129 respondents in the high erosion area lost their properties more than twice, compared with 14 respondents in the low erosion area. Sriprasertkul (2010) conducted research in the high erosion area and showed that the coastline in this area had been severely eroded by approximately 390 acres between 1984 and 2002 and that during this period most residents had relocated to landward 3-4 times.

Table 4-3: Respondents experiencing impacts of coastal erosion

	Total		**Low erosion area**		**High erosion area**	
	n = 358		*n = 177*		*n = 181*	
Loss of property from coastal erosion						
- Yes	259	73%	90	51%	169	94%
Frequency losses						
- 1 - 2 times	116		76		40	
- More than 2 times	143		14		129	

Socio-economic and demographic factors were examined to determine whether any particular respondents were more vulnerable to property loss. The factors included time of residency, income and land ownership (see Table 4-4).

In the low erosion area, almost all respondents who experienced land loss, lived in communities longer than 10 years. Half of respondents who lost land were fishermen and one fifth of respondents were sellers. Most respondents who lost land had low educational qualifications. More respondents who had lost land had higher incomes and owned land than respondents who had not lost their land.

In the high erosion area, most respondents who experienced land loss had also lived in communities for a long time. Most respondents in the high erosion area who lost land had a low educational qualification, a low income, and did not own land (see Table 4-4).

Table 4-4: Factors influenced property loss (n = 259)

Socio-demographic information of respondents	Low erosion area				High erosion area			
	No experience of land loss *n* = 87		Land loss *n* = 90		No experience of land loss *n* = 12		Land loss *n* = 169	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Time of residency								
– within 10 years	12	14%	2	2%	6	50%	10	6%
– Over 10 years	75	86%	88	98%	6	50%	159	94%
Employment								
– Fishermen	51	59%	47	52%	10	88%	151	89%
– Vendors	13	15%	18	20%	-	-	9	5%
– Housewives	8	9%	7	8%	1	8%	6	4%
– Employees	11	13%	12	13%	-	-	-	-
Education								
– Low education	68	78%	75	83%	7	58%	156	92%
– High education	19	22%	15	17%	5	42%	13	8%
Income								
– Low income	46	53%	38	42%	7	58%	114	68%
– High income	41	47%	52	58%	5	42%	54	32%
Land ownership								
– Not owned land*	41	47%	39	43%	9	75%	153	91%
– Owned land	46	53%	51	57%	3	25%	16	9%

* Respondents did not own land due at the time of the questionnaire.

In the low erosion area, key informants explained impacts of coastal erosion in villages in terms of the physical environment and land loss:

> *"Since I grew up, the coastal area had been eroded by approximately 200 metres. ... In the past, this school was offshore and it has been relocated once already." H7 (village key informant)*

> *"My previous house was close to the coastline. When the coastline eroded, I migrated to rebuild a house in an area far from the sea, as did other residents." H5 (village key informant)*

> *"Some residents move to live beyond the village because less land remains. There is insufficient area to build houses." 7F (village key informant)*

In the high erosion area, the impact of coastal erosion was more extreme. Some key informants explained that the coastline that had been eroded by more than a kilometre, lost aquaculture

farms and other areas amounting to approximately 32 square kilometres (20,000 Rais) in the past 30 years. These severe disruptions caused evacuations to more distant villages, so fewer households remain. Often this was a function of being able to afford distant relocation. Some respondents had to rent another area for farming.

> *"During my childhood, I walked for a kilometre from my house to the coastline. At that time, accretion to form the beach could occur. Now, it is only erosion, and the coastline is in front of my house." 9M (village key informant)*

> *"A huge area is eroded resulting in loss of a large number of households. Thirty years ago, more than 100 households were in the village. Now, less than 10 households remain." H8 (village key informant)*

> *"When the coastline eroded, tens of households migrated inland. ... Having earned sufficient money, they have to pay for removing and rebuilding houses. Residents often relocate. Then they build their houses on banks of canals or rented other areas" H9 (village key informant)*

> *"Mangrove forests and shrimp ponds have lost a total of more than 20,000 Rais in 20 years." H10*

> *"After land erodes, some residents can afford to migrate to live outside a village. The rich always move out, but the poor still live in the village. If some residents own land, they have to live in the village." M10 (village key informant)*

> *"Some residents live in this village but they rent other ponds for farming because their own area erodes." H11 (village key informant)*

4.3.1 Property protection

The 259 respondents who experienced loss of property were asked whether they built structures to prevent coastal erosion, and if so, what method they applied to prevent future erosion. In the semi-structured interview, key informants were also asked about the advantages and disadvantages of coastal protection and the constraints of coastal protection.

Forty eight of 259 respondents who were impacted by coastal erosion in both areas had protected their properties. Twenty one of 90 respondents in the low erosion area built some infrastructure to protect the coastal area compared with 27 of 169 respondents in the high erosion area (see Table 4-5). In both areas, most respondents placed rocks to protect the coastal area. Nineteen of 21 respondents placed rocks in the low erosion area compared with 14 of 27 respondents in the high erosion area.

Twelve of 27 respondents built infrastructure in the high erosion area by embedding bamboo stems on the seabed offshore. Only two respondents built infrastructure by planting mangrove trees in the low erosion area and a respondent built a seawall in the high erosion area.

Table 4-5: Respondents who experienced coastal erosion impacts and who had sought to prevent property losses

	Total *n = 259*	**Low erosion area** *n = 90*	**High erosion area** *n = 169*
Do you protect the property?			
• Yes	48 (18% of 259)	21 (23% of 90)	27 (16% of 169)
Methods to protect the property			
• Rock placement	33 (69% of 48)	19 (90% of 21)	14 (52% of 27)
• Embedding bamboo stems	12 (25% of 48)	-	12 (44% of 27)
• Planting vegetation	2 (4% of 48)	2 (10% of 21)	-
• Seawall	1 (2% of 48)	-	1 (4% of 27)

In the past in the low erosion area, the coastal area fluctuated between erosion and accretion; respondents did not build structures to protect coastal area. Since then the coastal area has been continuously lost. Initially local respondents protected their coastal area themselves, but several years later local governments built some infrastructure to prevent coastal erosion. This change was narrated by key informants from both areas, and also key informants from organisations.

In the low erosion area, all key informants outlined there to be no coastal protection over 20 years ago. The government started placing rocks in shallow seashore areas approximately 15 years ago. After that, rock placement was the common method applied due to support from the local government. Seawalls were built to protect residential areas in every coastal village several years ago.

> *"In the past 20 years, land owners themselves invested in placing rocks. Only some land owners could afford maintenance costs. Whoever had sufficient budget would invest the maintenance costs; without it they stopped protecting the coast." H5 (village key informant)*

> *"The government had not supported any structure in the past so the coastal area was continuously eroded. In 1996, the government supported rock placement easing the erosion. Last year, a sand tube was installed." 7M (village key informant)*

> *"Last decade, big rocks were placed along a coastline but rock structures had fallen within a year, and protected the coastline for approximately only 3 years because of strong waves. ... We, now, have a seawall breakwater to protect the residential area." 4F (village key informant)*

> *"The cabinet committee of the local government has no problems to approve funding for the coastal villages to place big rocks. It was necessary to mitigate residential problems." A local official (external organisation key informant)*

In the high erosion area, most respondents losing property did not protect their property and one key informant described reasons for this (8M).

> *"When the coastline erodes and reaches my house, I start migrating. I let the house collapse. I don't know how to prevent the erosion nor how much money to spend." 8M (village key informant)*

The local government for these villages with high erosion provided limited support for coastal protection. Some wealthy landowners bought land in the villages and protected their land by applying rock placement.

> *"Our organisation gets little income from revenue and the revenue is not sufficient to build coastal protection for every coastal village." An official (external organisation key informant)*

> *"One rich landowner bought farms close to the primary school and placed rocks approximately 100 trips of ship. The rock structure was frequently maintained. Without the rocks near the school, the school might be damaged." 9M (village key informant)*

In addition, some respondents protected their areas by placing rocks and embedding bamboo stems to mitigate wave energy.

> *"Respondents prevent coastal erosion themselves by placing rocks and embedding bamboo stems. It is very important to succeed at mitigating wave energy and protecting coastal areas. Firstly, we have to try to stop the erosion." H11 (village key informant)*

For the coastal area close to a temple in one village, embedding triangular concrete poles were embedded to mitigate wave energy; the project was designed and implemented by scientists. The triangular concrete poles gave positive results by increasing accretion, and the number and type of marine life between the poles and the coastline.

> *"Triangular concrete poles to mitigate wave energy designed by the university show positive results because sediments sink behind the poles. Many types of marine creatures live in this coastal habitat and mangrove trees grow gradually." 9F (village key informant)*

4.3.2 Advantages and disadvantages of structures

Key informants described experiences of coastal protection in their communities, particularly around the advantages and the disadvantages of 6 main structures: sand tubes, seawalls, rock placement, embedded electric poles, embedded bamboo stems and planted vegetation. As discussed earlier, the sand tubes had been installed by the national government in one village and seawalls had been established in every coastal village in the low erosion area (section 3.2).

Sand tubes

A sand tube is a long geo-textile tube filled with sand (Liu & Silvester, 1977; Restall, Jackson, Heerten, & Hornsey, 2002) (see Figure 4-2). It is designed to protect coastal areas but key informants detailed many problems.

> *"Sand tubes mitigate some pressure of strong waves but they obstruct boat routes of fishermen who catch fish at night. The fishermen cannot see them and hit them."H7 (village key informant)*

> *"Sand tubes are very heavy and they are installed in mud areas without a foundation so sand tubes sink in the mud. Sea water, then, flows over at high tide. ... The geo-textile tubes are wet and dry many times a day and are colonised by a large number of marine borers which are sharp so that the tubes are easily torn." A provincial official (external organisation key informant)*

> *"Cockles collected from nearby the broken sand tubes sell for less. No one wants to buy cockles from our village due to small size and mixed sand inside the shells." 7M (village key informant)*

Two heads of villages and respondents from villages in a high erosion area were asked by the government to install geo-textile tubes to prevent coastal erosion. They denied the support with reasons:

> *"No. No. If sand tubes were broken, the environment would be badly deteriorated. Local residents cannot catch marine animals at this coastline. They have to seek marine creatures in other areas." H10 (village key informant)*

> *"The coastal area is like our supermarket. If sand tubes were installed, we would suffer from starvation. We do not want this method." H9 (village key informant)*

Figure 4-2. Sand tubes were installed in a low erosion village.

Rock placement

Rock placement had been a common method to protect the coast from erosion in both areas. It was considered a costly method because it needed to be maintained every year. All coastal villages had experience in applying rock placement but it was not successful in preventing coastal erosion in a muddy coast (see Figure 4-3). A few key informants explained the reasons why rock placement was inappropriate in this area.

> *"Rock structures often need to be fixed. If rock structures were not fixed, they would fall and sink in mud layers resulting in ineffectiveness. It seems to waste government budget." H4 (from a Low Erosion Village)*

> *"If you place stone in this area, we have to destroy mountains or degrade other natural resources." H9 (from a High Erosion Village)*

> *"If most local respondents have a coastal erosion problem, they will firstly place rocks to prevent the erosion. ... The respondents do not understand that the bottom of the sea is mud, and it is soft. Rocks are heavy. The rock walls will collapse." A national official (external organisation key informant)*

Figure 4-3. Rocks placed offshore to protect coastal area where they had fallen and collapsed.

Seawall

Seawall breakwaters were solid structures to prevent coastal erosion (see Figure 4-4). Seawall breakwaters completely prevented residential areas from coastal erosion but they were considered expensive by key informants. One head of a village explained that the areas next to the end of the seawall were more severely eroded. This evidence was related to the view of one provincial official describing the impacts of hard structures on neighbouring areas. In addition, the seawall was unsuitable to build in mud area because it easily collapsed after a short period of time.

> *"When waves strike the structure, force will be transferred to left and right sides of the structure. Neighbouring areas in the end of both sides will be eroded more severely." An official (external organisation key informant)*

> *"It is difficult to build a big seawall in mud coast because the foundation is soft and easy to drift." 9F (from a High Erosion Village)*

Figure 4-4. A seawall in the low erosion area

Embedded concrete poles and triangular concrete poles

As described above, triangular concrete poles embedded in the sea bed offshore were a method to mitigate wave energy. They were designed by a group of scientists from the university to test the capacity of equipment to prevent coastal erosion (see Figure 4-5). One head of village and one key informant supported the scientists' project, describing results which showed high sedimentation and increased numbers and types of marine life between the lines of the poles and the coastline; they believed the structure to be useful to protect their coastline. However, the method was expensive and poles needed to be embedded by machinery.

> *"The force of sea water will decrease after passing through the structure. The solid substances taken by the water will be settled behind the structure. Many marine species come and live behind the structure due to starting increasing sediments and growing mangrove trees." 9F (from a High Erosion Village)*

> *"After installing the structure, local fishermen catch more yields of marine creatures." H9 (from a High Erosion Village)*

> *"It is an expensive method and the concrete poles cannot be embedded in the seabed by people alone. The poles need to be transported and embedded by a ship with a crane." 9M (from a High Erosion Village)*

Figure 4-5. Embedded triangular poles in the sea bed offshore to protect coastal area

Embedded bamboo stems

Local respondents embedded bamboo stems in the seabed offshore to protect a coastline. Bamboo stem was an economical material bought from neighbouring provinces. The respondents often applied a thin bamboo stem *(Thyrsostachys siamensis)* (Japan International Research Center for Agricultural Sciences, 2010) and embedded the stems as a single line offshore. The method, therefore, did little to mitigate impacts of coastal erosion but it was used by local villagers

particularly in the high erosion area. The method was regarded as unsuccessful because the bamboo stem was easily broken (see Figure 4-6).

> *"Embedding bamboo stems aims to mitigate wave energy and it protects coastal area. The technique is inexpensive and able to be implemented by local villagers." H11 (from a High Erosion Village)*

> *"Embedding bamboo stems offshore has a short lifespan project of approximately 2 years. They will be completely torn or decayed because bamboo is not a durable material. The bamboo stems are thin and all bamboo stems will break and float off. Then bamboo stumps will cut villagers' legs while they are catching fish and other marine life." H9 (from a High Erosion Village)*

Figure 4-6. Bamboo stems were decayed and broken.

Planting vegetation

The findings from a study of coastal erosion and mangrove in the Gulf of Thailand illustrated that the coastal area without mangroves had more severe impacts from exposure to coastal erosion than the coastal area with mangroves (Thampanya, et al., 2006). The study reported that erosion rates and mangrove area losses were increased in the area with the expansion of shrimp farms. It was found that planting mangrove was an alternative for local respondents but local respondents needed to have knowledge and skills to implement this method (Field, 1999).

Planting mangrove on its own had been applied by only two respondents in the low erosion area but this method was unsuccessful in protecting the coastal area. In the high erosion area, 9M and 11M described their experiences in planting vegetation when students and volunteers came to their villages and planted mangroves at unused shrimp farms. In addition, young mangrove needed to be protected at high tide. The mangrove grew well when there were enough soil layers (see Figure 4-7).

"There are strong waves. Wave energy mitigation is necessary to settle particles. If soil layers are compacted and high enough, we can plant mangrove." 11M (from a High Erosion Village)

"When a high tide comes up, mangrove trees cannot hold out against wave energy. Lots of mangrove trees a metre high are put along the coast one day, when we come back and look the next day, only a few remain. They are gone. So we put a stick for each tree and tightened them with ropes. The sticks and trees cannot hold against the wave energy and they all float off." 9M (from a High Erosion Village)

Figure 4-7. Planting mangroves in coastal area

Embedded bamboo stems and planted vegetation

The combination of two methods embedding bamboo and planting vegetation had been applied to prevent coastal erosion in Samut Sakorn province since 2005. One NGO informant and colleagues applied thick bamboo stems, *Dendrocalamus asper* (Malanit, 2009) embedding them in the seabed offshore. The key informant took thick bamboo stems from other local villages where local people planted bamboo to collect bamboo shoots for their income. The people cleared a clump of bamboo stems by cutting some mature bamboo stems out every year to allow young bamboo stems and bamboo shoots grow up.

Embedding thick bamboo stems was implemented. The NGO informant described the advantage of embedding thick bamboo stems (see Figure 4-8).

"We use 'Pai Tong' which is a thick bamboo stem. It is at least 3 inches diameter. ... Pai Tong is used and lasts three to five years before breaking. In that time, we can get a build-up of layers of sediment and mangrove trees will be established." NGO (external organisation key informant)

These methods had been promoted and disseminated by an NGO and a regional government to their networks along the coastline in the upper Gulf Thailand. Support for this method was widespread among the officials who were interviewed:

Figure 4-8. Bamboo stems were embedded in the sea floor to protect coastal areas

Source: The Coastal Conservation Networks in the upper Gulf of Thailand, 2010

"Embedding bamboo is applied to absorb wave and wind energy and increase sedimentation behind the bamboo lines. We, next, grow mangrove trees on the accretion." A provincial official (external organisation key informant)

"We promote embedding bamboo to mitigate wave energy and knowledge of planting to coastal communities which are our networks in the upper Gulf of Thailand." A regional official (external organisation key informant)

"Fishermen respond that more marine life appears after embedding bamboo stems and planting vegetation. In fact, there is a story of Bryde's whales often appearing around these areas. It means the area has good water quality and abundant food." A provincial official (external organisation key informant)

"The idea of the project not only addresses coastal erosion but also improves quality of life for local respondents to get higher income from marine life." A national official (external organisation key informant)

4.4 Key informants' views about future coastal erosion

Respondents were asked to predict whether they were likely to be affected by erosion in the future, and if so the period of time for which they would be affected. The results are shown in Table 4-6.

Most respondents in both areas indicated they might be impacted by erosion in the future. Nearly all respondents in the high erosion area expected to be impacted by erosion compared with half the respondents in the low erosion area. Eighty five per cent of respondents in the high erosion area predicted to be affected by erosion in the next 10 years compared with 62% in the low erosion area. In addition, 15% of respondents in the high erosion area predicted they would be affected by erosion over the next 10 years compared with 38% of 90 respondents in the low erosion area (see Table 4-6).

Table 4-6: Respondents views on whether they would be impacted by coastal erosion in the future

	Low erosion area *n = 177*		High erosion area *n = 181*	
Predict to be affected by coastal erosion				
- Yes	90	(51% of 177)	175	(97% of 188)
Timeframe for impacts				
-in the next 10 years	56	(62% of 90)	149	(85% of 175)
-over the next 10 years	34	(38% of 90)	26	(15% of 175)

From the semi-structured interviews, key informants in both areas predicted the impacts of the erosion on their villages based on existing structure protections. A key informant living in the village in the high erosion area for almost 60 years understood the severe impacts of coastal erosion on his village, having witnessed it for 30 years. He predicted the impacts of the erosion.

> *"The federal government has ignored a coastal erosion problem for long periods. Land is singularly eroded now. If the government does not support, all areas in our village will be in the sea within a decade." 9M (village key informant)*

In the low erosion area, seawalls were constructed to protect residential areas. All key informants believed that they would not be affected by the erosion within the next 10 years or shorter. A key informant living close to the seawall was unsure that the seawall could act against the sea waves for long time periods.

> *"Every day, the thing that scares me is that the seawall is not strong enough to protect against sea waves. If there were extreme high waves, the sea wall would be damaged." 5F (from a Low Erosion Village)*

In summary, almost all villagers in the high erosion areas predicted they would be impacted by the erosion compared with only a half of villagers in the low erosion area (see Table 4-6). Most of those in both areas believed they would be impacted within a decade. Key informants in the high erosion area needed action from governmental organisations before areas in the villages erode. When there were extreme events and strong winds with high tides, the coastline, shrimp farms and coastal infrastructure were exposed to coastal erosion.

4.5 Respondents' interest in coastal erosion issues

Respondents were asked about their level of interest in the impacts of coastal erosion and coastal protection in their villages and these data were analysed, according to a) the location of respondents' houses and distance from the coastline with or without the coastal protection and, b) whether the respondents experienced property loss or relocation because of erosion. They were also asked about their daily activities which involve talking about coastal erosion and coastal protection with other villagers; listening to others talking about coastal protection issues; and participating in training programs and planting vegetation. Results are shown in Table 4-7, 4-8 and 4-9 (Appendix 4-3).

A review of Table 4-7, shows nearly all respondents in the high erosion area talked about coastal erosion with other respondents in villages and listened to people talking about activities to protect the coastal area, compared with 63% and 62% respectively of respondents in the low erosion area. Approximately four-fifths of respondents in the high erosion area talked about their experiences in coastal protection compared with half of the respondents in the low erosion area (see Table 4-7). More than half of respondents in the high erosion area participated in training programs to improve coastal erosion knowledge and participated in planting vegetation respectively, whereas a low percentage of respondents in the low erosion area participated in those activities.

Table 4-7: Level of interest of respondents in impacts of coastal erosion

Issues	**Coastal Erosion Areas**		
	Total *n= 358*	**Low** *n= 177*	**High** *n= 181*
1. Respondents talk about coastal erosion with others in villages	289 (81%)	111 (63%)	178 (98%)
2. Respondents listen to others talking about activities to protect coastal area	281 (78%)	109 (62%)	172 (95%)
3. Respondents talk about experiences in coastal protection to others	241 (67%)	94 (53%)	147 (81%)
4. Respondents participate in training programs in coastal erosion	128 (36%)	29 (16%)	99 (55%)
5. Respondents participate in planting vegetation	169 (47%)	73 (41%)	96 (53%)

In addition, respondents were asked about their level of interest in coastal erosion and protection issues in their villages (see Table 4-8; Appendix 4-3). Villagers in the high erosion area displayed a higher level of interest in coastal protection than villagers in the low erosion area. Significantly, more villagers in the high erosion area knew persons providing information about causes and protection methods of coastal erosion than villagers in the low erosion area - the first statement (χ^2 = 40.825, df = 1, p <0.05), and the second statement (χ^2 = 39.450, df = 1, p <0.05).

Table 4-8: Respondents' level of interest in coastal erosion and protection issues

Statements	Low erosion area *n = 177*		High erosion area *n = 181*		x^2-test p, *level of significance*
	Does not select agree	Agree	Does not select agree	Agree	
1.Know persons who can provide information about causes of coastal erosion.	127 (72%)	50 (28%)	69 (38%)	112 (62%)	0.00*
2.Know persons who can provide information about coastal protection.	126 (71%)	51 (29%)	69 (38%)	112 (62%)	0.00*
3.Planting vegetation is a famous method to protect a coastline.	50 (28%)	127 (72%)	29 (16%)	152 (84%)	0.01*
4.Community leaders are interested in coastal protection.	33 (19%)	144 (81%)	4 (2%)	177 (98%)	0.00*
5.Local government makes an effort to support coastal protection.	40 (23%)	137 (77%)	28 (15%)	153 (85%)	0.09
6.A coastline in the village is sufficiently protected.	160 (90%)	17 (10%)	181 (100%)	0 (0%)	0.00*

Strongly disagree, disagree, neutral and strongly agree, agree were combined for analysis.

Almost all key informants in the low erosion area did not participate in training courses related to coastal protection. From their experience in coastal protection, they often placed rocks offshore as a rock-wall. Sunken and collapsed rock walls were applied to be the fundamental base for a new seawall to be built. Community leaders were annually designated funding to repair the seawall by the local authority. 5M reported that his village always applied for funding to add rocks or maintain a seawall in a village without training programs about coastal protection.

> *"No organisations have arranged training programs about coastal protection for our village. We organise meetings to look for the method to prevent the erosion by ourselves before applying annual funding to the local authority." 5M (from a Low Erosion Village)*

In the high erosion area, community leaders always participated in meetings and training courses about coastal erosion, coastal protection and other community issues organised by governmental organisations. The leaders transferred the information to their respondents at community meetings when they occurred. The leaders seemed to have more knowledge and understanding about coastal erosion and coastal protection than others. 11F described how her community leaders gained and shared knowledge with the respondents.

> *"Cabinet members and a village head receive information of coastal erosion from various organisations. They gain more knowledge. When organising meetings, they distribute the information to local villagers." 11F (village key informant)*

Respondents in the high erosion area received information about coastal erosion and coastal protection from their leaders when attending meetings. Therefore, respondents in the high erosion area knew persons in their villages who provided the information to them.

Regarding planting mangroves in villages, significantly more respondents in the high erosion area believed that planting mangrove was the most well-known method to protect coastal area compared to respondents in the low erosion area ($\chi^2 = 7.779$, df = 1, $p < 0.05$).

Not only were local residents interested in planting mangroves but so were other civic groups from external communities. All key informants in both areas agreed that growing mangroves was important to protect coastal areas. In the low erosion area, only relatively few local respondents occasionally participated in the activities when external people visited and grew mangroves. 7F described planting vegetation activities in a village.

> *"Students from outside sometimes come in the village and grow mangrove. A small number of villagers who are available participate in the activities." 7F (from a Low Erosion Village)*

In the high erosion area, most respondents often grew mangroves in villages. H11, a head of village, often applied for funding from other organisations to buy bamboo stems to create accretion before planting mangroves in collaboration with local residents. He concluded the method used was successful when planting vegetation.

> *"Some organisations are able to support our village. They provide bamboo stems to embed in the seabed offshore to mitigate wave energy and increase sedimentation behind the bamboo stems. Then we grow young mangroves." H11 (from a High Erosion Village)*

For the question concerning leaders' interest in coastal protection, significantly more villagers in the high erosion area believed that their leaders were interested in coastal protection issue than villagers in the low erosion area ($\chi^2 = 26.081$, df = 1, $p < 0.05$).

Results from key informants showed that leaders in both areas were interested in coastal protection issues. From the low erosion area, 7M described the interest of a village head in coastal protection by planting mangroves in a village.

> *"A village head introduces villagers to grow mangrove trees to protect coastal area but the villagers do not collaborate with planting activity. The village head cannot do anything." 7M (village key informant)*

In a high erosion area, 10F described the leaders in villages 9 and 10 as being interested in coastal protection by seeking help from external organisations.

> *"Village heads made an effort to seek help by sending documents to various responsible organisations but no organisations provided support." 10F (from a High Erosion Village)*

From both sources of information, community leaders in both areas were similarly interested in solving the coastal erosion problems in their villages. Significantly more respondents in the low erosion area agreed that the coastline was sufficiently protected from impacts of coastal erosion

than villagers in the high erosion area (χ^2 = 18.251, df = 1, p < 0.05). The results from the interview revealed that key informants in the low erosion area received budgets to maintain structures to prevent coastal erosion so they were perhaps not worried about impacts of the erosion. Meanwhile, all key informants in the high erosion area had not received support from the government to protect the coastline. They sought support from external organisations but the resources received from external organisations were not enough to prevent the coastline eroding.

In the low erosion area, 4F informed that

> *"I think that coastal erosion is not the major problem in our village because we have the seawall and receive funding to fix the seawall annually." 4F (village key informant)*

H9 expressed an opinion about insufficient coastal protection in communities in the high erosion area:

> *"Coastal villages in Laem Fa Pa subdistrict are going to be ruined and deleted from the map of Thailand." H9 (village key informant)*

Coastal erosion was a critical issue for the communities. Respondents were also interviewed to investigate their interests in coastal erosion issues, and asked whether they were interested in improving coastal erosion knowledge (see Table 4-9; Appendix 4-3).

Table 4-9: Respondents' interest in improving knowledge of coastal erosion issues

Issues	Coastal Erosion Areas		
	Total *n= 358*	**LEA** *n= 177*	**HEA** *n= 181*
- Interest in improving coastal erosion knowledge	288 (81%)	110 (63%)	178 (99%)
Interested to improve coastal erosion knowledge			
-Strongly agree	189	66	123
Interested to improve coastal protection knowledge			
-Strongly agree	190	66	124

Almost all respondents in the high erosion area were interested in improving knowledge about coastal erosion issues compared with about two third of the respondents in the low erosion area. Most respondents who were interested in improving their knowledge indicated they were strongly interested in information about causes of coastal erosion and methods to prevent the erosion.

4.6 Constraints affecting coastal protection

Key informants in the high erosion area experienced collaboration with external organisations to support the infrastructure needed to protect coastal areas. The key informants encountered various problems that impeded the building of structures to prevent coastal erosion such as: lack

of funding and support from local authorities; dishonesty in construction; ignorance of the real causes of coastal erosion; lack of land ownership; collaboration problems among groups or organisations; dealing with the causes of coastal erosion; and strategic plans emanating from the provincial level rather than from the local level:

> *"We have fewer budgets to develop infrastructure in every village because nearly half of revenue is paid for officials' salary." A local official (external organisation key informant)*
>
> *"The company which won the tender to build a coastal protection structure should have transported big rocks in approximately four fully loaded ships and 10,000 thick bamboo stems. In practice, the company only made two trips by boat, by dividing one fully loaded ship into two half loaded ships. In addition, only 1000 bamboo stems were embedded into the seabed. ... If the company applied all materials as per their tender, the structure would work properly against the erosion. The structure would benefit the next generation, but didn't. They were dishonest." A Leader*
>
> *"The responsible organisations have not visited our village to acknowledge the correct problems how low and high tides are? The solutions to solve coastal erosion are not correct. When governments conduct research or meeting, local villagers have little chance to participate in public involvement." A villager (village key informant)*
>
> *"Land issue is a problem because I do not know whether a wealthy landowner allows us to embed bamboo in his land" A villager (village key informant)*
>
> *"Different political parties impact on receiving budget. Sometimes a premier and a head of a village are in different political parties. It is difficult for them to work together." A local official (external organisation key informant)*
>
> *"Nowadays, coastal erosion cannot be addressed because the causes of the problem are national but not local levels. Coastal erosion is caused from other places or sediment was decreased due to dam construction upstream." An official (external organisation key informant)*
>
> *"The central government responsible for coastal prevention installed sand tubes along the coastline approximately 9 km. without any cooperation with provincial organisations. This is a repetition of coastal protection whereas the provincial policies focus on embedding bamboo stems to mitigate wave energy." An official (external organisation key informant)*
>
> *"Implementation projects in a provincial level depend on the provincial governor. If the governor is changed, the provincial strategy will be changed. It does not tell what projects will be continuously done in the future. If the new governor disagrees with projects, the projects will be stopped." An official (external organisation key informant)*

4.7 Support from organisations to address coastal erosion

Coastal villagers applied for funding from their local authorities to develop infrastructure and address environmental issues. If the local authorities believed the projects were necessary and they had sufficient budget, they would allocate funds to coastal villages. If the local authorities had no revenue, the local authorities needed to cooperate with other governmental organisations such as provincial, regional and federal government organisations which had the capacity to provide budget support, equipment and knowledge. Organisations relied on different authorities, roles and other potential supporters.

Governmental organisations from local to national levels had different roles to support coastal communities to address coastal erosion problems.

"Funding is allocated to place big rocks. Local villagers have placed rocks for many years. They address their problems by themselves." A local official (external organisation key informant)

"We only encourage and support other organisations to receive budget for managing coastal protection projects." A provincial official (external organisation key informant)

"We promote coastal villagers to become involved in networks and to have knowledge of coastal conservation laws." A regional official (external organisation key informant)

"The office has started working in addressing coastal erosion for two years. In the past, the office had promoted the embedding of bamboo stem technique to grow mangrove forest and had not coped with the erosion. Therefore, experiences in managing coastal erosion are low due to lack of data, specialists and clear policies." A national official (external organisation key informant)

"Finding severe erosion in residential areas, we need to build some types of structure to prevent the erosion. We will not conduct a Feasibility Study of the project but we will study Detail Designs. In some cases, if a situation is ambiguous, we will firstly conduct Feasibility Study of the project." A national official (external organisation key informant)

4.8 Discussion

Respondents in the low and the high erosion area similarly described causes of coastal erosion, but they had different practices for coastal protection. In this section, causes of coastal erosion, impacts of coastal erosion, methods to protect coastal areas and perception of coastal erosion were discussed in the context of environmental issues and management in coastal areas.

Although respondents illustrated that waves and winds were main causes of coastal erosion, other causes were mentioned. Approximately 33% of respondents believed that sea level rise and land subsidence were causes of coastal erosion in both coastal areas. In the upper Gulf of Thailand, sea levels were reported to be rising approximately 0.25 cm per year (Fuchs, 2010, p. 2), whereas the projection of sea level rise worldwide was between 0.18 and 0.59 metre by 2100 (IPCC, 2007, p. 820). Additionally, land subsidence rates at some locations in Bangkok between 1978 and 1981 were approximately 10 cm/year (Jarupongsakul, Chaimanee, & Suphawajruksakul, 2004, p. 37; Phien-wej, Giao, & Nutalaya, 2006). This was because groundwater pumping from wells had been over-used in Bangkok and surrounding areas for municipal and industrial development (Sabhasri & Suwarnarat, 1996; Syvitski, 2008). After the government launched the measure to mitigate land subsidence by controlling groundwater withdrawal, land subsidence still occurred but at only 3.8 cm/year between 1992 and 2000; whereas in the coastal areas subsidence was about 1 to 2 cm/year (Winterwerp, et al., 2005, p. 226). Therefore, sea level rise and land subsidence were significant factors affecting erosion at the coast.

A lower percentage of respondents felt that mangrove area loss was a significant factor in coastal erosion because mangroves helped trap sediment and protect coastal areas against storm damage (McLeod & Salm, 2006). In coastal communities, mangroves were cut to build shrimp ponds and make charcoal as firewood for cooking; this resulted in accelerated coastal erosion due to an absence of mangrove roots to bind sediment and resist erosion (European Commission, 2004). Barbier (2007) found from the study of the livelihoods in coastal

households that those on the coast exploited mangrove forests. After the government promoted shrimp farming, the price of shrimp per kilogram increased thereby encouraging many respondents in coastal areas to cut mangroves for building shrimp ponds (E. B. Barbier, 2006). Approximately 9,000 tons of shrimps were harvested in 1979 across the country whereas the harvest surged to 200,000 tons in 1993, causing destruction of coastal mangroves (Dierberg & Kiattisimkul, 1996, p. 650). Mangrove forests were dramatically decreased by approximately 32% between 1979 and 1996 due to the building of shrimp farms across the coastal areas of Thailand (Dierberg & Kiattisimkul, 1996, p. 653; Jenkins, et al., 1999). Saito (2001) and Winterwerp et al. (2005) suggested that mangrove forest destruction accelerated coastal erosion. Therefore, mangrove forest loss could be a significant cause of coastal erosion.

In addition, sediment supply was another main cause of coastal erosion. For example, sediment supply carried down by rivers to the delta had decreased due to the low level of runoff from the dam constructed upstream (French, 1997). The amount of sediment deposited along the delta and the contiguous shoreline was less than the earlier period (Bird, 2000; French, 1997; Sabhasri & Suwarnarat, 1996). After two big dams were operated upstream of the Chao Praya River approximately 40 years ago, the sediment yields from the river were decreased significantly by about 75% (Winterwerp, et al., 2005, p. 226). Similarly, approximately 50% of total sediment reduction of the downstream river system was experienced in the Red River Delta, Vietnam between 1979 and 1994 after the hydropower dam upstream began operation (Mai, Stive, & Van Gelder, 2009). Therefore, it could be concluded that dam construction upstream affected new sediment in the Chao Praya Delta River resulting in increased coastal erosion.

Decreasing new sediment yields of deposit to the inundated area was clearly one significant cause of the many potential ill-defined and ill delineated causes of coastal erosion. The erosion threat could happen because of interactions between the various causes of the erosion found in the great deltas across the world. Such causes would certainly include: sea level rise, land subsidence and sedimentation depletion (Ericson, Vörösmarty, Dingman, Ward, & Meybeck, 2006). Similarly, Fuchs (2010) found that major causes of coastal hazards in cities in Asia were sea level change and land subsidence. Additionally, the World Bank (2007) reported the main reasons of coastal erosion in the upper Gulf of Thailand were mangrove deterioration, sediment supply reduction, land subsidence and rising sea level.

A large number of strong structures to protect coastal erosion built across the Gulf of Thailand were possible causes of coastal erosion. The study by Feng et al. (2009) indicated that a large number of solidly engineered solutions caused coastal retreat because they blocked coastal sediment transportation and changed local water circulation. When waves were broken on these structures, wave axis direction was changed resulting in coastal morphological alteration so the accretion and the erosion were deposited in the adjacent area (European Commission, 2004; French, 1997; Xeidakis, et al., 2007). The results were closely linked to Vandas' conclusion

(1998) that after solid structures were constructed, coastal environments continually altered, seeking to keep equilibrium from the impact of natural change and human intervention.

Solid structures were constructed to prevent residential areas in three coastal villages in the low erosion area from environmental degradation by building seawalls and sand tubes. The seawalls protected land from falling into the sea, but the seawalls created wave action downward to the seabed resulting in accelerating coastal erosion in front of the seawalls (Committee on Mitigating Shore Erosion along Sheltered Coasts, 2007; European Commission, 2004). The seawalls needed to be repaired every year, and they were maintained with supporting funds from the local authorities. However, respondents living close to the seawall were not confident that the wall could resist large storms because of the many cracks. The seawalls could be damaged further because the materials of which they were constructed had been corroded by storm waves (Xeidakis, et al., 2007).

Sand tubes had been supported financially by the federal government but some tubes had been broken within a year after installation. Restall et al. (2002) suggested that geo-textile sand containers were broken by accident during the preparation and installation processes, punctured by application of sharp equipment or cut by coral debris. The sand then became dispersed across the mudflat area resulting in deterioration of the ecosystem.

These more strong built solutions could efficiently stop erosion for periods of time but they continuously exacerbated erosion situations later (European Commission, 2004). These solid structures were inappropriate in terms of construction and maintenance costs (May, 2003). Ninety per cent of seawalls needed to be maintained within 10 years (European Commission, 2004; Xeidakis, et al., 2007, p. 89). The strong structural walls were built at high cost with a time limited on their longevity so local communities applied annually for funding to be allocated by the local authorities to repair them (May, 2003).

Some respondents constructed solid structures by placing rocks to protect their property. This technique had a slope characteristic composed of big and heavy rocks (European Commission, 2004), but the technique needed to be maintained often because the heavy rocks sunk. Other respondents applied less firm solutions to mitigate the impact of coastal erosion by embedding bamboo stems and planting mangroves. The European Commission concluded that embedding bamboo stems helped absorb wave energy and augment soil deposition; whereas planting mangroves bound sediment, enhanced force of soil layers, and decreased erosion. They concluded these weaker solutions were fragile. Klein et al. (2001) argued that weaker structural solutions often needed to be repaired, but the solutions could be better designed and constructed using new and relevant knowledge. Cooper and McKenna (2008) pointed out that the latter solutions were useful because they helped dilute wave energy breaking a coastline, and increased sedimentation thereby decreasing negative effects. These less robust structures increased community resilience to coastal erosion by creating bottom-up approaches which

could be related to socio-economic aspects, and promoted coastal protection in the long-term (May, 2003; Xeidakis, et al., 2007).

These less than solid solutions applied in the high erosion area were good alternative methods to prevent coastal erosion. Most respondents in the high erosion area were concerned about the impacts of coastal erosion in the future by predicting to be impacted by coastal erosion within a decade. They discussed their problems, sharing experiences and participated in activities about coastal erosion and coastal protection. Respondents in the high erosion area seemed to have hazard awareness. Anderson-Berry (2003) explained that communities effectively prepared and managed their vulnerability when responding to natural hazards when members in communities had hazard-education, were aware of potential hazards and had experience in natural hazards. Weber (2006) supported these findings that people who experienced impacts of natural hazards were interested in reducing risks and hazards, and they stored their knowledge from risk management practices and previous responses to changes (Fouillet et al., 2008). This meant that respondents in the high erosion area often experienced coastal erosion, so they understood risks from it and were concerned about mitigation of, and adaptation to impacts of coastal retreat. Meanwhile, some people would be less concerned about the impact of global warming because they failed to perceive risks and make decisions to manage their risks (Lavell, et al., 2012; E. U. Weber, 2006). This explained why respondents in the low erosion area who were less impacted by coastal erosion, were less interested in predictions of natural hazard reduction in risk management.

4.9 Summary

As expected, respondents in the high erosion area were found to have more severe impacts of coastal erosion than respondents in the low erosion area in terms of frequency of property loss. Overall, respondents in coastal villages perceived there would be impact from natural hazards in their communities, and they indicated their understanding of the main causes of hazards. In terms of thresholds of coastal retreat, respondents in the two erosion areas had different degrees of understanding coastal erosion impacts.

In the past, respondents in the low erosion areas had prevented their coastal erosion by using rock placement; whereas respondents in the high erosion area equally applied placing rocks and embedding bamboo stems to prevent coastal retreat. For them, embedding bamboo stems were low cost and fragile methods with a relatively high degree of success in coastal protection. At present the low erosion area prevented coastal erosion by constructing seawalls and sand containers. Meanwhile, those in the high erosion area applied materials found in the local area to protect their coastal areas. A high number of respondents in the high erosion area seemed to be more vulnerable to impacts of coastal erosion than respondents in the low erosion area. Therefore,

respondents in the high erosion area had better perceptions of the risk of coastal retreat by being more interested in improving their knowledge about coastal erosion and coastal protection.

Information in this chapter shows respondents in the two areas built on their experiences to improve their understandings of coastal erosion and coastal protection. In the next chapter, key factors for building community capacity to cope with coastal erosion are investigated to understand significant differences among the factors between both areas. Outcomes of those significant factors can then be applied to improve the capacity of local communities to mitigate coastal erosion in the future.

Chapter 5: Understanding community capacity: descriptive factors

5.1 Introduction

The literature review (chapter 1) outlined a set of components required to build capacity of a community to address coastal erosion: close relationships and trust, sense of community, levels of participation, skills and knowledge, leadership, and resources available. It is complicated to measure an improvement in the strength of a community, but increasing levels of community capacity can be assessed by outcomes such as stronger connections between residents; increased abilities to deal with difficulties; and improved leadership skills (Frank & Smith, 2006). These components can be used as a framework to examine the degree of readiness and ability to respond to a community issue like coastal erosion. Chaskin et al. (2001) stated that different communities displayed different capacities because these were composed of groups of varying economic status and different resources to develop community, infrastructure, dwellings, employment, income and education. These elements were investigated via the questionnaire, and were examined in chapter 3.

The purpose of this chapter is to analyse and compare, between the low erosion area and the high erosion area, the components of community capacity in the light of these socio-demographic and socioeconomic elements. This comparison should highlight the more important factors that need to be addressed for building community capacity.

5.2 Descriptive analysis of community capacity factors

5.2.1 Trust

Trust is an essential feature for groups to obtain collaboration from members (Mahan, Garrard, Lewis, & Newbrough, 2002). Hughes et al. (2007) stated that close friendship and kinship was the root of a strong relationship, creating trust among members. A strong community developed from close friendships and kin relationships where a strong connection promoted internal cooperation and collectivism in villages (Hughes, et al., 2007; Kenny, 2006; Misztal, 2000). If close relationships in families or groups became eroded or diminished, members could feel pain and hurt resulting in the weakening of bonds in a community (Hughes, et al., 2007). Mohseni and Lindstrom (2007) suggested that trust was an important feature to enhance cooperation among residents because they hoped to receive good reactions from others fairly, openly and reliably (Gilson, 2003; Mohseni & Lindstrom, 2007). In rural communities, residents had many opportunities to interact and improve trust.

Four statements were used to investigate the opinions of respondents about the relationship of respondents with other members and trust in other residents (see Table 5-1; Appendix 5-1).

Table 5-1: Percentages of respondents responding to statements about trust in low and high erosion areas

	Statements	Low erosion area			High erosion area			x^2-test*
		Disagree (%)	Neutral (%)	Agree (%)	Disagree (%)	Neutral (%)	Agree (%)	p, *level of significance*
	Trust							
1	You know most people	5	0	95	1	0	99	0.01*
2	Most people know each other	2	3	95	0	0	100	0.00*
3	Most people can be trusted	17	21	62	13	4	83	0.00*
4	Most people honestly share opinions with each other	18	24	58	16	8	76	0.00*

Strongly disagree and disagree, and strongly agree and agree were combined for this analysis.

Most respondents in both areas stated they knew their neighbours and they believed other people within their villages knew each other also. Respondents in the high erosion area had a slightly higher but significant number of responses agreeing with both statements than respondents in the low erosion regarding both statements (χ^2 = 6.77; df = 1; $p < 0.05$); and second statement (χ^2 = 9.44; df = 1; $p < 0.05$).

All key informants insisted they had close relationships with other members in their villages. Key informant 5M from the low erosion area had been living in the village almost his whole life and his house was at the centre of the village.

> *"Residents in this village are close relatives. We know all residents. That house is my aunt's house. The next house is my uncle's house. If people coming from external ask to someone's house in the village, I can explain the direction to the house." 5M (village key informant)*

Similarly, 10F from the high erosion area immigrated to live in the village 7 years ago. Her house was built on the bank of the shrimp pond, the nearest house being approximately 100 metres away; she said

> *"We know everyone. We often meet each other in a village when we participate in community meetings, go to mud beach to catch sea animals and work in others' ponds to gather cockles." 10F (village key informant)*

The results from the semi-structured interview confirmed that most residents within villages were relatives and they knew each other well. The residents often met with each other in the villages to enjoy social activities. They demonstrated that they had strong connections with each other.

The above information was a typical pattern for local residents in rural villages in Thailand. Most residents had many siblings and when those siblings married and separated to build new houses, their houses were built in the same village. Verdery et al. (2012) investigated the relationships between kinship bonds and house built in rural villages in Thailand. They concluded that residents with close relationships or families always lived within the village by building their houses close to their relatives. Some residents grew up and married but still built their houses within the villages.

Similar proportions of responses were noted for the two statements: respondents in the high erosion area indicated they trusted each other and shared opinions with each other honestly more than respondents in the low erosion area. Respondents in the high erosion area felt that residents in their villages could be trusted more than respondents in the low erosion area (see Table 5-1) (χ^2 = 28.47; df = 2; $p < 0.05$). In both areas, most respondents who disagreed with the statement about trust in other residents were men (see Figure 5-1 in Appendix 5-2). In addition, 75% of respondents living in the high erosion area longer than 10 years trusted other residents in their villages compared with 59% of respondents in the low erosion area (see Figure 5-2 in Appendix 5-2).

More respondents in the low erosion area displayed neutral opinions compared with respondents in the high erosion area. Most respondents who selected neutral on the statement in the low erosion area were men with a low income, low educational qualification and vocation as fishermen (see Figures 5-1, 5-3, 5-4 and 5-5 in Appendix 5-2). In the high erosion area the characteristics of respondents were unclear due to small sample sizes for those who disagreed, or responded neutrally. Respondents in the low erosion area did not want to reply negatively, but neither could they said anything positive when responding to the question (Nardi, 2006).

For the question on residents sharing honest opinions with each other, more respondents in the high erosion area agreed with the statement than respondents in the low erosion area (Table 5-1) (χ^2 = 18.36; df = 2; $p < 0.05$). The characteristics of respondents who responded to this question were similar in most respects to those responding to the question about trust as described above.

Information from the semi-structured interview confirmed that all key informants in their villages had close relationships, good cooperation and trust in others in their villages.

> *"When I park a motorcycle in front of a house and I put a key in a switch of the motorcycle, nobody takes my motorcycle. Additionally, many residents park their cars at parking area in the temple, and the cars have not been lost." 5M (from a Low Erosion Village)*

> *"I don't only enter or exit any houses but have meals in their houses also. If I am hungry, I can ask some house owners to get meals. We are relatives. Everybody is generous. Sometimes one neighbour cooks food in big pots. Then food is separated into bowls and provided to neighbours." 9F (from a High Erosion Village)*

Key informant 11F in the high erosion area had lived in the village for 40 years. She described the strong relationships and mutual trust within the village. After she and neighbours had lost their properties from the erosion, a landowner allowed everyone to rebuild houses on his land.

> *"I have no owned land. I asked a landowner to rebuild a house on his area and he allowed me to rebuild a house without paying rent. Other residents built their dwellings in his land also. We have lived in the village for many years and we have close relationships." 11F (village key informant)*

The findings from the interviews confirmed these differences. There were high levels of trust among respondents in both areas but respondents in the high erosion area seemed to have stronger relationships within their villages than respondents in the low erosion area. Informants in the low erosion area could trust their neighbours by leaving properties in public area without loss. Meanwhile, informants in the high erosion area went beyond this level; they reported trust in terms of allowing others to build houses on their land and maintained relationships with other residents by providing meals.

Respondents in both areas built trust with neighbours in their villages because they knew each other well. They often met other residents in the open spaces, on the footbridge and around public areas in their villages; the result was the creation of social interaction and an increased level of trust. Levi (1996) suggested that people improved trust with others whom they knew and one source of trust is the neighbourhoods.

Respondents in the high erosion area created and maintained relationships between donors and receivers. Almost all respondents in the high erosion area had been living in their village for a lengthy period thereby consuming considerable time in building a high level of trust. This finding was strongly supported by the study of Hughes et al. (2007) who also found that people who knew neighbours well and remained in the rural neighbourhood a long time have high level of trust.

Overall, respondents in both areas had close relationships with neighbours and other residents in their villages. More respondents in the high erosion area said they could trust persons in their villages than respondents in the low erosion area. In addition, respondents having a longer time of residency in the high erosion area had higher levels of trust than respondents in the low erosion area due to the constant and continuous building of mutual trust. Men in both areas showed higher distrust than women.

5.2.2 Sense of community

Strong relationships among members and neighbourhood in the community can predict the degree of sense of community (Prezza, Amici, Roberti, & Tedeschi, 2001). Neighbours can have social interactions and create close relationships with each other. After that they can become a part of the neighbourhood, belonging in their community, and living out the core characteristics which predominate in of a sense of community (McMillan & Chavis, 1986; Riger & Lavrakas, 1981).

The meaning of ‘community’ can vary between individuals, and the range of perceptions of it needs to be understood. Definitions range from community of place, to community of interest and to community of identity (Frank & Smith, 2006; Hughes, et al., 2007). A community of place consists typically of a group of residents sharing the social interactions, goals and norms in a particular area, such as a block, village or town. A community of interest is a group of

people who have the same interests or activities such as careers, hobbies and education. A community of identity is a group of people having the same qualities and attitudes such as gender, age and religion.

All respondents were asked how they defined a community through an open-ended question. The definitions of community were clustered into two groups. One referred to it briefly: 'community' meant 'village'; the other group gave longer explanations, summarised as being encompassed by the following phrase: 'people living in the village who have close relationships and who help each other'. There was no overlap between the two types of response (see Table 5-2), with approximately half of the respondents giving one or other meaning. In summary, a community from the perspective of all respondents was one of a community of place.

Table 5-2: Percentages of respondents providing definition of community

Definition of community	Example of definitions from respondents	Numbers of responses
A community means a village.	"A community means a village."	182 (51%)
A community means residents in a village having relationships and helping to each other.	"A community means people living together in a village."	176 (49%)
	"A community means residents having relationships to each other and helping each other."	
Total		358

Most respondents in the study area had been living in their villages for longer than 10 years during which time they had developed a range of interpersonal ties so they responded to the definition of community as a village. Riley (1992) stated that people developed personal bonds and also with places in a village through community activities. In addition, Low (1992) identified and described how places were important to residents. Place meant area that was valuable and meaningful for people and culture. In addition, Low contended that place was relevant to the history of families; community land that was lost; land owned or inherited by residents; and land-used to improve religion and spirit.

Sense of community means caring and sharing among residents who feel that they are members of existing groups which are important for improving quality of life and circumstances (Goodman, et al., 1998; T. Mannarini, et al., 2006). In this instance, people come together to support general goods, share values, cultures and beliefs, have daily relationship with neighbours, and live in secure places (Chaskin, et al., 2001; McMillan & Chavis, 1986). As part of the questionnaire, ten statements were used to examine opinions about sense of community (see Table 5-3; Appendix 5-1).

Table 5-3: Percentages of respondents responding to statements about sense of community in low and high erosion areas

	Statements	Low erosion area		High erosion area		x^2-test* p, *level of significance*
		No *(%)*	Yes *(%)*	No *(%)*	Yes *(%)*	
	Sense of Community					
32	You always volunteer to help a community	0	100	0	100	-
33	You feel a community is like home	0	100	0	100	-
34	You feel safe at night while walking alone	2	98	0	100	-
36	You participate in local community events in the past 12 months	6	94	0	100	-
35	You always pick up other garbage	8	92	10	90	0.47
39	You feel free to express your opinions when disagreeing	31	69	8	92	0.00*

	Statements	Dis-agree *(%)*	Neutral *(%)*	Agree *(%)*	Dis-agree *(%)*	Neutral *(%)*	Agree *(%)*	x^2-test* p, *level of significance*
14	You tolerate other with different perspectives in meetings	3	10	87	2	2	97	0.00*
6	You welcome new residents	3	6	91	0	3	97	0.01*
9	People with different incomes can work together	3	3	94	0	0	100	0.00*
5	You belief a community can address most problems by itself	14	13	73	3	8	88	0.00*

Strongly disagree and disagree, and strongly agree and agree were combined for this analysis.

All respondents in low and high erosion areas always volunteered to help their communities and felt a community was like home (see Table 5-3). In addition, all respondents in the high erosion area felt safe when walking alone at night and had participated in community events in the past 12 months; whereas a lower percentage of respondents in the low erosion area agreed with this statement.

Respondents always volunteered to develop their villages. Hughes (2007) stated that the respondents who volunteered believed they might offer some of their skills to other people. From those activities, volunteers would be motivated to improve their relationships and to benefit outcomes which had resulted from increased association with other residents and their villages. This was reinforced by informant H9 who made the connection between local people and coastal area.

> *"Men in the village sacrifice themselves almost every night to look for boats with illegal equipment to catch sea creatures near the village. The men are not being paid. They love the village and they just want to have enough coastal resources in the village for their families and siblings." H9 (from a High Erosion Village)*

The local residents had been protecting the coastal area from external fishermen who sailed big fishing boats with trawls or push nets to catch sea creatures in the sea adjacent to the village. If

the local residents allowed the fishermen to catch fish in the shallow sea close to the high erosion area with inappropriate equipment, all sizes of sea creatures would be caught. Additionally, some equipment would damage the sea bed resulting in increased coastal erosion. Therefore, the local residents in the high erosion area volunteered to protect their coastal area from those fishermen.

All respondents believed their villages to be like home. Villages were identified as geographical areas where people could share common interests, values and cultures (Terri Mannarini, et al., 2006; Pretty, Chipuer, & Bramston, 2003). A sense of community was created by integrating relationships of residents and/or areas (Jorgensen & Stedman, 2001). Respondents in both areas felt they belonged to their villages and they organised and celebrated traditional activities there together.

Informants in both areas had a strong connection with their places of domicile. *Sarn Jao* a god at the shrine in a village, was established in every village many years ago, and informants celebrated ceremonies annually. They arranged the ceremonies in the *Sarn Jao* area by donating food, desserts and fruit, and wishing for happiness by performing small explosions of fireworks and playing games. Residents migrating to live and work in other areas always returned to their villages to celebrate the ceremonies. Informant 4F shared information about the *Sarn Jao* ceremony in her village.

> *"Some residents got married and migrated to live far away from a village. When there is an annual Sarn Jao ceremony, they always return because they have strong belief in the god at Sarn Jao. On that day, the village is crowded. We have participated in the ceremony from an early age." 4F (from a Low Erosion Village)*

Residents could participate in an annual, traditional ceremony like this to enhance the norms, values and culture so leading to the creation of a sense of community. The shrine was the place for social interaction of people who had different levels of income, educational qualification, age and gender thereby allowing for bonds to be formed in the community (Talen, 1999).

Safety is a component of sense of community. When respondents feel safe in their villages it means the villages are secure places (McMillan & Chavis, 1986). An informant in the high erosion area illustrated the way residents connected with a community in terms of feeling safe. Key informant 9F lived in a village for almost her whole life of 27 years. She was a housewife; she and her husband often went out at night, leaving the house unlocked.

> *"I feel safe in a village. When I gather cockles at night on the mud beach, it is safe because there are no robbers in our village. There are only siblings here and nobody comes into the village." 9F (village key informant)*

Some authors refer to a "sense of place", a feeling of a place as secure home and of belonging to the place. This sense of belonging develops over time; the longer the time elapsed, the stronger the feeling (Hay, 1998).

Active participation in local activities created a sense of community (Chavis & Wandersman, 1990; Prezza, et al., 2001). In villages where there was a high degree of sense of community, people had a high level of connections among members, and came together to promote the common good through community processes and activities (Chaskin, et al., 2001; Ife & Tesoriero, 2006).

Residents in both areas participated in community events in the 12 months prior to the survey. Key informant 7F, living in the low erosion area, described participation in annual community activities. Her village was located at a distance of approximately 4 km from the next nearest community and at a distance from other residences.

> *"On national holidays such as Mother's day and Father's day, people regularly participate in community activities by cutting high grasses on both sides of streets outside a village because everybody has to use this street to get to the village." 7F (village key informant)*

Improved conditions of their streets by clearing grasses along both sides of streets to help residents' vision when riding at night and participation in community activities to develop a sense of caring collectively equate to a collective action to manage community concerns and respond to their needs (Goodman, et al., 1998).

As Mannarini et al. (2006) has observed, under certain circumstances people feel they are members of villages and they would like to improve the quality of life and the environment in their villages. Members can improve the community by demonstrating their sense of community in different ways. In the questionnaire, the question was asked about experiences in picking up garbage in public areas of villages. Most respondents in both areas always picked up other rubbish in the public area (see Table 5-3). Approximately 9% overall denied collecting garbage in public space, and there were no differences between high and low erosion areas ($\chi^2 = 0.72$; df = 1; $p > 0.05$).

There were, however, significant differences between high and low erosion areas about expressing opinions when disagreeing, tolerating other opinions in meetings, welcoming new residents, working with different income groups, and addressing their own community problems. For all of these statements, significantly lower rates of agreement were expressed by respondents in the low erosion areas (see Table 5-3).

Residents having a sense of community are involved together in community meetings (Chaskin, et al., 2001). The community meeting creates and increases the potential of residents because they can learn from meeting processes to express, discuss and share opinions with others, including even tolerance of other perspectives (McMillan & Chavis, 1986).

More respondents in the high erosion area insisted they felt free to speak out when they disagreed with others' opinions, than respondents in the low erosion area. Approximately 31% of respondents in the low erosion area did not feel free to speak out in these circumstances,

representing a significant difference (χ^2 = 29.01; df = 1; p < 0.05). Most respondents who did not feel free to speak out were respondents with low income and low levels of educational qualification (see Figures 5-6 and 5-7 in Appendix 5-3).

More respondents in the high erosion area tolerated other opinions in meetings than respondents in the low erosion area; the differences were significant (χ^2 = 11.26; df = 1; p < 0.05). Approximately 10% of respondents in the low erosion area were uncertain; these were low income earners (see Figure 5-8 in Appendix 5-3).

In the low erosion area, some residents did not tolerate other opinions in community meetings. Informant 5F said that meetings had been organised monthly in the past. During this year, meetings were arranged for every 2 or 3 months. This informant had the duty of inviting residents to participate in community meetings:

> *"It is difficult to invite villagers to attend community meetings. If villagers are invited to participate in a meeting without notice in advance, only a small number of villagers will participate in the meeting. Many villagers do not want to attend community meetings because some villagers had loud arguments during meetings and they had conflicts afterwards. Many residents think in this way similarly so they rarely attend meetings." 5F (village key informant)*

Informants 11F and 9F in the high erosion area described participation in meetings, often organised in their villages at least once a month in advance:

> *"When we have any community activities, we always organise meetings to tell information to residents. Residents frequently discuss about the activities to be organised. If residents need to collaborate in community activities, they provide help to each other." 11F (village key informant)*

Some residents in the low erosion area rarely participated in meetings and they had fewer opportunities to learn to work together to achieve their needs. Residents in the high erosion area often participated in meetings because they could get information from formal leaders through meeting processes. They could talk and work together to share information and meet their own needs. When the residents had suffered from environmental hardship, the residents needed to help each other to address and overcome the environmental issues. The collaboration among residents enhanced the residents connecting together, feeling of belonging in their places and bonding together.

Two questions were asked in the protocol about connecting with other residents such as welcoming new residents and working together among residents with different incomes. Respondents in both areas welcomed new residents. Respondents in the low erosion area had a lower (but significantly so) percentage of responses in agreement compared with respondents in the high erosion area (see Table 5-3) (χ^2 = 6.39; df = 1; p< 0.05).

All respondents in the high erosion area agreed with the statement that people with different incomes could work together compared with 94% of respondents in the low erosion area who thought similarly (χ^2 = 10.52; df = 1; p < 0.05).

In the low erosion area, many informants explained that residents in villages cooperated and worked together. Meanwhile, 7F, 7M and 5F told how residents in their villages engaged in lower degrees of collaboration at this time compared with the past. 7F described the current experience of collaboration in her village.

> *"Twenty years ago, we lived in our village without surrounding factories, didn't we? We went to the sea as groups. Now a small number of residents go to the sea for fishing. Most residents work in factories resulting in lack of time to participate for community activities." 7F (village key informant)*

As described earlier in this thesis, there had been a decrease in a number of fish resulting in a large number of residents working in manufacturing plants where they spent many hours a day. In the past, residents went fishing together and thereby created relationships. In addition, the residents had opportunities to maintain connectedness among members. Now, residents spent long hours working in factories daily so they did not have enough time to participate in such community or collective activities.

In terms of the community's ability to manage most problems, a higher percentage of respondents in the high erosion area responded positively compared with respondents in the low erosion area (see Table 5-3). Approximately 27% of respondents in the low erosion area did not agree (χ^2 = 15.55; df = 2; $p < 0.05$). Of those respondents who did not agree, most were men of high income and had been residents for longer than 10 years (see Figures 5-9, 5-10 and 5-11 in Appendix 5-3).

Most informants believed communities could cope with all community issues. However, two informants (5F and 7M) in the low erosion area disagreed with this opinion. For example:

> *"Burglar and drug problems in the village have not disappeared and we are scared of these problems." 5F (village key informant)*

In the high erosion area, 11M had migrated to live with his family there 10 years ago. He was happy in his village and had strong ties with neighbours. After living in the village for a decade, he said:

> *"If there were not coastal erosion in our village, we would have no problems. Although we do not have roads, we do not have difficulty. Coastal resources are perfect and marine life is plentiful. The most important thing is that residents in the village are generous." 11M (village key informant)*

In conclusion, all respondents in both areas believed that their communities were geographically defined as villages. Their sense of community was at a high level, however, respondents in the high erosion area tended to show a higher level of sense of community than respondents in the low erosion areas. More respondents in the high erosion area often participated in meetings, shared opinions with neighbours and worked in community activities than respondents in the low erosion area.

5.2.3 Skills and knowledge

Residents who reside in a community for a longer time are more likely to have a stronger sense of community (Prezza, et al., 2001), and display different ways to support common goals of the community by sharing and working together to achieve its needs (Goodman, et al., 1998). Those residents need to have skills and knowledge which have been developed through informal and formal learning processes (Hughes, et al., 2007).

Local skills and knowledge are important for community development. Ife and Tesoriero (2006) point out that local skills are developed by grounding from local experiences over periods of time and residents with skills help other local residents to strengthen their capacity to respond to community issues. After local people gain knowledge on how to improve their community, they can give local support to problem responses and in achieving their needs.

Frank and Smith (2006) have suggested that each resident has specific skills for community improvement but no residents have all the required skills; therefore skills can be learned and shared with others. To improve a community some skills are more useful than others (Homan, 2008, p. 74). Community work skills, for example, are defined as parts of activities in everyday life from which people can learn from life experience from an early age (Ife & Tesoriero, 2006, p. 307). In terms of technical skills, such as using a computer, managing budgets and collecting data in the community, these skills were not essential for residents as they could seek help from a specialist. In the questionnaire, seven statements were made to investigate skills and knowledge to determine how respondents perceived their abilities to improve the community (see Table 5-4; Appendix 5-1).

Table 5-4: Percentages of respondents responding to statements about skills and knowledge in the low and the high erosion areas

	Statements	Low erosion area			High erosion area			x^2-test* p, *level of significance*
		Disagree *(%)*	Neutral *(%)*	Agree *(%)*	Disagree *(%)*	Neutral *(%)*	Agree *(%)*	
	Skills							
26	Many people have good skills to work for a community	2	5	93	2	3	95	0.39
7	All sectors in a community can work together	2	3	95	1	0	99	0.01*
	Knowledge							
29	You welcome questions or alternatives from other members in groups	2	2	95	2	0	98	0.14
28	You know someone in a village giving you information to make decision in any matters	50	10	40	36	13	51	0.02*
18	Information in a community is always published	16	1	83	6	1	93	0.00*
	Questions	No *(%)*		Yes *(%)*	No *(%)*		Yes *(%)*	x^2-test* p, level of significance
40	You are interested in seeking data to improve a community	32		68	23		77	0.06
41	You attend training programs to develop environment in the past 12 months	64		36	39		61	0.00*

Strongly disagree and disagree, and strongly agree and agree were combined for this analysis.

Respondents in low and high erosion areas seemed to perceive that they have similarly high levels of skills to contribute to their communities. Most respondents (93% in low erosion area and 95% in the high erosion area) believed that many in the villages had good skills for improvement of the community (χ^2 = 0.87; df = 1; p > 0.05). In addition, most respondents in low and high erosion areas, 95% and 99% respectively, believed that all sectors in a village could work together (noting the difference between the areas) (χ^2 = 6.77; df = 1; p < 0.05).

Most informants in both areas described residents in their villages as having the required skills to work for their community. For example:

> *"Residents have been living in the village since they were born. They have basic skills to live in the village and they know everything they need for their lives. But beyond that they see other skills as irrelevant and unnecessary. They do fishing and collect cockle in the sea. They know what to do with those sea creatures in terms of raising or selling." H11 (from a High Erosion Village)*

In terms of local knowledge, Howlett (2010) has stated that residents can learn and develop knowledge from various sources including outside the educational system, by independent learning. Local residents learn from circumstances in local villages to create their own knowledge. To explore the original knowledge gained from living in the villages, five statements were made on the questionnaire (see Table 5-4).

Respondents were asked whether they knew persons who had the information they needed to make decisions and sought the necessary data to improve communities. Almost all respondents in both areas felt they welcomed questions or alternatives suggested from other members of groups (see Table 5-4) (χ^2 = 2.46; df = 1; p > 0.05). Respondents in the high erosion area were more likely to have higher percentages concerning those statements than respondents in the low erosion area.

More respondents in the high erosion area knew someone in their village who could provide information for making decisions compared with respondents in the low erosion area (see Table 5-4). Approximately half of the respondents in the low erosion area disagreed with the statement whereas 36% of respondents in the high erosion area disagreed with the statement (χ^2 = 7.6; df = 1; p < 0.05). Respondents who disagreed with the statement in both areas were men more than women and had incomes in the lower bracket (see Figures 5-12 and 5-13 respectively in Appendix 5-4).

More respondents in the high erosion area believed that information was always published in their villages compared to respondents in the low erosion area (see Table 5-4) (χ^2 = 9.58; df = 1; p < 0.05).

Respondents in the high erosion area were more likely to seek data to improve their communities than respondents in the low erosion area; however, the differences were not significant (χ^2 = 3.62; df = 1; p > 0.05). A higher percentage of respondents who were over 60 years in both low and high erosion areas showed they were not interested in seeking helpful data (see Figure 5-14 in Appendix

5-4) perhaps because they were older and no longer interested. A higher percentage of respondents who disagreed with the statement in both areas were those who had a lower income (see Figure 5-15 in Appendix 5-4) and only finished primary school (see Figure 5-16 in Appendix 5-4).

The semi-structured interview data showed that information was transferred by local leaders to residents for improvement of knowledge. Three informants from the low erosion area, such as H4, F5 and H7, revealed that information was published in their communities. For example:

> *"When I receive information from governmental organisations, I inform residents in the village through loud speakers in the village or meetings." H4 (village key informant)*

In the high erosion area, most informants explained that they had enough knowledge to improve their communities. Information was published in local communities by village heads.

> *"Whenever receiving information from the government, a village head distributes the information to residents in a monthly meeting equally." 11F (village key informant)*

Local residents received information about community issues and policies from local leaders after the leaders attended meetings with government organisations. Information was often broadcast through loud speakers and at meetings in the low erosion area, and via meetings in the high erosion area. Homan (2008) concluded that when leaders made direct contact with residents, leaders' and residents' information was better received and shared.

Significantly more respondents in the high erosion area had attended training programs to improve their communities in the past 12 months (see Table 5-4) ($\chi^2 = 23.72$; df = 1; $p < 0.05$). Men attended the training programs more than women in the low erosion area; whereas women attended training programs more than men in the high erosion area (see Figure 5-17 in Appendix 5-4). In the low erosion area, respondents with higher income attended training programs more than respondents with lower income. Meanwhile, in the high erosion area, respondents with lower income attended training programs more than respondents with higher income (see Figure 5-18 in Appendix 5-4).

The interview findings regarding attendance at training programs were similar to the results from the questionnaire:

> *"Training courses are occasionally organised by the government to make dish-washing liquid. But it is difficult to find raw materials and equipment to make the dish-washing liquid. A lot of money needs to be invested. There are many problems, aren't they? Nobody is interested in making the products." 7F (village key informant)*

In the high erosion area, H9, H10 and H11 agreed there were many organisations providing training courses for local residents to gain knowledge of coastal erosion issues. H9 lived in the village almost all her life and often attended training courses organised by academic organisations; she said:

> *"Scientists conduct research in our village. They transfer research knowledge and coastal erosion protection knowledge to residents asking them to cherish their coastal resources. Another group of*

lecturers trains young residents to be tourist guides to take visitors to attractive places in the village." H9 (from a High Erosion Village)

Some residents were members of the Coastal Conservation Networks in the upper Gulf of Thailand. The group organised seminars three times a year.

"We participate in the seminars organised by the Coastal Conservation Networks. Respondents give presentations to exchange knowledge about coastal conservation, coastal erosion prevention and cooperation among coastal communities in networks." 9F (from a High Erosion Village)

In the high erosion area, external organisations provided various types of knowledge to local residents through seminars, training programs and research. Residents had opportunities to improve their knowledge for addressing community issues. Meanwhile, residents in the low erosion area attended vocational training courses but either did not have sufficient financial resources to take advantage or the necessary raw materials could not be found in order to make products in the local area.

In summary, respondents in both areas felt they had sufficient skills to improve communities and necessary skills for catching fish to feed their families and earn revenue. They could learn additionally by using informal processes in daily life to improve their skills. Respondents in the high erosion area tended to have a higher level of information acquisition compared with respondents in the low erosion area because they had a higher percentage of respondents receiving published information and access to informed persons. Additionally, external organisations often conducted research, and arranged training courses or seminars for local residents in the high erosion area to improve the residents' knowledge.

5.2.4 Participation in community activities

People who have necessary skills and knowledge are able to help strengthen their community (Hughes, et al., 2007). When they participate in local community development activities such as meetings, planning and implementing, they need to adapt their ability to collaborate with the activities, share decision making with members and solve problems (Hung, et al., 2011; Jamal & Getz, 1995).

Reid (2000) reports that community participation is different from one community to another because residents participate in activities by having enough good information about the nature of community work and their responsibilities. Some studies have revealed that local people are directly involved in community development by voluntary participation because of the opportunities they have or they believe it is their responsibility (Tosun, 2000; Williams, 2006). Participation in community activities enhances the community's particular capacity because residents can share and combine their experiences of skills, trust and networking (Beilharz, 2002). Four statements were examined in this study regarding participation in community activities by respondents, with comparisons between low and high erosion areas being tabulated (see Table 5-5; Appendix 5-1).

Table 5-5: Percentages of respondents responding to statements about participation in the low and the high erosion areas

No.	Statements	Low erosion area			High erosion area			x^2-test* p, *level of significance*
		Disagree (%)	Neutral (%)	Agree (%)	Disagree (%)	Neutral (%)	Agree (%)	
	Participation in community activities							
15	All ages participate in community activities in a village	1	1	98	1	0	99	
16	You have opportunities to participate in decision-making processes	24	5	71	5	4	91	0.00*
	Statements	No (%)		Yes (%)	No (%)		Yes (%)	x^2-test* p, *level of significance*
37	A respondent is a member of groups in a village	75		25	45		55	0.00*
38	A respondent is a committee in a village	79		21	81		19	0.69

Strongly disagree and disagree, and strongly agree and agree were combined for this analysis.

Almost all respondents in low and high erosion areas felt that all age groups participated in community activities in their villages.

Respondents in the high erosion area tended to report greater opportunities to participate in community activities and be members of groups in villages than respondents in the low erosion area (see Table 5-5). Respondents in the high erosion area reported significantly more opportunities to participate in decision-making processes about community development projects than respondents in the low erosion area ($\chi^2 = 27.48$; df = 2; $p < 0.05$).

In the low erosion area, approximately 24% of respondents felt that they did not have opportunity to participate in decision making. Of these, the most represented were respondents between 40 and 49 years (see Figure 5-19 in Appendix 5-5), and most respondents who only finished primary school (see Figure 5-20 in Appendix 5-5).

Informant H4, a village head, shared experiences of how people became involved in developmental projects. Formal and informal leaders in communities regularly made decisions in development projects:

> *"When we want to develop the community, we organise a meeting by inviting everybody to participate in the meeting such as a village head, deputy a village head, cabinet member and other community leaders. If we have similar opinions, we will propose activities to be development projects for a village." H4 (from a Low Erosion Village)*

In the high erosion area, 9M experienced community meetings in his village. He participated in meetings in few processes and was involved in decision making about programs to develop the village:

> *"We regularly organise a monthly meeting in our village. When we make the community plan, villagers in the meeting help express opinions about what residents require. Then we will vote on the priority of those requirements. In this village, building a hard structure to prevent coastal erosion is the highest priority because residents do not want to migrate and rebuild their houses." M9 (village key informant)*

As described above, participatory processes are different between the low and the high erosion areas leading to providing different opportunities for local residents to participate in decision making processes. The key informant in the high erosion area reported opportunities to make decisions in communities so as to prioritise community development projects. Meanwhile, formal and informal leaders in the low erosion area attended meetings to make decisions to prioritise developmental projects together. It can concluded that residents in the high erosion area had more direct opportunities to participate in decision making concerning community development projects.

For the statement concerned with membership of groups in a village, over half of respondents in the high erosion area were members of groups compared with less than half of respondents in the low erosion area (see Table 5-5), (χ^2 = 33.21; df = 1; $p < 0.05$). In the low erosion area, more men were members of groups in communities (see Figure 5-21 in Appendix 5-5).

In the high erosion area, respondents over 59 years were the highest category not to be members of a group (see Figure 5-22 in Appendix 5-5). In addition, fewer than a half of respondents with low income were members of groups whereas most respondents with high income were members of groups (see Figure 5-23 in Appendix 5-5).

Most informants in low and high erosion areas were members of the Village Saving Fund and associated vocational groups. In addition, some informants in village 9 and village 11 in the high erosion area were members of the Coastal Conservation Networks in the upper Gulf of Thailand.

In terms of the Village Saving Fund, the government provided one million Baht (approximately $31,250: $1 = 32 Baht) to every village across the country in 2001 to stimulate the economy in rural areas by increasing new jobs, improving household income and providing social welfare to members and communities (Boonperm, Haughton, & Khandker, 2007, p. 2). Informant 7F was a committee assistant in the Village Fund, saying:

> *"The committee' roles are approving the projects and loans. Members get maximum loan approximately 20,000 Baht ($625) for each household. There are about 70 members now." 7F (from a Low Erosion Village)*

In the high erosion area, F11 was employed in the secretariat of the Village Fund. She shared her experience about members who were almost all from households in her village and neighbouring areas:

> *"The Village Fund has been operating for 6 years. Now, the village fund has a membership of 200. The Village Fund committee has been changed in the last two years. The new committee visited the villages with successful management of the Village Fund. Then the good practice was adopted more widely leading to better management of the Village Fund." 11F (village key informant)*

As described above, more residents in village 11 in the high erosion area were members of the village fund than residents in village 7 in the low erosion area. This was because the management system of the Village Fund in the high erosion area was improved by applying successful practices

from villages which achieved successful management in their Village Fund. The members in the Village Fund received high profits and the number of members increased dramatically. Homan (2008) ascribes the reason for the increased membership as the people having strong membership in the fund with the resulting improvement in membership numbers. Thus the members benefit from the profits and Village Fund's credibility increases. In the future, profits from the fund could possibly support community activities to build capacity of villages.

In conclusion, almost all residents in both areas participated in community activities. Residents in the high erosion area had more chances of making decisions about community development projects and prioritising their activities than residents in the low erosion area. Meanwhile, only formal and informal leaders in the low erosion area made decisions in community development projects before applying for funding.

In terms of being members of groups, more residents in the high erosion area were members of groups than residents in the low erosion area. This was because membership of the Village Fund in the high erosion area had a good management system. The committee of the fund visited and learnt about successful management systems in other villages before applying this knowledge to villages in the high erosion area. Members and communities received benefits from the Village Fund which resulted in increased members of the fund.

5.2.5 Leaders and leadership

Positive effects on community participation result from leaders who empower members to collaborate with others and promote governance (Alexander, et al., 2001; El Ansari, Oskrochi, & Phillips, 2010). Recent evidence suggests that community leaders have important roles in improving community capacity because accepted leaders are able to encourage and motivate local residents to create and share direction when addressing community problems (Aref & Redzuan, 2009; Chaskin, et al., 2001; Dubrin, 2010; Wituk et al., 2003). Leaders need to increase their abilities for dealing with issues likely to arise by improving their skills, developing innovative approaches, and building trust for collaboration from residents wanting to achieve goals (Dubrin, 2010; Sarros, 2009). In addition, residents need effective leaders who are able to build capacity for villagers, identifying and addressing environmental problems (Sylvia, et al., 2010).

The questionnaire protocol sought definitions of leaders so as to investigate and understand clearly who residents perceived their leaders to be. Respondents were asked how they defined the meaning of a leader using an open ended question. The definition of leaders from respondents' views referred to types of formal and informal leadership. Respondents provided diverse definitions, with some giving broad definitions. Definitions were divided into three clusters by reviewing and separating the meaning of the words and phrases as given by respondents. The clusters in broad terms involved duties, positions and selection methods of leaders (see Table 5-6).

When coding and counting the meaning of leaders, it was evident some respondents had provided broad and long terms that overlapped more than one of these clusters. Thus the total frequency of definitions was more than respondent numbers in the study area. That is, a definition could count more than once because was included more than one of these three clusters.

The first column (see Table 5-6) shows examples of definitions from respondents; the second column illustrates the refined definitions of leader based on respondents' opinions; and the third column tabulates the frequency of respondents' opinions in each cluster.

Some evidence from studies of the relationships between leaders and followers has suggested that leaders performed a variety of roles in providing guidance, direction, control and assistance (Mayseless, 2010; Popper & Mayseless, 2003) because leaders prefer their community to function perfectly (Chaskin, et al., 2001). Almost half of the respondents in this study (47%) defined a leader as a person who had duties to manage community problems and improve it. Thirty seven per cent described leaders as those with a formal role in their villages. Others referred to their leaders as people who volunteered as village leaders with subsequent election to the position. Overall, the definitions of leaders provided by respondents referred mainly to formal leadership roles, particularly village heads. In addition, informal leadership was not represented in these definitions.

Table 5-6: Percentages of respondents providing definition of leaders from respondents' opinions

Example of definition of leader from respondents	Definition of leader	Frequency of response
"A leader means a person who has duties to improve a village and solve problems happened in a village."	A leader means a person who has duties to address community issues and develop circumstances in a village.	229 (47%)
"A leader means a village head, deputy of a village head, village committee, cabinet members, health care volunteers and a senior monk."	A leader means a person who fills a formal authoritative role (like a village head and a cabinet member).	178 (37%)
"A leader means a person who volunteers and is elected to be a head of village."	A leader means a person who is elected to work for a village.	77 (16%)
Total		484 (100%)

Regarding leadership, it was viewed as the relationship between a leader and other residents within a community. Hughes et al. (2007) pointed out that where good leadership was present in a community, that community would improve awareness of human rights, quality of life, quality of working, collaboration and opportunities for leadership roles in groups. To examine perceptions of the leaders and levels of leadership in communities, five statements were asked and answered (see Table 5-7).

Table 5-7: Percentages of respondents responding to statements about leaders and leadership in the low and the high erosion areas

	Statements	Low erosion area			High erosion area			x^2-test* p, *level of significance*
		Disagree (%)	Neutral (%)	Agree (%)	Disagree (%)	Neutral (%)	Agree (%)	
	Leaders and leadership							
19	Community leaders build on the positive things in your community	6	4	90	2	1	97	0.02*
20	Informal roles as leaders	12	7	80	9	2	89	0. 04*
21	Women are accepted when they work as leaders	16	5	79	3	1	96	0.00*
22	A young generation is encouraged in leadership positions	23	21	56	8	5	87	0.00*
23	Leaders are interested in all problems	7	16	77	2	12	86	0.046*

Strongly disagree and disagree, and strongly agree and agree were combined for this analysis.

Most respondents in the low and the high erosion areas had positive opinions or agreed with the statements about their formal leaders and leadership. Overall, respondents in the high erosion area tended to have more positive opinions than respondents in the low erosion areas. Significantly respondents in the high erosion area agreed that their leaders built on positive things in communities more than respondents in the low erosion area ($\chi^2 = 5.99$; df = 1; $p < 0.05$).

Informants in both areas explained that their village heads built on positive aspects. In the low erosion area, informant 7M shared his experience of the village head who had worked in the position for 10 months:

> *"The village head is very good and helpful. He helps all residents. When some residents get sick and have no money, he takes them to see a doctor." 7M (village key informant)*

In the high erosion area, most key informants described their leaders as being elected because they worked for communities. Informant H9 described her leadership vision to protect her village from impacts of coastal erosion:

> *"In early next year, we will organise Pha-Pa to raise fund for building hard structures to protect coastal area. We will not wait for support from the government. If the government starts helping us, it means our attempt has been successful. But if the government doesn't, we continuously raise funds. We don't think to get back the land lost but how we can protect the remaining area for the next generations." H9 (village key informant)*

Leaders in both areas were elected because they helped local residents and developed local communities. In the high erosion area, leaders attempted to raise money to construct permanent engineering solutions by themselves because they did not know when the government would support coastal protection infrastructure. Permanent shore protection was very costly so local residents attempted to collect money to build structures themselves. Results from the interviews showed leaders endeavoured to address the crisis situation by using resources, strategies, experiences and learning processes to achieve safety for the community and wellbeing for coastal residents.

In terms of respondents taking informal leader roles in villages, respondents in the high erosion area had slightly higher levels than respondents in the low erosion area (see Table 6-8) (χ^2 = 6.46; df = 2; p < 0.05).

Regarding the acceptance of women working as leaders, more respondents in the high erosion area agreed with the statement than respondents in the low erosion area and again these were significantly different (χ^2 = 22.13; df = 1; p < 0.05).

In the low erosion area, men disagreed with the statement more than women (see Figure 5-24 in Appendix 5-6). Respondents with lower income had higher percentage of disagreement responses to the statement than respondents with higher income (see Figure 5-25 in Appendix 5-6). In addition, most respondents who disagreed with the statement had finished only a lower educational qualification (see Figure 5-26 in Appendix 5-6).

In the low erosion area, informant 5F told her experience about a woman leader in her village in the past three years, saying:

> *"She is smart and well known by external villagers. When she was a cabinet member, she helped improve the village. She sought help from external organisations to support a housewife group to have good jobs and increase income. When she organised a vocational training course, nobody was interested in the course. The important thing was many residents did not give her collaboration." 5F (village key informant)*

Informant 4F had slightly different experiences about acceptance of women when working as a leader in her village:

> *"A deputy of a village head is a woman. She works hard by attending meeting with governmental organisations almost every week and seeking funding to improve community every year." 4F (from a Low Erosion Village)*

In the high erosion area, most informants accepted women when they worked as leaders.

> *"The village head, now, is a woman. Residents accept women as leaders. She improves the village by seeking money for organising Pha-Pa and Ka-Tin ceremonies to build a hard structure to prevent coastal erosion." 9F (village key informant)*

Residents in some villages in the low erosion area accepted women who worked as leaders whereas residents in other low erosion villages did not. In the high erosion area, most residents accepted women to be leaders because woman leaders not only resolved community issues but also addressed the environmental crisis in the village without support from the government. The works of O'Toole and Macgarvey (2003) and Sylvia et al. (2010) illustrate that women could provide stronger leadership in terms of good management of local resources for developing the community, and having equal power to improve the community by using creative strategies.

To support the young generation in leadership positions, significantly more respondents in the high erosion area agreed with the statement than respondents in the low erosion area (χ^2 = 41.01; df = 2; p < 0.05).

Informant 4F, from the low erosion area, shared her opinion about encouraging leadership positions for young residents:

> *"Teenagers have not been interested in working for community development yet. They are more interested in working in factories." 4F (village key informant)*

In the high erosion area, informant H9 described the situation of supporting young respondents to work in leadership positions:

> *"We support young generation in a village to practice in leadership positions. They are skilful in living with nature and capable of managing community issues. I like to ask whether the young residents are wise enough for tricks of deceptive persons when they involve with others from outside. The young residents are not clever enough. They need to learn more from experiences." H9 (village key informant)*

Concerning the interest of leaders in community problems, more respondents in the high erosion area agreed with the statement than respondents in the low erosion area. Their differences were significant (χ^2 = 6.16; df = 2; $p < 0.05$). An interesting response to this statement was the relatively high proportion of respondents who replied 'neutral', in both areas. In the low erosion area, many more respondents in the age groups between 40 and 59 selected neutral compared with other age groups (see Figure 5-27 in Appendix 5-6). Men responded neutrally more often than women (see Figure 5-28 in Appendix 5-6).

Perhaps not surprisingly, evidence from the interview was different from the data derived from the questionnaire. Informant H7 explained that he was interested in every problem in the village; he shared his experiences of what he did while working as leader:

> *"I encourage residents to collaborate in working together, look for the retired people who have not registered to get the pension and address flooding problems after raining by installing drainage pipes, building a bridge and rebuilding streets to make streets higher than the flood level. If residents need help, I will support them also." H7 (from a Low Erosion Village)*

In the high erosion area, all informants agreed that their village heads were interested in all community issues. Informant 9F related that her village head addressed all community problems:

> *"The village head speaks out for residents to get a budget to build footbridges so residents could conveniently travel in a village. She supports all community issues. The most important thing is that she pays attention to building hard structures to stop the erosion." 9F (from a High Erosion Village)*

Active community leaders were important to successful community development because they played key roles in organising activities and making plans to achieve wellbeing in their communities by involving the residents in making decisions and applying strategies to solve problems effectively (Aref & Redzuan, 2008). Leaders in the two erosion areas were interested in and worked for their local residents. Meanwhile, more respondents in the high erosion area expressed their opinions in the scaled questions saying that their leaders were interested in community issues than respondents from the low erosion area. In addition, more respondents in

the high erosion area believed that their leaders spent efforts towards receiving assistance to prevent coastal erosion than leaders in the low erosion area.

Overall, respondents in both areas explained that their leaders were formal ones such as village heads and cabinet members who had duties to manage community problems and improve community environment in a village. More respondents in the high erosion area believed their leaders to have leadership qualities and were interested in working for community than respondents in the low erosion area. Interestingly, these differences often focused on the issue of coastal erosion, rather than other community issues.

5.2.6 Resources

Leaders play a key role in equipping projects and mobilising resources to cope with community issues (Aref & Redzuan, 2009). Goodman et al. (1998) state that resources in a community can be divided into social capital and traditional capital. Social capital related to human ability to collaborate with other residents to improve community capacity such as skills, knowledge and trust whereas traditional capital involved goods, assets and money.

Materials, money and infrastructure were important in building community capacity. Flora et al. (1992) defined infrastructure as the permanent physical facilities needed to support community activities such as roads, bridges and light poles. In addition, having the ability to access technology was necessary to innovate ideas, share information and improve collaboration in a community (Goodman, et al., 1998). Sufficiency of resource in a community was assessed by evaluating the responses to six statements on resources (see Table 5-8; Appendix 5-1).

Table 5-8: Percentages of respondents responding to statements about resources, with comparisons between low and high erosion areas

	Statements	Low erosion area			High erosion area			x^2 –Test* p, *level of significance*
		Disagree (%)	Neutral (%)	Agree (%)	Disagree (%)	Neutral (%)	Agree (%)	
	Resources							
11	You always donate your money to support a community.	10	4	86	2	0	98	0.00*
12	You always donate your time to support community activities	11	1	88	2	0	98	0.00*
13	You always donate your goods to support a community.	18	3	79	2	2	96	0.00*
26	A community has enough equipment to support community activities such a computer	66	7	27	97	1	2	0.00*
29	Roads/tracks had been improved in the past 3 years	1	2	97	12	3	85	0.00*
30	Lighting had been improved in the past 3 years	8	3	89	13	19	68	0.00*

Strongly disagree and disagree, and strongly agree and agree were combined for this analysis.

Respondents in the high erosion area had a higher percentage of positive attitudes about donation of money, time and goods to the community than respondents in the low erosion area

(see Table 5-8). Among respondents in the low erosion area, 10% did not always donate money, 11% did not always donate time and 18% did not donate goods to support community development. In the low erosion area, respondents who agreed to make donations were more likely to come from higher income rather than lower income groups (see Figures 5-29, 5-30 and 5-31 respectively in Appendix 5-7).

In the low erosion area, informants outlined their experiences in donation of money, time and goods. 5M is a 32 years old factory employee; he shared experiences about devoting personal resources to arrange activities in his village:

> *"For running activities on the Children's day, I and other residents donate money to buy foods and toys for children. We organise the activity in the primary school." 5M (village key informant)*

Informant H7 discussed donation of time to develop the village:

> *"Residents from almost all households participate in community activities by clearing trees' branches on the Father's day and the Mother's day." H7 (village key informant)*

In the high erosion area, informant H9 described how residents in her village tried to protect their land from coastal erosion by using local residents' resources. She had experienced residents' collaboration in planting mangrove for ten years:

> *"Residents help grow mangrove trees. Now we have mangrove forest growing over more than 20 Rais (1 Rai = 0.3954 acre or 0.16 hectare) without it having been supported by the government. Residents help each other by donation of money and objects. We willingly do it for our and children' survival in the future." H9 (village key informant)*

Informant 11F informed about having limited financial resources to improve the community:

> *"Developing community in our village is a little bit of a problem because most residents are not quite ready with having money. Money will be donated by people who have sufficient income. People who have not enough money donate their effort and time instead." 11F (from a High Erosion Village)*

Informants have noted that residents in both areas donate their goods, money and time to improve well-being in their village resulting in increased community capacity. Residents in the low erosion area donated their resources to undertake activities in the local school and improve the environment in villages. Residents in the high erosion area donated their resources to protect coastal areas and the infrastructure like temples and schools etc., where the area had been severely impacted by erosion. Residents in the high erosion area had limited resources to address their environmental crisis. To increase their ability to protect coastal areas, residents in the high erosion area needed more resources from external organisations such as the governments, business sectors and networks.

Regarding statements about sufficient equipment and infrastructure improvement, more respondents in the low erosion area had positive attitudes about the statements in their communities than respondents in the high erosion area, and this difference was significant. For the statement about

sufficient equipment, most respondents in both areas thought that their communities did not have enough equipment to support community activities, although 27% of respondents in the low erosion area believed they had enough equipment (χ^2 = 58.69; df = 2; p < 0.05).

In terms of infrastructure improvement in the past 3 years, respondents in the low erosion area agreed that roads and lighting had been repaired and improved. In addition, respondents in the high erosion area said footbridges and more lighting had been installed and improved in the residential areas. Significantly more respondents in the low erosion area felt their infrastructure had been improved than that in the high erosion area (see Table 5-8). Road improvement was an indicator (χ^2 = 17.10; df = 1; p < 0.05) as was improvement of lighting (χ^2 = 28.51; df = 2; p < 0.05).

Similar evidence was presented during informant interviews, most of whom from the low erosion area reported having sufficient infrastructure in their villages. Informant H5, 52 years and a village head who had lived in the village for his whole life, described the infrastructure in his village:

> *"We have complete necessary infrastructure in our village such as electricity, pipe water, street and telephone. Streets are annually repaired and supported by the local authority." H5 (village key informant)*

In the high erosion area, informants told that footbridges had been built to help residents travel within villages and water pipes were installed already. However, there were no roads to access to villages in the high erosion area. The informants said most residents were satisfied. The one exception was an informant who owned land which he wanted to sell. Informant H10 and 11F gave their opinions about living in the village without roads:

> *"We, now, need road to access to our village because residents can comfortably commute to external community. Our village will be rapidly developed and land value will rise." H10 (village key informant)*

> *"Most people said to me that they were happy to live in the village. If there were roads, residents would be more comfortable but it would increase the danger from thefts." 11F (village key informant)*

In the low erosion area, informants described that local authorities annually supported, maintained and improved infrastructure for local communities. The local authorities supported funding to build and maintain infrastructure to prevent coastal erosion, and to improve streets and lighting conditions in communities. The literature supports these types of findings, for example Flora et al. (1992) showed how infrastructure in communities can help residents live conveniently and have productive activities. Interestingly, informants in the high erosion area were happy with their lifestyles in rural communities; they did not want to build streets connecting their villages because they feared theft problems from those outside their villages. Additionally, the local authority did not assist coastal villages to cope with coastal erosion due to its low revenue. If land based infrastructure were installed in coastal villages in the high

erosion area, land values in communities would increase. FAO (2007) concluded from other studies when land for use was sold and changed from aquaculture farms to residences and commercial activities that low income villagers feared losing their livelihoods because they could not adapt to live with the changes. This might explain the reticence expressed by respondents in high erosion areas to infrastructure development.

In summary, most respondents in both areas donated goods, money and time to their communities. Respondents in the high erosion area had higher percentages of donation to communities than the low erosion area, and these increased donations could be linked to addressing the problems of coastal erosion, at least in part. Respondents in the high erosion area spent resources to create mangrove forests to protect coastal area; whereas respondents in the low erosion area donated resources and received resources from local authorities to improve the infrastructure in the community. Respondents in the high erosion area sought help from external organisations to increase future community activities. In terms of sufficiency and improvement of infrastructure, residents in the low erosion area placed their emphasis on various types of infrastructure more than those in the high erosion area. This meant that respondents in the low erosion area seemed to be at least materially responsive to community hazards.

5.2.7 External support for villages

A community needs resources. Faced with inadequate resources, a community expects to obtain required resources from outside sources (Goodman, et al., 1998; Minkler, Vásquez, Tajik, & Petersen, 2008). A community has relationships with external organisations which provide cooperation, funding, materials and scientific knowledge (Freudenberg, 2004). Strong relationships between a community and societal networks increase community capacity; the strength of networks can then be assessed by considering characteristics of connection and frequency of contacts or communication (Goodman, et al., 1998). To examine support from networks, responses were sought to four relevant statements (see Table 5-9; Appendix 5-1).

Table 5-9: Percentages of responses to statements about external village support, with comparisons between low and high erosion areas

	Statements	Low erosion area			High erosion area			x^2 –Test* p, *level of significance*
		Disagree (%)	Neutral (%)	Agree (%)	Disagree (%)	Neutral (%)	Agree (%)	
	External village support							
10	A community is willing to seek help from external sources	1	4	95	0	1	99	
8	You always visit friends in other villages	42	0	58	18	1	81	0.00*
17	Local governments are responsive to needs of people	0	1	99	1	1	98	1.00
24	The local government carefully uses funding	3	33	64	7	43	51	0.04*

Strongly disagree and disagree, and strongly agree and agree were combined for this analysis.

For questions about seeking help from outside the community, most respondents in both areas had positive attitudes about this type of support (see Table 5-9). All informants in the low erosion area agreed they needed help from external organisations to help prevent coastal erosion. This remark by 7M typifies the general attitude:

> *"Groups of factory employees and undergraduate students occasionally come in our village to plant mangrove. But public area is not big enough to grow the trees." 7M (village key informant)*

In the high erosion area, many external organisations regularly visited village 9 to support the village in various activities:

> *"Students, governmental officials and company employees come in and grow mangrove almost every day and a large number of people come in the village on weekends. Mass media staffs often make documentaries in our community to publicise impacts of coastal erosion." 9M (village key informant)*

In addition, a monk told his experience of what people supported the monastery.

> *"The monastery is supported by donation of money from external people to build halls." Monk (from a High Erosion Village)*

Accordingly, residents in both areas needed support from external organisations such as company employees, students and civic groups. The high profile of coastal erosion and the plight of communities are obviously important. After the documentary evidence becomes more widespread, people and organisations from outside will be more likely to realise erosion has current, urgent impacts, respond and provide the support needed.

Regarding the statement concerning knowing more about visitations of friends in other villages, more respondents in the high erosion area agreed with the statement than respondents in the low erosion area (see Table 5-9). Approximately 58% of respondents in the low erosion area and 81% in the high erosion area always visited friends in other areas ($\chi^2 = 23.51$; df = 1; $p < 0.05$). This suggested respondents in the high erosion area had more frequent contact with friends and networks than those in the low erosion area.

In the low erosion area, respondents with lower income were less likely to visit friends in external areas compared with those having higher income (see Figure 5-32 in Appendix 5-8). Respondents in the low erosion area who had only finished primary school were less likely to visit friends in other villages when compared with the same groups of respondents in the high erosion area (see Figure 5-33 in Appendix 5-8).

Some reasons for these differences could be ascertained from the interview data.

> *"Some families have no vehicles, so travelling is difficult for them. Walking to the main road is almost an hour." 4M (from a Low Erosion Village)*

> *"When we are going to outside places, we will make an appointment with others and take the same boat. That way everyone will help pay fuel cost for the boat owner." 9M (from a High Erosion Village)*

Hughes et al. (2007, p. 193) contend that people who see and talk to each other often can build a strong sense of personal connection. Informants in the low erosion area explained that some residents did not have strong connection with many friends because the residents rarely visited friends outside villages due to difficulty to access the main road. Meanwhile, informants in the high erosion area described that residents in their communities often pooled their boats to go to urban areas or to visit friends.

Regarding the statement about response of local governments to the needs of people, almost all respondents in both areas agreed with the statement (Table 5-9) ($\chi^2 = 0.18$; df = 1; $p > 0.05$).

For the statement concerning the careful use of funding by local governments, more respondents in the low erosion area agreed with the statement than those in the high erosion area (see Table 5-9). Very high numbers of respondents replied neutrally, 33% of those in the low erosion area and 43% in the high erosion area ($\chi^2 = 6.57$; df = 2; $p < 0.05$).

In the low erosion area, a higher percentage of respondents aged from 50 - 59 believed that their local governments used funding carefully compared with each of the other age groups (see Figure 5-34 in Appendix 5-8). Women responded neutrally more than men (see Figure 5-35 in Appendix 5-8). Respondents with lower income felt neutral more than those with higher income (see Figure 5-36 in Appendix 5-8).

In the high erosion area, a higher percentage of respondents between 40 and 59 years agreed with the statement compared with other age groups (see Figure 5-34 in Appendix 5-8). Additionally, respondents with lower income were more likely to make a neutral selection than respondents with higher income (see Figure 5-36 in Appendix 5-8).

A head of village in the low erosion area, described support from the local authority:

> *"Residents will participate in public involvement and decide what the most required infrastructure is. Then the project will be submitted to the local authority. The authority will consider the residents' needs. If the project is necessary, the authority will allocate budgets." H4 (village key informant)*

In the high erosion area, the local authority had insufficient revenue to support local villages. Key informant 9M described his experience with the local government's revenue:

> *"The local authority's revenue is not enough to pay for staff's wages because there are no factories in this area. This area is mangrove forests and shrimp ponds. The authority annually gets little income. There is no budget to protect the coastline." 9M (village key informant)*

There were claims made that, in the low erosion area, local authorities carefully used funds to develop local communities because they considered the necessary requirements of local communities before allocating funds. In the high erosion area it is generally understood that the local authority had low income and lacked ability to support the community in coping with coastal erosion. This caused local communities to seek help from external sources and develop fund-raising skills (Frank & Smith, 2006).

Overall, respondents in low and high erosion areas were willing to get help from external organisations. In the low erosion area, groups of students and factory employees occasionally supported villages by planting mangroves. In the high erosion area, various groups of people always supported villages for different purposes such as planting mangroves, making documentaries and donating resources to the monastery. In addition, more respondents in the high erosion area visited others to improve and maintain relationships. Local authorities in the low erosion area carefully used funds allocated only after careful consideration of projects because funding was provided. In the high erosion area, the local government had less revenue to support and develop communities; hence the communities needed to search for financial sources and improve their fund-raising skills.

5.3 Discussion

Respondents in the low and the high erosion area provided different results to scale questions about factors to build community capacity to respond to coastal erosion. In this section, these factors are discussed.

Trust among residents in the high erosion area was much higher than for residents in the low erosion area. White-Cooper et al. (2009) stated that residents who built relationships with neighbours continuously could reciprocally improve strengthened relationships. These strong relationships can create trust (Hughes, et al., 2007). Christopher et al. (2008) reported that close relationships and collaboration, continuous among residents, helped to improve and maintain trust in communities. Additionally, Mason (2010) pointed out that designated geography in communities, by increasing livelihoods, could build trust; however, long time residency did not necessarily create trust. Hughes et al. (2007) argued that people who knew neighbours well and had lived in the rural neighbourhood for a considerable period had high level of mutual trust.

All studies tended to support the necessity of social interaction in communities to build and enhance trust. In this study, residents in the high erosion area had more opportunities to create trust through social interactions in communities, for example because most residents worked in shrimp farms, collected cockles in the mud beach, attended meetings and group events and caught local transportation together. Residents in the low erosion area had lower degrees of trust than those in the high erosion area, possibly because they spent many hours a day, including weekends, working in factories.[1] This form of livelihood resulted in lack of time for social interactions. Residents with long time of residency possessed a higher level of trust in the two areas.

[1] In the low erosion area, results from the questionnaire survey found that only 13% of respondents were factory employees, but findings from the semi-structured interview showed that a large number of residents worked in factories near their villages as described on page 58.

Residents in both areas who purposely connected with their locations and neighbours showed high degrees of sense of community. Some significant factors to enhance this sense could be duration of residency, married status, group participation and area of shelters (Prezza, et al., 2001). Findings from various studies had confirmed that neighbourhoods in general were related to a sense of community because linkages between residents and their neighbourhoods had been encouraged (Brodsky, 1996; Terri Mannarini, et al., 2006; Talen, 1999). Prezza et al. (2001) similarly investigated relationships between sense of community and several other factors in town, city and metropolis in Italy where neighbourhood relations were found as the strongest factor to predict degree of sense of community. An earlier study by McMillan and Chavis (1986) suggested four main components for sense of community: belonging to a group, influence on other members in a group, integrating individual and community needs with reciprocity, and sharing common experiences within communities. Residents in the high erosion area presented a high degree of sense of community related to the four components. For instance, most residents were members of groups; they expressed their opinions to others in meetings to influence others; they protected coastal resources from external fishermen for combining individual and community needs; they related experiences about property loss, relocation; and built structures to prevent coastal area degradation. Meanwhile, residents in the low erosion area presented lower degrees of sense of community in relation to these four main components.

Participation of residents was more likely to be found in the high erosion area than the low erosion area. Dassopoulos and Monnat (2011) averred that participation in local community meetings was related to greater satisfaction of all residents in the neighbourhood, particularly those individuals who had strong social cohesion. Hung et al. (2011) added that where different income groups who participated in community activities depicted highly effective community participation. This high effectiveness of participation was crucial for a community to prepare for and then respond to environmental changes (Few & Tran, 2010; Wisner & Adam, 2002). In the high erosion area, most residents who participated in community activities were of different socio-economic status. They created efficient community participation, presented strong social cohesion with their neighbourhoods and increased the ability of a community to address community issues. These results related to the findings of Goodman et al. (1998) that residents who participated in community events increased the level of community capacity building.

In addition, Wickrama and Wickrama (2011) pointed out that rural residents participated in community activities by their membership of informal collectives in their daily life which increased their social connection, social responsibility and mutual trust in neighbourhoods. Their involvements included money-saving groups, work on farms, and water or firewood collecting groups. These collectives facilitated those rural residents in achieving their works because they had appropriate plans and organised supportive activities for local communities (R. Dale, 2002; Wickrama & Wickrama, 2011). In this study, a lower number of residents in the

low erosion area were members of groups compared with those of the high erosion area. Most residents in the high erosion area participated in community events by being members of groups such as the coastal conservation networks and the saving fund groups because they had plans to manage their groups and members in communities which benefited from supportive activities. Participation in the low erosion area was limited to leaders and those with leadership and power positions, albeit in often less formal and administrative roles.

Leaders in the high erosion area tended to be more effective and performed at a higher quality of leadership compared with the low erosion area. Leaders had to lead, serve and protect residents to achieve wellbeing (Popper & Mayseless, 2003). Effective leaders needed to promote the participation of residents in community activities, build capacity for residents by creating interesting activities and address community issues (Hahn, et al., 2006; Sylvia, et al., 2010). Leaders in the high erosion area had spent their efforts in preventing coastal erosion impacts by raising funds, organising community activities and motivating residents to improve capacities by participating in coastal protection activities such as training programs, planting mangroves and monitoring coastal areas from damage by external fishermen. Evidence for good leadership was provided in the data by key informants and questionnaire respondents. Leaders guided residents to maintain the goal of protecting their land for their children. Meanwhile, leaders in the low erosion area addressed coastal erosion by receiving annual support from local governments and using financial resources to build and maintain permanent structures. Activities organised by the leaders were less intense towards residents to encourage them to participate in and improve their abilities, and evidence for the success of leadership was (only) self-proclaimed.

Brungardt (1997, p. 83) suggested that "leadership development is a continuous learning process that spans an entire lifetime; where knowledge and experience builds and allows for even more advanced learning and growth." This view was supported by Sylvia et al. (2010) who suggested that leadership was a learned process and people improved their leadership through learning from their mistakes. Young residents spent long periods trying to improve leadership skills. Residents in the high erosion area enhanced adolescents' leadership potential by giving them opportunities to learn leadership skills for the future. Most young residents in the low erosion area preferred working in factories for their income. The results of the study by Sylvia et al. (2010) are pertinent here. They studied the components necessary to improve leadership in rural women, finding that young residents had more alternatives to leave rural area to look for higher education or new employment than elder residents. In the low erosion area, residents might not have similar opportunities to learn leadership skills in the future.

Most residents in the high erosion area completed at least the lower educational qualification and showed interest in published information in communities, attended training programs to improve the environment and knew people who provided community information. Fenwick (2006) suggested that knowledge was created, improved and changed depending on activities

and interactions of people in their daily lives. Additionally, Frank and Smith (2006) argued that people who had various areas of knowledge benefited from working and solving problems in their daily life. However, the authors concluded people could work together collectively, learning from each other and sharing knowledge and experience (Frank & Smith, 2006; Ife & Tesoriero, 2006). Adger et al. (2007) believed that knowledge could be improved by integrating traditional knowledge, scientific knowledge and individual experience. Therefore, local residents in the high erosion area could improve their knowledge, even though the educational level they had completed was low. Most local residents in the low erosion area finished only low educational qualification and they improved their knowledge of related fields by exchanging experiences among groups and from government officials who organised training programs in their communities. Training programs organised by the officials for the low erosion area were infrequent because only a small number of residents attended the programs and most residents worked in factories.

Few external organisations relevant to vocational training programs supported communities in the low erosion area to improve skills to address economic problems. In contrast, various sources from external villages had supported the high erosion area such as scientists, NGOs and civic groups. Ife and Tesoriero (2006) found that residents could create their networks with other residents who had the same interest and lived in internal or external communities. These people included government officials, politicians, researchers and NGOs. Village residents maintained contact with their networks for sharing knowledge in related fields, improving necessary skills and mobilising resources and services (Ife & Tesoriero, 2006; Loza, 2004). Bopp and Bopp (2004) also suggested that specialists from external villages worked with local villages by contributing their knowledge, skills, resources and models for management to address critical issues and improve capacity of local communities. This view was supported by Goodman et al. (1998) who concluded that resources and specialists from external organisations could help communities cope with community issues effectively, resulting in increased community capacity. Residents in the high erosion area improved their knowledge regarding causes of coastal erosion and concerning structures to prevent this phenomenon from: scientist groups; residents developed their skills to protect coastal resources from NGOs; residents who had received assistance from civic groups in terms of planting mangroves; and funding provision for building structures to prevent coastal erosion. The work of Gibbon et al. (2002) work explained that communities connected with the inhabitants, institutions, partnerships and voluntary alliances could help communities to cope with community problems.

Communities in the low erosion area received support of financial resources and infrastructure development from local authorities aimed to prevent coastal erosion. Resources influenced the ability of communities to deal with change (Goodman, et al., 1998). Chaskin et al. (2001) suggested that the ability to access resources was an important component in building community capacity. In addition, the resources from external could be massive and of different types, boundaries and forms

of allocation. Bopp and Bopp (2004) argued that after communities received external resources, they needed to learn to apply and manage them to address changes effectively. Communities in the low erosion area obtained financial resources from the local authorities annually and the communities established community plans which prioritised projects in order to improve communities. Meanwhile, communities in the high erosion area also received support from external communities. These supported different types and numbers of resources having uncertainty as to time of availability, so communities needed to learn to manage those resources wisely. Few and Tran (2010) and Tompkins and Adger (2004) concluded that networks were very important in improving the capacity of a community with low income status.

5.4 Summary

Villagers in the two erosion areas already had high degree of community capacity for meeting individual erosion challenges. Beyond that, various factors of difference towards building community capacity were significant between the low and the high erosion areas. Communities in the high erosion area had a higher degree of community capacity than communities from the low erosion area. The high erosion area gave higher percentages of responses in several factors such as trust, sense of community, participation, leader and leadership, knowledge and networking.

The residents in the high erosion area knew others within their villages well and had a high level of trust compared with residents in the low erosion area. Stronger sense of communities was found in the high erosion area than the low erosion area in terms of being members of groups and expressing opinions to influence others. Villagers in the high erosion area promoted all income statuses to participate in activities leading to creating effective participation. Leaders in the high erosion area were effective leaders because they supported young villagers in leadership positions and enhanced abilities of villagers to address community issues. Villagers in the high erosion area improved their knowledge by attending training programs and seminars related to coastal protection rather than villagers in the low erosion area. Various groups of people from external organisations helped villagers in the high erosion area compared with a few groups in the low erosion area.

The villagers in the low erosion area revealed two significant factors, namely higher levels of resources and more infrastructure development than the high erosion area. The local governments made budget allocations to build and maintain infrastructure particularly permanent structures to prevent coastal erosion. In this sense, the low erosion area villagers were more ready to respond to the impacts of coastal erosion than the high erosion area villagers.

The results showed that residents in the high erosion area needed help from the government and their networks to support resources for coastal area protection rather than residents in the low erosion area. In addition, the residents in the high erosion area were more ready to work together to improve capacity for coastal erosion prevention in their communities by

participating in community activities and being effective leaders than the residents in the low erosion area. If the government and the external networks supported resources, infrastructure and training programs to improve knowledge, communities in the high erosion area would effectively improve their capacity to respond to coastal erosion impacts.

The findings from the descriptive analysis in this chapter illustrated the comparison between the significant factors existing in the two erosion areas. The factors have not been prioritised, and this is required in order to consider the potential to build community capacity to respond to erosion problems. Additionally, any priorities for building capacity of the community need to be considered from perspectives of the characteristics of villagers, and the attitudes of villagers to community and to coastal erosion impacts in a community. Therefore, in the next chapter, factors that have been found to be significantly different between the two erosion areas in terms of livelihoods, experiences of coastal erosion and characteristics of communities will be considered and analysed together. A multivariate factor analysis will be applied to seek those priority factors for building capacity to cope with the natural hazards to which coastal communities are exposed.

Chapter 6: Factor analysis: multivariate influences on community capacity

6.1 Introduction

In previous chapters, seven major factors to build capacity of the community derived from the literature have been examined and compared between the low and the high erosion areas to determine where and how community capacity differed. The results showed that higher degrees of all community capacity factors laid in the communities high erosion area compared with the low erosion area with the exception of two (namely resources and infrastructure). From the literature, all components were regarded as necessary to build community capacity and so far in this study the results from the comparison of factors between the two erosion areas were not set in any priority order to illustrate which were most important to improve the community capacity in this particular setting. This chapter sets out to do just that: to investigate the most important factors necessary to build community capacity in order to address natural hazards, like coastal erosion in the upper Gulf of Thailand effectively.

Factor analysis was applied by retrieving significant variables from socio-demographic information, attitudes about community capacity and experiences of coastal erosion in the previous chapters. The results from the factor analysis can be named and described, compared to the literature, and examined for the contribution that they might make towards setting recommendations for improving the capacity of community to respond to coastal erosion (and even other environmental hazards elsewhere).

6.2 Factor analysis

Factor analysis is a statistical method which helps reduce a large number of questions to a small number of factors (Garson, 2008; Hair, Anderson, Tatham, & Black, 1995). In this study, exploratory factor analysis is applied because the analysis does not have any specific expectations in terms of numbers and components of factors before computation (Thompson, 2004). Significant variables from the questionnaire were selected and analysed by the exploratory factor analysis. Pallant (2007) and Pett (2003) state that exploratory factor analysis is regularly applied to explore interrelationships among variables in a data set in the early stages of study and is useful when the study has not found a number of factors to describe the relationships.

Principal axis factor analysis, an appropriate method for exploratory factor analysis, is applied to derive a small number of components which account for the correlation of variables in their clusters (Garson, 2008) and factors from principal axis factor analysis are very robust

(M. Brown, Kaplan, & Jason, 2012; Gorsuch, 1997). Therefore, principal axis factor analysis was selected to apply in this study.

Processes used to select significant variables are illustrated in the next section, followed by the results of exploratory factor analysis. These results are described by separating them into three main processes which reflect stages in the analysis: assessment of suitable data for analysis, factor extraction and factor rotation (Pallant, 2007). The assessment of appropriate data for analysis includes sample size, relationships among items and normality (Pallant, 2007; Tabachnick & Fidell, 1996).

6.2.1 Selection of variables for analysis

All variables from the questions and statements from the survey sections on socio-demographic characteristics, coastal erosion and community capacity building were considered. Those variables that had shown significant differences between the two areas were considered for their potential contribution to the exploratory factor analysis. The significant variables between the two erosion areas were selected to study and investigate the power of the variables based on the following reasoning: variables where significant differences lie provided the most discriminative power between communities that have different levels of capacity: and in this instance, ones from which recommendations to build community capacity to address coastal erosion, will be most effectively drawn.

Variables were chosen according to four criteria. Firstly, if villagers in either low or high erosion area showed a homogeneous response for a variable, then this variable was excluded from the analysis because the responses were not normally distributed (Tabachnick & Fidell, 1996). Secondly, the responses from the two areas were tested by applying the chi-square test because it explores the distribution of frequency data (Brace, et al., 2000). If the responses on variables between the two areas were significantly different, the significant variables were considered for application in the next stage. Thirdly, a variable was included where chi-square test results showed significant differences, but only if the percentages of responses between both areas differed by more than 10%. Lastly, where statements (variables) appeared strongly ‘correlated’, that is, had a similar meaning, and showed an identical or similar difference between high and low erosion areas), then only one statement was selected for the exploratory factor analysis (Gorsuch, 1997).

The significant variables applied in the exploratory factor analysis were modified to two-scale answers. The work of Pett (2003) and Gorsuch (1997) suggested that two scale answers of variables were more able to be computed in exploratory factor analyses.

Significant information from the socio-demographic section (see Chapter 3) was selected to include in the factor analysis because it indicated the social characteristics of villagers as they related to the mitigation of the impacts of coastal erosion. Multiple choice data were modified

into two scale answers in terms of, for example, yes/no, short/long and low/high answers. Five statements from the socio-demographic information provided by residents were selected as follows: domiciled in either low/high erosion area; length of residency (short or long term); low or high educational qualification, low or high income; and land ownership (yes or no).

Statements from the community capacity section were included to enable an investigation of the relationship between building community capacity and ability to respond to natural hazards. Some variables included in the exploratory factor analysis were adapted from five scale choices and others were already dichotomous variables. Eleven variables with five-scale choices met the criteria, and for each, data were transformed from five to two scale choices: agree and disagree. Strongly disagree and disagree responses were merged and strongly agree and agree responses were combined to account for agree opinion. “Don’t know” and “neutral” were excluded from any computation because their opinions were not clear. For “don’t know”, residents might not want to answer the question or have no ideas about how to reply to the question (Nardi, 2006). In term of variables with two scale choices, three variables were recruited for analysis directly.

Data from the coastal erosion section (see chapter 4) were included for investigation of the experiences and perceptions of villagers, and their ability to cope with coastal erosion. The statements selected explored villagers’ experiences of planting mangrove trees, their receipt of coastal erosion information from others, of talking about coastal erosion in communities, and their views on future erosion impact. Two variables with five scale choices met the criteria and they were modified to two scale choices prior to computation. Four variables with two scale choices were recruited from the exploratory factor analysis directly.

6.2.2 Assessment of suitable data

Sample sizes should be large enough or have at least 300 villagers to analyse correlations for reliability (Pallant, 2007, p. 181; Pett, 2003, p. 48; Tabachnick & Fidell, 1996, p. 640). In this study, there were 358 residents.

In terms of assessing the strength of relationships among items, each item should have a correlation coefficient of over 0.3, otherwise the factor analysis needed to be reconsidered (Tabachnick & Fidell, 1996). Pairs of items which were relatively highly correlated were clustered together in the factor analysis (Leech, et al., 2011). In this study, many pairs of items were shown to have a correlation coefficient greater than 0.3 (see Appendix 6-1).

Tabachnick and Fidell (1996) state that when factor analysis is applied, the variables should be normally distributed; however, if the variables fail to create a normal distribution, the results are degraded, but even so they can still be considered meaningful. Several other studies have found that a normal distribution is not considered as the critical assumption when applying factor analysis

because the method is very robust from violation of normality (Allen & Bennett, 2008; Garson, 2008; C. Reimann & Filzmoser, 2000; Clemens Reimann, Filzmoser, Garrett, & Dutter, 2008).

Tabachnick and Fidell (1996) suggested that Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) needed to be applied to examine the appropriation of items for application of factor analysis. The Bartlett's test was applied to confirm the suitability of the factors when there were low correlations and a low number of samples per variable (M. S. Bartlett, 1954; Tabachnick & Fidell, 1996). Significantly correlated variables showed a Bartlett's test significance of less than 0.05 (Leech, et al., 2011, p. 72; Pallant, 2007, p. 181). In this study, Bartlett's test of sphericity value met the required criteria (χ^2 = 919.8, df = 300, p = 0.000).

KMO was applied to examine sampling sufficiency and this meant determining whether there were enough items to be predicted by each factor (Leech, et al., 2011). The KMO was more acceptable when it was higher than 0.60 (Tabachnick & Fidell, 1996, p. 642). In this study, the KMO equalled 0.64 (see Appendix 6-2).

6.2.3 Factor extraction

Factor extraction means reduction of the number of items that can be representative of the interrelationship among items in a data set (Hair, et al., 1995). The factors are extracted by applying the commonly used Kaiser's criterion technique (Pallant, 2007). The factors are derived from the initial solution in the Total Variance Explained Table. The technique considers Initial Eigenvalues (Pallant, 2007). The factors producing eigenvalues above 1 are significant and other factors lower than 1 are not (Hair, et al., 1995). The eigenvalues represent the total variance in all the variables that are described by factors (Pallant, 2007; Pett, 2003). The Initial Eigenvalues derived from variables of the study areas are shown in Table 6-1, and the three processes of total variance are outlined. The Table displays association of eigenvalues and the factors. The eigenvalues are set in order starting at the maximum (3.7); the first nine components are expected to be extracted and retained because they have eigenvalues greater than 1 (see Table 6-1).

In the second section of Table 6-1, data from these nine components are shown as Extraction Sums of Squared Loadings. The percentage of variance on Factor 1 was the highest, approximately 12.9% of variance in the data, with the percentage of variance on subsequent Factors gradually decreasing; between Factor 2 and Factor 9 declining from 8.6% to 1.9% of variance in the data.

Table 6-1: Total Variance Explained table derived from 25 variables to investigate factors to build capacity of community to respond to coastal erosion in the upper Gulf of Thailand

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**3.67**	14.67	14.67	3.22	**12.88**	12.88	2.31	**9.24**	9.24
2	**2.59**	10.35	25.03	2.14	**8.55**	21.43	1.76	**7.06**	16.30
3	**2.26**	9.02	34.05	1.74	**6.94**	28.37	1.58	**6.33**	22.64
4	**1.85**	7.39	41.44	1.35	**5.41**	33.79	1.41	**5.65**	28.28
5	**1.48**	5.91	47.35	0.97	**3.87**	37.65	1.20	**4.78**	33.06
6	**1.26**	5.05	52.40	0.78	**3.11**	40.76	1.05	**4.19**	37.25
7	**1.20**	4.80	57.19	0.67	**2.69**	43.45	1.04	**4.17**	41.43
8	**1.04**	4.16	61.35	0.55	**2.19**	45.64	0.91	**3.64**	45.07
9	**1.01**	4.05	65.40	0.48	**1.91**	47.55	0.62	**2.48**	47.55
10	0.93	3.71	69.11						
11	0.88	3.53	72.64						
12	0.78	3.13	75.76						
13	0.76	3.05	78.81						
14	0.69	2.75	81.56						
15	0.67	2.68	84.24						
16	0.57	2.27	86.51						
17	0.53	2.13	88.63						
18	0.49	1.98	90.61						
19	0.45	1.80	92.40						
20	0.42	1.67	94.07						
21	0.36	1.43	95.50						
22	0.33	1.33	96.83						
23	0.28	1.13	97.96						
24	0.27	1.09	99.04						
25	0.24	0.96	100.00						

Extraction Method: Principal Axis Factoring.

For the Rotation Sums of Squared Loading in the third section of table, the percentage of variance for Factor 1 was 8.37% which was slightly higher than the percentages for other factors. In addition, the percentages of variance of between Factor 2 and Factor 9 in the Rotation Sums of Squared Loadings table were higher than the same factors in the Extraction Sums of Squared Loadings table. Tabachnick and Fidell (1996) intimated this was because the variance on the first factor was extracted and distributed to the following factors. These nine factors could explain approximately 47.6% of the variance in the data. The cumulative

percentage of variance in the extraction process was not impacted after applying the rotation method (Tabachnick & Fidell, 1996).

The Scree plot is another method used to decide the number of factors in a data set. The Initial Eigenvalues described in the Total Variance Explained table was shown in a graph of the Scree plot (Allen & Bennett, 2008) (see Figure 6-1). Both Garson (2008) and Hair et al. (1995) demonstrated the utility of the Scree test to identify the most suitable number of factors from the extracted data. In the Scree test, while the number of factors was increased, the eigenvalues decreased. When the plots of eigenvalues stopped decreasing, and the curve had a less steep slope, the curve was evaluated by considering factors above a cut-off point. After the line flattened, it meant there were small differences in scores between factors (Burns & Grove, 2001). Hair et al. (1995) postulated that the number of factors found from the Scree test might be more or fewer than the Kaiser Criterion Test.

Plots of 25 factors were extracted and shown in the curve from Figure 6-1. Among the first eight factors, the shape of the curve sloped abruptly, and from factor 8, the slope was less steep. In this figure, the first seven factors above the cut-off were qualified for retention; and the number of factors from the Scree test was less than the number of factors found from Kaiser's criterion technique.

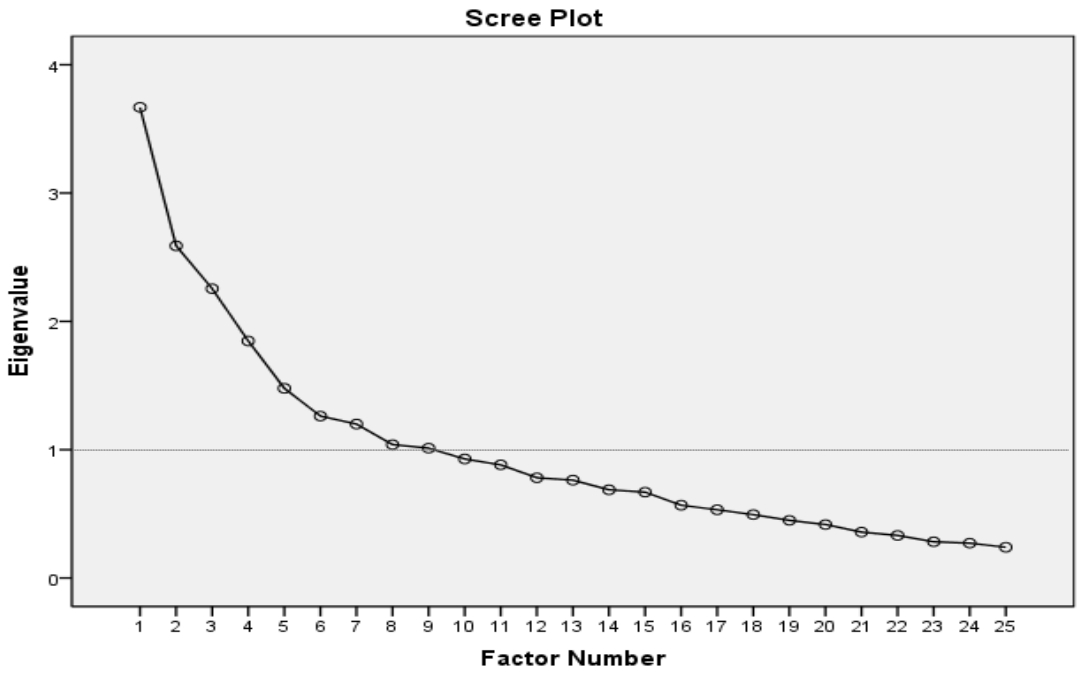


Figure 6-1. The Scree plot of factors extracted from 25 significant variables from the questionnaire

Table 6-2: Factor matrix extracted by Principal Axis Factoring and derived from the Kaiser's criterion technique for 25 measured variables (n = 358 residents)

	Factor								
	1	2	3	4	5	6	7	8	9
0) Residents live in an area expected to be high coastal erosion	0.65	-0.31							
48) If you disagree with what everyone else agreed on, would you feel free to speak out?	0.53		0.37						
08) Residents own land	-0.50	0.30	0.43						
26) Your village has sufficient equipment to support community activities	-0.48								
56) Residents expected to be impacted by coastal erosion in the next 10 years	0.48	-0.36							
16) You have chance to participate in decision-making about development projects in your village	0.46			0.35					
8) You usually go to other villages to visit friends or relatives	0.40								
18) In your community, information about community activities will usually be made public	0.33	0.62							
24) The local government carefully uses funds to develop new projects		0.56							
69) Community leaders are interested in coastal erosion protection		0.53						0.42	
22) This community has encouraged a younger generation in leadership positions	0.41	0.47							
67) You know where you get information about coastal protection	0.42		0.51						
63) Have you participated in activities for planting vegetation to protect coastal areas in the past 12 months?			0.43		0.35				
46) Are you an active member of a group or organisation in the village?			0.42						
07) Residents tend to have high income			0.35						
50) Have you ever attended training programs to develop your environment in the past 12 months									
14) You tolerate others with different perspectives in your community when discussing a matter at a meeting			-0.32	0.53					
05) Residents have high levels of educational qualification				0.37					
13) You always support the village through donation of goods	0.39				-0.39				
5) You believe the community can manage most problems by itself	0.34		-0.32	0.33	0.35				
61) Have you talked about coastal erosion with others in your village in the past 12 months?	0.50					0.62			
4) Most people in this community honestly share points of view with each other							-0.38		
54) Residents experience coastal erosion	0.33						0.34		
30) In the past 3 years, the conditions of the public lighting on streets have improved				0.33					-0.39
03) Residents live in an area longer than 10 years									

Extraction Method: Principal Axis Factoring.

From Table 6-2, nine factors with eigenvalues greater than 1 were extracted from the analysis of 25 variables with minimum loading values of approximately of 0.3 considered acceptable (Hair, et al., 1995; Nunnally & Bernstein, 1994; Pett, 2003). In this study, the minimum loading value was set to be greater than |±0.4| so as to ensure that items extracted contained strong loading to explain factors. Most items with strong loading were distributed on Factors 1, 2, 3, 4, 6 and 7; two items loaded on Factor 7; and one item loaded on Factors 6, 8 and 9.

From the table above, it was difficult to interpret the results because 14 items were clustered on Factor 1, 7 items on Factor 2 and 8 items on Factor 3. Garson (2008) suggested that at this stage the variables on factors are not appropriately sorted. In addition, an item 03 “residents live in an area longer than 10 years” and an item 50 “have you ever attended training programs to develop your environment in the past 12 months” did not load on any Factor. Therefore, a rotation process needed to be implemented to help interpret results (Thompson, 2004).

The variables with higher loading are likely to underlie the factors. The item 0 “residents live in an area expected to be high coastal erosion” had the strongest loading on Factor 1 (0.65). The item 18 “in your community, information about community activities will usually be made public” had the highest loading on Factor 2 (0.62). Four variables 08, 22, 61 and 67 with strong loadings appeared on more than one factor, resulting in difficulty in interpretation of the factors appropriately. Overall therefore, under these circumstances, a rotation of the Factor Matrix was necessary to help clarify the strong loadings and subsequent interpretation of the factors (Allen & Bennett, 2008; Hair, et al., 1995).

6.2.4 Factor rotation

Factor rotation means the factor axes are moved to the area where the measured variables that create factors are located (Thompson, 2004). There are two main types of rotation: orthogonal and oblique (Pallant, 2007; Tabachnick & Fidell, 1996). Tabachnick and Fidell (1996) state that orthogonal rotation is applied when the factors are independent, providing meaningful results in terms of being easy to interpret, describe and report. Orthogonal rotation creates a loading matrix which shows the association between variables and factors. The higher loadings mean stronger relationships between each variable and each factor. Orthogonal rotation is appropriate to apply where factors produce low correlation (Floyd & Widaman, 1995) and when researchers need to apply a single analysis of variables more than a sequential analysis of variables (Ferguson & Cox, 1993). On the other hand, Tabachnick and Fidell (1996) recommend that if the factors are correlated, then oblique rotation will be required. Results from the oblique solution are more difficult to understand than those from orthogonal rotation.

In this study, orthogonal rotation was applied for all the reasons outlined above, the three orthogonal rotation techniques being varimax, quartimax and equamax (Tabachnick & Fidell, 1996). Varimax is the most commonly used because it aims to simplify factors by reducing the number of items which have high loading within factors (Pallant, 2007; Tabachnick & Fidell, 1996; Thompson, 2004). Quartimax seeks to simplify variables rather than factors whereas equamax aims to simplify between variables and factors (Tabachnick & Fidell, 1996). Varimax was employed to investigate factors in this study. The orthogonal rotation utilised in conjunction with the Varimax technique helped clarify and simplify factors by increasing the percentages of variance explained.

Results of the Varimax Rotation were displayed in Table 6-3. Nine factors were identified from the underlying 25 questions which had a loading of above 0.4 (in bold in the Table) for one or more factors. Twenty-two variables qualified on these solutions for Factor 1 to Factor 9. Three variables, 03, 05 and 8, loaded lower than 0.4 and were suppressed.

Item 48 which had a coefficient value higher than 0.4 loaded on two factors: Factors 2 and 5. It was consistent with variables on Factor 5. Three variables, 13, 24 and 54, loaded on more than one factor. The variables loading on factors with coefficient values higher than 0.4 were retained (see Table 6-3).

Eigenvalues and percentages of variance of the data for all factors are illustrated in Table 6-3. The eigenvalues greater than 1 decreased from Factor 1 (3.7) to Factor 9 (1.0), alongside a decrease in the percentages of variance of the data from 13% to 2%. The total percentage of variance was 47.6% of variance of the data.

The total amount of explained variance by seven factors was relatively low. The works of Hair et al. (1995, p. 378) and Pett (2003, p. 118) concluded there to be no guideline to consider the appropriate threshold for both PCA and PAF, but they suggested that extracted factors in social science should account for 50-60% of variance in the data. The factor analysis herewith had not achieved this level of explanation; nevertheless the results enabled grouping of community capacity variables to be considered.

Table 6-3: Factor loading from Principal Axis Factoring with the Varimax Rotation to build community capacity to respond to coastal erosion in the upper Gulf of Thailand

	Factor								
	1	2	3	4	5	6	7	8	9
08) Residents own land	**-0.80**								
0) Residents live in an area expected to be high coastal erosion	**0.71**								
26) Your village has sufficient equipment to support community activities	**-0.58**								
56) Residents expected to be impacted by coastal erosion in the next 10 years	**0.48**								
54) Residents experience coastal erosion	**0.45**							-0.34	
18) In your community, information about community activities will usually be made public		**0.72**							
22) This community has encouraged a younger generation in leadership positions		**0.68**							
05) Residents have high levels of educational qualification		-0.32						0.30	
67) You know where you get information about coastal protection			**0.66**						
63) Have you participated in activities for planting vegetation to protect coastal areas in the past 12 months?			**0.59**						
46) Are you an active member of a group or organisation in the village?			**0.50**						
50) Have you ever attended training programs to develop your environment in the past 12 months			**0.44**						
5) You believe the community can manage most problems by itself				**0.75**					
14) You tolerate others with different perspectives in a community when discussing a matter at meetings				**0.73**					
07) Residents tend to have high income					**0.56**				
13) You always support the village through donation of goods	0.37				**0.53**				
48) If you disagree with what everyone else agreed on, would you feel free to speak out?		0.49			**0.51**				
8) You usually go to other villages to visit friends or relatives					0.32				
61) Have you talked about coastal erosion with others in your village in the past 12 months?						**0.87**			
69) Community leaders are interested in coastal erosion protection							**0.77**		
24) The local government carefully uses funds to develop new projects		0.38					**0.46**		
16) You have chance to participate in decision-making about development projects in your village								**0.59**	
30) In the past 3 years, the conditions of the public lighting on streets have improved									**0.49**
4) Most people in this community honestly share points of view with each other									**-0.41**
03) Residents live in an area longer than 10 years									
Eigenvalues	3.67	2.59	2.26	1.85	1.48	1.26	1.20	1.04	1.01
Explain variance (%)	12.9	8.6	6.9	5.4	3.9	3.1	2.7	2.1	1.9
Total explain variance (%)									47.6

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 12 iterations.
Items with coefficient values higher than 0.4 were in bold.

6.3 Consistency of questions

To examine the internal consistency of the questions in the test, Cronbach's alpha was applied to assess reliability (Pett, 2003). Tabachnick and Fidell (1996, p. 676) explained that for the internal consistency factors a coefficient alpha between 0 and 1 indicated a good solution if the acceptable value of Cronbach's alpha was 0.7 and above because the information suggested that the variables had sufficient variance in the scores of the factor. High scores of the coefficient alpha account for its high reliability. In this study, coefficient alpha for 25 items from the questionnaire was 0.68. The investigation of internal consistency of each factor individually from the FA found that Factor 1 produced a coefficient alpha above 0.7 whereas Factor 2 to Factor 9 had Cronbach's alpha coefficients of between 0.14 and 0.68 (Factor 1 = 0.75, Factor 2 = 0.61, Factor 3 = 0.68, Factor 4 = 0.34, Factor 5 = 0.41, Factor 7 = 0.6 and Factor 9 = 0.14).

On Factors 1 and 9, there were negative variables which correlated with other variables. Pallant (2007) and Pett (2003) suggested that negative correlations severely impact the value of the coefficient alpha so the data needed to be recoded before examining reliability. If all variables on factors were positive, this meant the variables were examined for the same underlying characteristics (Pallant, 2007). Therefore, two variables on Factor 1 and one variable on Factor 9 were recoded before those variables were computed and Factor 1 Cronbach's alpha was increased to 0.75.

6.4 Naming and interpreting

Each factor with its clustered variables was named to help understand the main characteristics of the grouped variables. The work of Thompson (2004) and Hair et al. (1995) asserted that naming should help to explain all variables loaded on a factor where a variable with the higher loading had stronger relationships with the factor label more than other variables. Only those variables with higher loading (greater than 0.4) were included in the naming process. The nine factors had all been thus named: control over land, leaders and leadership, coastal community resilience, sense of community, household socioeconomics, transferring experience, interest in coastal protection, participation in community development and infrastructure (see Table 6-3). The potential factors needed to have high percentages of variance in the data and were of different attribution to other factors illustrated in the past chapters.

6.4.1 Factor 1: Control over land

Five variables (variables 08, 0, 26, 56 and 54) loaded on Factor 1. The coefficient values of the first three variables were greater than 0.4, the loadings ranging from |-0.80| to 0.45 thus explaining 12.8% of variance of the data. The highest loading variable on Factor 1 pertained to land ownership. The Factor 1 was composed of four other statements: residency in the area with severe impacts of coastal erosion, sufficient equipment to support community activities, expecting to be impacted by coastal erosion in the next decade and experiencing coastal erosion.

Two of five loading values were negative, indicating the opposite meaning of the statements, and showing that most residents who did not own land have insufficient equipment. Meanwhile, other variables with high loading referred to villagers who experienced property loss and expected to be impacted by coastal erosion in the next 10 years.

Residents lived in coastal areas which tended to be eroded. Residents and communities could not build structures to prevent coastal erosion along the coastline because most coastal residents did not own land along the coastline and in their communities. Larger areas in communities were occupied by external land holders because most coastal residents sold their land to the landholders during the previous two decades due to surging land prices. Residents in the communities did not have property rights to access the use and benefit from the land. Residents and communities needed to obtain permission from the landholders because they might use different methods for protecting the coastline and developing their land.

To improve the capacity of the community, land should be managed by local residents rather than others who lived outside the community. Land was the basic resource for living, housing and building relationships with others in communities (Angell et al., 2008), and landlessness was the major issue found in rural poverty (Cotula, Toulmin, & Quan, 2006). From their study to build the strength of the Glades Community Development Corporation (GCDC), Chaskin et al. (2001, p. 199) suggested that the board of GCDC needed to improve the ability of organisations to make decisions and manage resources themselves, rather than being controlled by external groups or organisations. In this study, it was apparent that coastal residents needed to have property rights in the coastline and large areas in their communities.

Land ownership is the most significant variable in this factor and it seems to be the critical variable which enhances communities to respond to erosion and improve their wellbeing in communities in respect of building structures to prevent coastal erosion and infrastructure to support local residents. If local residents owned large areas in their communities, the coastline would effectively be managed by local residents without seeking permission from landholders. Additionally, cumulative resources from the local residents would be provided to support coastal protection. Therefore, the critical factor important to building the capacity of a community to respond to the erosion on Factor 1 was “Control over land”.

6.4.2 Factor 2: Leaders and Leadership

Two statements, 18 and 22, loaded on Factor 2 with loadings 0.72 and 0.68 respectively, thereby explaining 8.6% of the variance of the data (see Table 6-3). The statement with the highest loading value was concerned with community information about community activities usually being made public. Another statement was in item 22 regarding the community having encouraged a younger generation in leadership positions. The final statement loaded less than 0.3 and it was excluded.

Two statements on Factor 2 were relevant to leader roles and leadership. Chaskin et al. (2001) suggested that leaders played a key role in community capacity building because they provided directions for community works. Size (2006) provided a useful account of leadership opining that it referred to the capacity to understand and interpret a vision for the future of communities to contain real activities by considering leadership development for everyone who exercised leadership, rather than leader development. In addition, leaders and residents supported leadership development by engaging in participation, promoting development skills and connecting between leaders and residents with information of interest to respond to changes (Chaskin, et al., 2001; Murphy & Cunningham, 2003).

Two major activities were significant in Factor 2. Leader roles were important to lead communities and improve capacity of residents to support communities. For having a role to distribute information, leaders who had received information from various levels of government needed to transfer the information to their residents equally in terms of all income statuses, all levels of educational qualification and across the communities. Information about community activities was important for residents to help them receive good information, make decisions and plan to participate in community activities. Risk information such as impacts of coastal erosion and intensity of cyclones was necessary for all residents to prepare and adapt to the impacts. In terms of leadership, leaders and residents needed to collaborate to support young residents to work in leadership positions to build leadership skills for them. Both variables were related to leader roles and leadership, hence the name given to Factor 2.

6.4.3 Factor 3: Coastal community resilience

Four items, 67, 63, 46 and 50, loaded on Factor 3 with a loading ranging between 0.44 and 0.66, explaining 6.9% of variance of the data. The item with the highest loading value concerned obtaining where to get information about coastal protection. Factor 3 was comprised of 3 other items, such as participation in activities for planting vegetation to protect coastal area in the past 12 months, activity as a member of a village group and attendance at training programs for environmental development in the past 12 months.

The four variables were clustered around two aspects, knowledge and participation. For the former, residents had knowledge to access sources of information and were interested in improving knowledge to develop communities. Knowledge, as in access to sources of information, was necessary for residents when communities were affected by coastal erosion or other natural hazards. Knowing how to access various sources of information benefited residents in helping make decisions to ameliorate effects of natural hazards (Me´heux, et al., 2007). Knowledge of residents could be improved when they were interested in receiving it through attending training programs or seminars associated with coastal erosion protection. In terms of participation, residents were members of groups which participated in coastal protection activities. They could improve their degree of participation through membership of

interested community groups and being involved in community activities to prevent coastal erosion; this form of participation could be empowering and could lead to improved knowledge for dealing with coastal erosion, or other community issues.

Community practices enhanced the capacity of a community to respond to natural hazards by mitigating impacts and increasing the potential for recovery resulting in building community resilience (Paton, Millar, & Johnston, 2001). Walker et al. (2004) explained resilience as a system with the ability to absorb changes and reorganise when responding to changes by maintaining the same function, structure, characteristic and response. In this study, the meaning of resilience made more sense in its social aspects than the natural because community resilience involved their adaptive capacity to maintain the ability to respond to impacts of coastal erosion. Therefore, resilience in this context referred to a community having the capacity to learn and adapt to impacts of natural hazards by retaining social, environmental and economic aspects sustainably (Berkes, et al., 2003).

Four variables in this factor were related to improvement of community ability through learning and practising processes to cope with a range of potential environmental hazard consequences. Therefore, the label given to Factor 3 was “Coastal community resilience”.

6.4.4 Factor 4: Sense of community

Statements 5 and 14 load on Factor 4 with loading 0.75 and 0.73 respectively, which explained 5.4% of the variance of the data (see Table 6-3). The statement with the highest loading was where residents believed that the community could manage most problems by itself. The other statement concerned item 14 which asked about respondents’ tolerance of others with different community perspectives when discussing a matter at meetings.

Residents with long term residency believed that they had sufficient capacity and could manage general community problems by themselves. This meant they felt safe in dealing with community problems after building and maintaining good collaboration with neighbours (McMillan & Chavis, 1986; Prezza, et al., 2001). In addition, they would come to trust their neighbours and have an emotional connection with their places of residence (Norris, et al., 2008).

As well, residents believed that they were tolerant and listened to other members’ opinions when discussing in community meetings. These activities were related to neighbourly interactions and understanding other opinions and desires of neighbourhoods (McMillan & Chavis, 1986). The two statements were associated with the meaning of a sense of community which was characterised by being concerned with community issues, caring and sharing, connecting with people and places, and feeling contented and safe (Goodman, et al., 1998) The meaning of variables on this factor, therefore, involved a sense of community.

6.4.5 Factor 5: Household socio-economics

Three components, 07, 13 and 48, loaded on Factor 5 having loading ranging between 0.51 and 0.56, these loadings explaining a very small variance in the data (see Table 6-3). The highest loading value on Factor 5 was related to the size of residents' income. Respondents' support for the village through donation of goods, and the matter of disagreement with the status quo and the feeling of freedom to speak out, were the other two statements.

Most villagers in coastal villages were fishermen so their income relied on marine animals in the coastal area and yields from aquaculture farms. Residents' income was quite low because the number of marine creatures declined from overfishing, seawater quality and loss of habitat. Therefore, household income needed to be increased to assist residents in improvement in the ability of communities and individuals to address community issues and recover loss from natural hazards (Anderson-Berry & King, 2005; Bardsley & Hugo, 2010; Few & Tran, 2010).

Most residents donated their goods and objects to support community activities. High income residents in the low erosion area donated resources to communities more than low income residents. This activity illustrated residents propensity to come together and provide basic requirements to communities when there was a need (Chaskin, et al., 2001). Feeling free to speak out when disagreeing, inferred that villagers felt free to explain their opinions to communities because they felt secure being members of the community (Terri Mannarini, et al., 2006). Most villagers with high income and high educational qualification in the low erosion area felt free to speak out compared with almost all villagers in the high erosion area.

While these three statements seem unrelated, there is a socio-economic element to each of them, either directly of as an indirect clarification. The factor has been named accordingly.

6.5 Discussion

Nine factors with 47.6% of the variance in the data computed by applying factor analysis were considered for building community capacity to cope with impacts of coastal erosion. Those factors illustrated their priority from most to less important by indicating the percentages of the variance in the data. The first five factors were selected to build community capacity because they explained 33.0% of variance in the data, and each of those had over 4.5% of variance in the items. The remaining four factors presented very small percentages of variance in the data, so they were not considered further. Therefore, the five main potential factors isolated were control over land, leaders and leadership, coastal community resilience, sense of community and household socio-economics.

Control over land was the priority factor for coastal communities to build community capacity for addressing coastal erosion. Land was the source of matters from which the whole of human life benefited: food, housing and related accessories (P. Dale, 1997; Simpson, 1976). Reale and

Handmer (2011) intimated that land survived because food was produced on land. Boonyabancha (2009) and Yunlong (1990) argued that land was the fundamental aspect which supported and contributed to various types of development in communities, and eliminated the major causes of poverty. Land was very important for communities but residents needed to have rights to use land in communities; "land tenure was the system of rights and institutions that govern access to and use of land and other resources" (Maxwell & Wiebe, 1999, p. 825). Land ownership was important for residents to build their shelters and improved their livelihoods, so they needed the rights to access and use the land (Maxwell & Wiebe, 1999; Reale & Handmer, 2011). Land ownership could assist communities to improve well-being by the construction of large basic installations and development of public services (Kreimer, 1979). In this study, most residents with long term residency in coastal villages did not own land, it being occupied by external landholders. Coastal residents needed to obtain permission from external landowners before building infrastructure and structures to prevent coastal erosion. If the external landowners disagreed, communities would not improve land to support livelihoods or address coastal erosion by collective actions; this resulted in risk of property loss during severe coastal erosion. Therefore, control over land was the most important component for transferring the rights to use and benefit from land to communities by external landowners.

Coastal residents did not only need land ownership, but they needed security of land tenure also because they needed security of control over land in the long term (Boonyabancha, 2009). When land tenure was insecure in terms of losing livelihoods, land and house, lacking sanitation and was located in disaster prone areas, the tenants did not want to invest in land improvement (Kreimer, 1979; Reale & Handmer, 2011). In this study, most coastal residents did not prevent coastal erosion in their communities but a small number of residents invested funds to apply rock placements or embed bamboo stems to mitigate the impacts. Burby et al. (2003) studied the environmental hazard preparedness of renters and homeowners in the United States and concluded that most renters experienced in environmental disaster and knew how to prepare for environmental hazards, but they still were at risk because the renters had lower resources and had less incentive to prepare for disasters. If renters asked house owners to improve their shelters, the owners did not want to invest in mitigation of natural hazards because the investment was high and it was difficult for the owners to get the investment back from rental fees (Burby, et al., 2003). This information implied that if land in coastal communities was still owned by external landowners and rented by local residents, coastal areas would be at risk of eroding continuously because both landowners and renters lacked incentives to build structures. If residents and communities owned land, the communities could help individuals or apply collective actions to prevent the coastline from coastal erosion. When communities protected land from erosion by the collective actions, land tended to be more secure and provided benefits to residents and communities resulting in improvement of community capacity.

The ‘control over land’ component is insufficient on its own to improve community capacity. Communities needed effective leaders and leadership to mobilise activities and build community capacity. Community leaders played a key role in the achievement of community wellbeing (Aref & Redzuan, 2009). Leaders should have abilities to manage community problems quickly and have creative opinions which lead communities to adapt to environmental changes (Phillips, 1993; Reichard & Johnson, 2011). Effective leaders empowered, influenced and motivated other residents to act on significant roles (Austen, 2003; Yukl, 2002); promoted new members to work together effectively; improved skills and knowledge to cope with problems; and managed resources appropriately (Butterfoss, 2004; El Ansari, et al., 2010). For these reasons, communities with natural hazard impacts needed effective leaders to build their capacity to respond to the impacts. In this study, leaders in the high erosion area were effective by improving capacities of members and communities to address community issues and enhancing young residents to work in leadership positions.

Leadership was a form of connection of formal hierarchical positions for leaders to explain visions, goals and strategies to organisations (Alexander, et al., 2001; Yukl, 2002). Leaders and followers needed to adopt leadership concepts to build community capacity because leadership brought all sections in communities to work together and achieve the aims of activities (Austen, 2003). Community capacity would not occur if communities lacked leadership (Aref & Redzuan, 2009; Austen, 2003). Leadership processes occurred when leaders and followers worked together as group members (Giessner, van Knippenberg, & Sleebos, 2009). In this study, leadership effectiveness was demonstrated by two aspects: residents of internal organisations were followed and received delegated legitimate authority; and communities which exercised relevant activities, achieved their goals and survived (Storey, 2010).

Coastal community resilience helped communities absorb impacts from natural hazards and respond to the impacts effectively (Carpenter, et al., 2001). This component was comprised of residents’ knowledge and participation. For knowledge, actors from various sectors assist local residents to improve their knowledge and perception of environmental impacts and appropriate solutions (Adger, et al., 2007). In this study, most residents in the high erosion area often participated in training programs organised by scientists and seminars arranged by NGOs to improve and exchange knowledge about coastal erosion and coastal resource protection. Scientific knowledge about coastal erosion and climate change was crucial for local residents to adapt to change related to residents’ experiences (Raihan, Hug, Alsted, & Andreasen, 2010). A study of increasing resilience in responding to environmental hazards by coastal communities in Vietnam, local villagers transferred knowledge by collaborating on growing mangrove trees to protect the coastline, developed means of accessing resources in mangrove forests and increased income by catching marine animals in the forest (Adger, et al., 2005; Wright & Thom, 1977). Several studies have found that community resilience was relevant to their ability to reduce risk, access resource equity, improve villagers’ understanding of mitigating of environmental

impacts, promoting collective actions and supporting policies to manage environmental changes and provide its data for those residents (Adger, et al., 2007; Lorenzoni, Pidgeon, & O'Connor, 2005; Norris, et al., 2008).

In terms of data provided, local residents in this study received risk information and relief information from their leaders. In the literature, Cutter et al. (2012) stated that residents living in hazard prone areas received information from various sources for different reasons such as radio, television and the internet for immediate up-to-date information, and meetings for clarifying questions. Handmer (2007) argued that the up-to-date information about coastal erosion and storm was necessary for coastal residents to make risk reduction decisions for themselves and families. When residents received natural hazard information, residents prepared to protect their houses, look for alternative shelters, buy food and materials and transfer money in the bank (D. S. Mileti, 1999). These activities helped residents to better cope with disasters and maintain community functions.

For participation, residents participated in community activities to build community capacity such as planting vegetation, attending meetings, being members of saving groups and coastal community networks. Wickrama and Wickrama (2011) suggested that residents working in informal grassroots collectives improved their social responsibility, trust, good understanding and social linkages engendering a feeling among residents which led to a strong degree of participation. Jayal (1999) and Williams (2006) argued that participation was related to community development activities associated with democratic practices. In the high erosion area, residents came together to protect juvenile marine animals in their coastal villages from external fishermen. Potter (1985) concluded that high degrees of participation depended on relationships between communities and residents in terms of good experiences in past activities, sufficient knowledge and good communication.

For the fourth component, a sense of community was necessary to build community capacity because people felt belonging, were members and were enabled to support others in communities. When there were community problems, people enabled collective actions (Goodman, et al., 1998). Williams (2006) described that sense of community as associated with the feeling of people for connection to their homes in the particular area because where place identity was strong increased social cohesion and community awareness internally (Uzzell, Pol, & Badenas, 2002). In this study, residents in both areas possessed high degrees of sense of community. The strong sense of community was basic to organise participatory processes for the solving of community problems (Alexander, et al., 2001; Prezza & Costantini, 1998). However, Kaniasty and Morris (2004) pointed out that natural disasters and other catastrophes affected large numbers of people severely, broadly resulting a diminishing of sense of community. Bachrach and Zautra (1985) argued that people who countered threats cope with them strongly by applying all strategies through community involvement leading to higher

degrees of sense of community. Comparing sense of community between both areas, the high erosion area seemed to have a stronger sense of community than the low erosion area. This was because communities in the high erosion area organised participatory processes for addressing natural hazards and they understood that coastal erosion was an environmental hazard affecting their communities so the community brought villagers to participate in activities through sense of community.

Household socioeconomics was the fifth component in which was necessary for coastal rural villagers. The villagers need to use their savings for building their resilience because household incomes of villagers in the same community differ, resulting in differences in abilities to address the environmental changes confronted (Norris, et al., 2008). Villagers with higher income can respond to environmental hazards efficiently thereby improving the quality of life of members in households (Few & Tran, 2010). Most villagers in the study area had low income and their income depended on fisheries and other coastal resources. The majority of villagers in the high erosion area and some villagers in the low erosion area built their houses on the banks of canals risking flooding, canal erosion and severe wind forces. This was the result of economically disadvantaged villagers not having sufficient resources to build good quality houses and live in safe areas (D. S. Mileti & Gailus, 2005). Those of low economic status lacked resources to invest in human development or improve knowledge and skills for villagers (Grindle & Hilderbrand, 1995) who, when they had knowledge about risk and its mitigation, could practise their knowledge and skills to address other natural hazards (Few & Tran, 2010).

6.6 Limitations

Principal axis factor analysis was applied in this study and the total percentage of variance from the nine identified factors was low (47.6%). The total percentage of variance computed by Principal axis factor analysis was lower than other methods such as principal component analysis because principal axis factor analysis solved common variance of the variables (M. Brown, et al., 2012; Costello & Osborne, 2005; Garson, 2008, p. 3; Pett, 2003).

Coefficient alpha for 25 items from the questionnaire was 0.68. In addition, the Cronbach's alpha coefficients for between Factor 2 and Factor 9 were lower than 0.7. This meant the internal consistency reliability of variables of these factors was not good (Pallant, 2007). Pett (2003) showed that the value of coefficient alpha was influenced by the value of the correlation among variables, the number of variables, the format of responses and the length of the scale on variables. When there were a greater number of variables and more response clusters, the coefficient alpha would be higher. In addition, higher alpha coefficients are more likely to be found in the responses on variables in the Likert-scale patterns; it was difficult to get high scores of the coefficient alpha on variables for dichotomous or yes-no answers (Pett, 2003).

6.7 Summary

In this chapter twenty five significant variables from three sections in the questionnaire, socio-demographic information, attitudes of building community capacity and experience of coastal erosion, were analysed by using exploratory factor analysis. Nine factors were prioritised with 47.6% of variance in the data: 1) control over land, 2) leaders and leadership, 3) coastal community resilience, 4) sense of community, 5) household socioeconomics, 6) transferring experience, 7) interest in coastal erosion, 8) participation in community development and 9) infrastructure. The first five of the nine factors represented 33.0% of variance in the items and were selected for further interpretation to build community capacity to respond to coastal erosion.

Control over land was the most important for communities to have secure power and rights on land in their communities for the long term. If land was occupied or owned by external landowners, individuals in communities are less likely to work towards preventing coastal erosion. Communities in areas exposed to hazards needed effective leaders who could address coastal erosion impacts by empowering residents and improving their abilities to do this. In addition, leadership was important to bring leaders and residents together to work to achieve the goals or protect land losses successfully. Coastal community resilience was associated with residents' knowledge and participation in collective activities to address coastal erosion. These activities helped reduce impacts of coastal erosion and maintain community functions effectively. A strong sense of community was necessary in circumstances of threats from natural hazards such a sense helped unite residents in coping with the impacts by participatory processes. Household socio-economic elements were important to consider both for the individual capabilities of residents to respond to natural hazards, and the likelihood higher income residents were more ready to support community resources through donation to address collective problems.

Therefore, the five factors derived in this chapter were prioritised in order that a picture emerged of the community capacity to address coastal erosion. When capacities of communities had been eroded by the impacts of natural hazards, they re-built their capacities to address these impacts through the prism of the prioritised factors.

In the following chapter, the prioritised factors to improve the capacities of communities in both low and high erosion areas to cope with environmental hazards will be recommended. The recommendations will include activities, stakeholders and relevant organisations instrumental in improving community capacities. To cope with the natural hazard impacts efficiently, communities need to understand the cycles of coastal erosion impacts and the appropriate time line necessary to tackle the problems.

Chapter 7: Understanding community capacity to address an environmental hazard

7.1 Introduction

This study explored socio-demographic information, factors that built community capacity and experiences of coastal erosion impacts, to compare communities in low and high erosion areas in the upper Gulf of Thailand. The findings provided an understanding of community capacity differences between the two erosion areas; a better knowledge of the impacts of coastal erosion; and a clearer sense of what it takes to build community capacity to deal with coastal erosion. The factors which were necessary to build capacity of a community to deal with coastal erosion were prioritised and described in chapter 6.

This chapter presents recommendations to help improve capacities of communities through five priority factors which are suggested for managing coastal erosion impacts at particular periods so as to increase opportunities to address the problems successfully. The first section of the chapter narrates the historical responses to coastal erosion in the upper Gulf of Thailand to increase the understanding of the causes, responses and consequences of coastal erosion in this area. The second section, the multi-scales of the adaptive cycle and characteristics of residents' relocation, is described to help understanding of how residents and governmental authorities respond to coastal erosion impacts in a socio-ecological system. The final section presents a cycle of coastal erosion in coastal communities to consider appropriate points at which problems may be managed by applying the five priority factors comprising activities stakeholders may undertake to build community capacity.

7.2 Environmental hazards influence community capacity building

A historical chronology is described to understand the sequence of relevant events in the occurrence of coastal erosion. This sequence is interpreted by adopting the theory proposed by Gunderson, Holling and Light (1995) where the interactions of residents, in responding to change, revealed cyclical periods of environmental hazards and adaptation. The influence of residents relocating to live in other areas, as a form of adaptation, is examined in terms of its effects on the community's capacity in the villages.

7.2.1 A history of coastal erosion and responses

Historical information about changes that have had inevitable consequences for coastal erosion was identified, to clarify characteristics and boundaries of past cycles whereby communities were affected by coastal erosion and then addressed the ensuing problems. Historical information was modelled to illustrate the main characteristics of the erosion disturbances, and

how people prepared, addressed and managed inevitable changes by collaboration with both internal and external organisations. The model shows how communities have responded to changes, in terms of improvement or deterioration of their affected environments (see Figure 7-1).

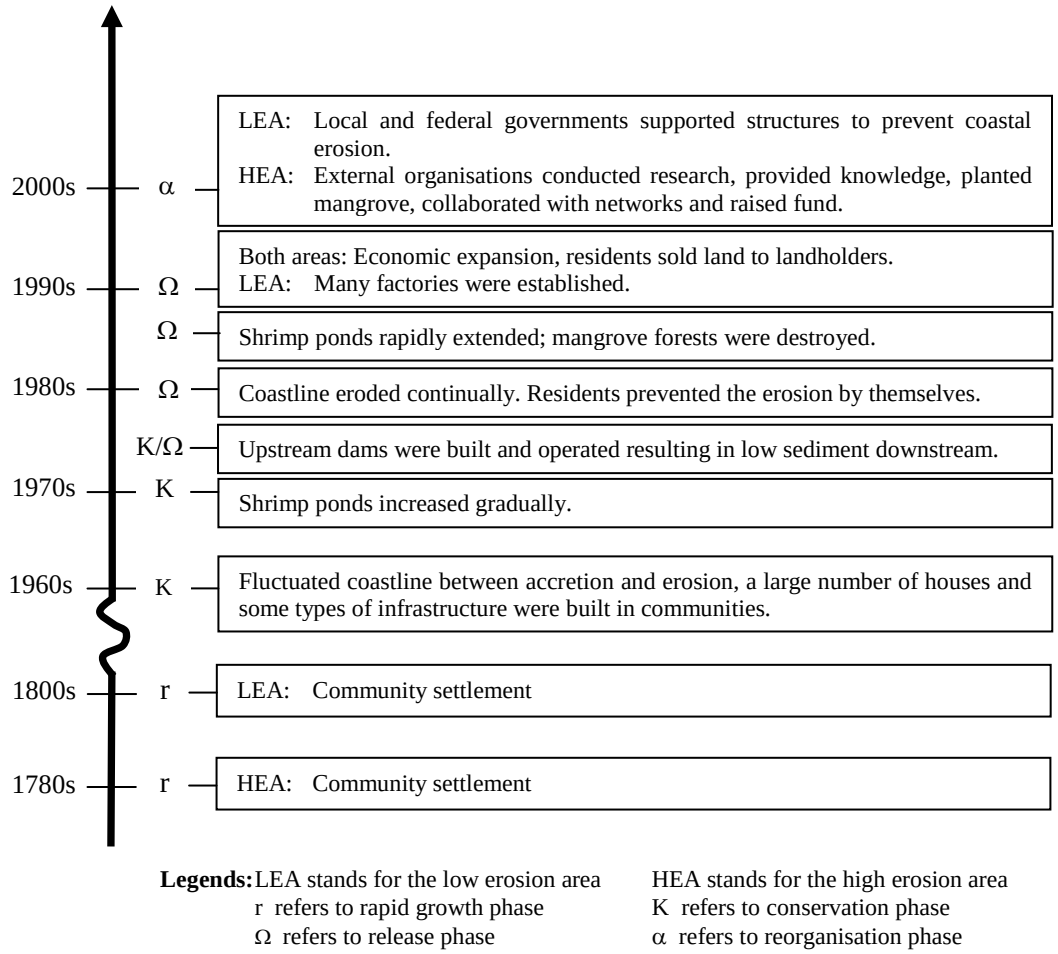


Figure 7-1. Historical events of coastal erosion in low and high erosion areas
Source: Modified from Resilience Alliance (2007, p. 21)

Major events in the past were described using the adaptive cycle to help explain changes in the focal scale, connections across scales, and abilities of actors in scales to support the focal scale (Resilience Alliance, 2007). Four phases of the adaptive cycle were illustrated by using concepts provided by Walker and Salt (2006). The rapid growth phase (r) happens in the early stage of the cycle in which there are new opportunities and high resources. Actors in the system use those resources resulting in rapid expansion of new communities and societies. In this phase, all components in the systems are weakly linked and regulated. The conservation phase (K) occurs when connection among actors increases; new actors are established; the regulation is strong; people adapt to changes effectively; actors' abilities improve from general to specific

aspects; the numbers of population are huge; actors are wise in the use resources; but resilience of the cycle declines. The release phase (Ω) happens when the systems cannot respond to the environmental hazards; components of resources, environment, society and economy leak out the system; relationships within the system are broken; and regulation is weak. Resources leaked from the system are applied as resources for the reorganisation phase (α) which occurs when the system has opportunities, innovation and invention. During this phase new groups of actors become established and control organisations.

In the rapid growth phase (r), coastal communities in the high erosion area were located close to Chao Praya River Delta and near Bangkok after that city was established in 1782 (UNESCAP, 2000). During a period of time later, coastal communities in the low erosion area were established further from the deltas of rivers. Much later, prior to the 1970s, coastal areas for all these communities had fluctuated between accretion and erosion. At that time, most coastal areas across the upper Gulf of Thailand were covered by mangrove forest (Dierberg & Kiattisimkul, 1996). The number of households in coastal communities increased but their connections were weak during the early stage of village formation. Most residents were fishermen, capturing marine animals manually by using bamboo traps, cast-nets, and gill-nets for their income (FAO, 2012). In the conservation phase (K), the number of households increased rapidly; residents had high skills in fishery, increasing their infrastructure and investment; and fishermen bought boats to improve their capacity for catching fish in deeper seawater and over a wider area. This is supported by other studies in the Gulf of Thailand; many fishermen used boats to catch marine life for selling in local markets before developing their boats by installing engines to improve abilities for catching marine fishery to sell in local and national markets (Masae & McGregor, 1998). Other residents cultured shrimp in ponds and the number of shrimp farmers increased gradually. These anthropogenic factors depleted numbers of marine fishery and coastal resources in Thailand (Nissapa, Masae, Boromthanarat, & Jungrungrot, 2002). Such infrastructure was installed to service local communities as power lines on poles, construction of streets and schools to service the increasing interest in education.

When socio-economic conditions in local communities become more fragile and less resilient, surprises occur potentially leading to crises (Holling, 2010). In 1972, the construction of two dams was completed and they started operating upstream of the Chao Praya River thus contributing to the more connected K phase. Unfortunately, the dams had downstream impact by significantly reducing the supply of sediments to the river's delta thereby contributing to the release phase - Ω (Winterwerp, et al., 2005, p. 226). Communities close to the Chao Praya River were more severely impacted by coastal erosion than others.

In the same period of time, mangrove forests were being rapidly removed due to construction of shrimp ponds across coastal areas (Dierberg & Kiattisimkul, 1996). Shrimp yields in Thailand had increased gradually between 1977 and 1987, but subsequently that era the yields of shrimp

dramatically increased (Jenkins, et al., 1999). Over commitment to shrimp farm economies drive this process (Jenkins, et al., 1999; Tookwinas, 1996). Many families in the coastal area had cut mangrove trees to make charcoal for export, and to use as firewood for household cooking (Winterwerp, et al., 2005). These activities made the impacts of coastal erosion in the two areas worse. In the early stage of coastal erosion impacts, most residents did not seek to prevent these impacts. By the late 1980s, some residents had individually prevented coastal erosion by using local materials – the Ω phase.

By the 1990s, the economy in Thailand had expanded rapidly and coastal areas were in high demand by wealthy landholders. Large areas in coastal villages across both low and high erosion areas were sold to wealthy landholders at elevated land prices. Additionally, many factories were established in the low erosion area. A large number of residents in the low erosion area applied to work in those factories because the residents could not earn sufficient income from fishing, due in part to wastewater discharge from factories which resulted in the quality of seawater being lowered and marine resources depleted.

The coastline in the two erosion areas continually eroded and residents who lived close to the coastline often relocated to landwards. Areas to rebuild new houses in coastal villages were scarce because large areas were occupied by external landholders; the coastline eroded and some residents who had migrated occupied public spaces. Consequently, many villagers in the high erosion area reconstructed their houses on the banks of canals in their villages and exposing themselves to the future high risk of erosion. Some villagers, who could not occupy public spaces, moved to live outside their villages. In the low erosion area, some residents who lost land and who could not find a public area suitable for housing, migrated to external villages.

The reorganisation phase, occurring in the 2000s, saw external organisations supporting local residents in the high erosion area. Scientists conducted research by setting up triangular poles to prevent coastal erosion and transferring new knowledge to local residents; civic groups from outside helped grow mangrove trees; and NGOs enhanced networks between many coastal villages. Local residents annually organised traditional ceremonies in their communities for fund raising to build structures to prevent coastal erosion.

In the low erosion area, local authorities annually provided financial resources for the installation and maintenance of seawalls to prevent coastal erosion. In addition, the federal government supported the construction of sand tubes.

7.2.2 Interaction of coastal erosion across scales

A social-ecological system is dynamic and complicated, so the system which is changing, and moving from rapid growth, conservation, release and reorganisation is difficult to describe by using a single adaptive cycle (Resilience Alliance, 2007). Several adaptive cycles are applicable

and can be set in hierarchical scales (S. L. Cutter et al., 2008; Holling & Gunderson, 2002) relating to capacity to address the coastal erosion problems in the system. The system functions across scales, time and organisations and changes are unpredictable because people have limited knowledge and information to understand and make decisions to cope with the environmental events (Holling & Gunderson, 2002; Resilience Alliance, 2007). The multiple scales of the adaptive cycle can be applied to help develop a better understanding of the dynamic scales in the system.

In the Upper Gulf of Thailand, impacts of coastal erosion occurred abruptly and unexpectedly. Coastal villages in the two erosion areas used different methods, and had different access to resources and amounts of support from external organizations to respond and cope with the effects of coastal erosion. Coastal erosion occurred at the household and community levels of the organisation scale. According to Smit and Wandel (2006), the capacity to solve environmental problems varies from area to area and community to community. The ability to improve community capacity at a household level depends on episodes and phases of support from the community level or other levels of the organisation scale. Smit and Wandel further emphasise that effective response at a community level reflects the characteristics of the resources, support and approaches provided from higher levels, such as the subdistrict, provincial and national levels. For this study, these characteristics of interactions across scales can be illustrated using the adaptive cycle, from rapid growth to reorganisation phases for a household level and across to other phases in the hierarchical levels such as community, local authority, provincial and national. It shows that knowledge, technology, resources and structures to prevent coastal erosion must be provided from the higher levels to help improve capacity to address natural hazards (see Figure 7-2).

In the hierarchical scale, a smaller and faster scale which is disturbed by changes in the release phase (Ω) provides a trigger in the conservation phase (K) for a larger and slower scale, called a 'revolt' (Berkes, et al., 2003); whereas at a larger and slower scale the stored social memory is connected across to a renewal phase (α) in a smaller and faster scale, referred to as 'remember' (Berkes, et al., 2003). They explain that social memory is a long-held understanding of environmental hazards enabling a transfer of experiences to other residents, thereby helping them reorganise their experiences with the hazards, and develop their abilities to adapt to changes effectively (Berkes, et al., 2003). Further, communities built resilience when residents experienced coping with crisis, those residents having memorised their resources for reorganisation (Berkes & Folke, 2002). For this study, these cross-scale interactions were explained to model the historical changes in both erosion areas.

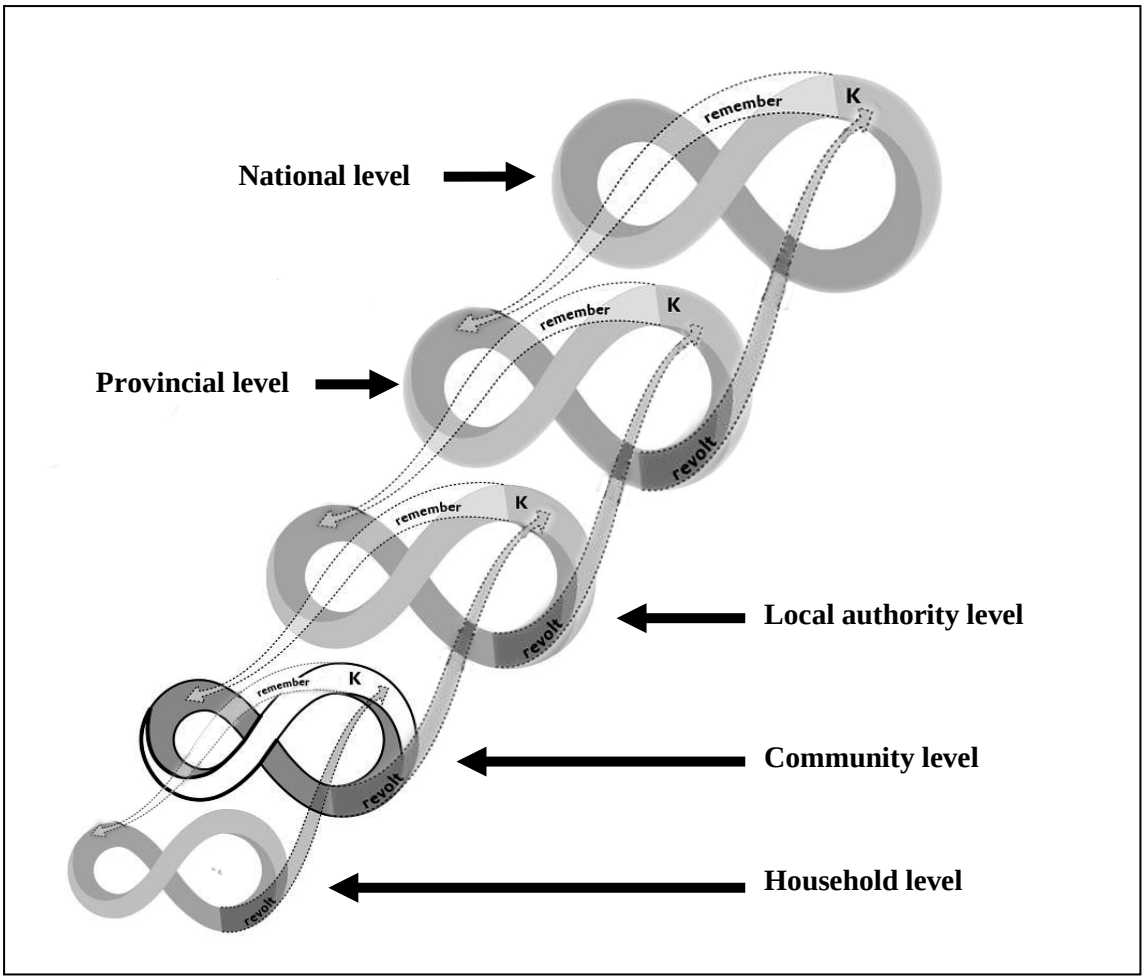


Figure 7-2. Five scales of the adaptive cycle of coastal erosion in the upper Gulf of Thailand
Source: Modified from Gunderson (2008).

At the household level, settlement occurred in the low and the high erosion areas (r). Almost all villagers in coastal villages were fishermen. They caught marine animals for home consumption and income raising by using boats with engines leading to over fishing, hence the renewal phase, Ω. Coastal erosion commenced, impacting on those households. Some households protected the coastline in front of their house by placing rock (Ω). Others did not prevent coastal erosion and asked for help from the community level (Ω). Some coastal areas were not protected resulting in increasing erosion (Ω). This revolt connected the household and community levels. Households which were impacted by erosion migrated to other areas.

At the community level, when several households were affected by coastal erosion (Ω), the effects added to the over-connected phase (K). A village had not increased its capacity due to having insufficient resources, knowledge and skills to address impacts of natural hazards. Coastal erosion impacts were transmitted to the release phase because the coastline continued to erode (Ω). Thence a village appealed for funding and other support from the local authority.

When a community/village was impacted by natural hazards (Ω), the impacts added to the over connected phase (K) at the local authority level. The local authority had more resources and experiences in coastal protection than the community so it provided monetary resources to build seawalls for local communities particularly in the low erosion area. The knowledge of seawall construction and the resources to be able to do so, were 'remembered', and connected between the maturity phase (K) at the local authority level and the renewal phase (α) at the community level.

A local authority is a larger and more conservative (slower) level than a village level and household level. The local authority takes longer to process project proposals before allocating funding to local villages because the local authority approves and prioritises the budget through their operational rules and committees annually (Berkes, et al., 2003).

Seawalls increased coastal erosion rates in adjacent areas, requiring more seawalls to be built in a never ending process. At this stage, village and household levels were affected by coastal erosion because they were smaller and faster levels than the local authority from which they waited for support, so many households migrated to reconstruct their houses in safe areas landwards.

The local authority in the high erosion area had insufficient resources and experiences of coastal protection in this area so it was not protected (Ω). These impacts added to the over-connected phase (K) at the provincial level.

The provincial level was a larger and slower cycle than the local authority level. The provincial level had various types of resources (K) but lacked specific knowledge and experience in coastal protection. Their social memory constructed the nature of resources to support the lower levels. Civic groups at the provincial level visited coastal villages to grow mangrove trees and donate money and goods for other hazards related purposes. Various external groups at the provincial level visited the high erosion area compared with fewer groups for the low erosion area, the latter seemingly having a lower degree of concern for care provision. The provincial authority could not efficiently support and address natural hazards, and the effects being added to the over connected phase (K) at the national level.

At the national level, this largest cycle had more technology, knowledge, resources and experiences to address coastal erosion. Its "memory" connected the conservation phase (K) in the national authority and the renewal phase (α) in smaller cycles. It took a relatively long time before the national government supported sand tube construction to prevent coastal erosion in the communities of the low erosion area. The national organisations supported the sand tube structure to prevent coastal erosion in the low erosion area because they might have successful experience of this structure in other areas where there were low coastal erosion rates. In this case, the national organisations had no sufficient experiences, skills and knowledge to respond to the severe impacts of coastal erosion. Therefore, in the high erosion area, scientists investigated appropriate structures to prevent coastal erosion and examined their capacities,

transferring research knowledge and coastal protection trends to local residents by organising training programs for them. In addition, staff from TV media companies made documentaries about impacts and responses to coastal erosion for broadcasting and hence personal consumption. Additionally, a large number of civic groups visited communities and NGOs organised seminars to enhance networks and share experiences for local communities.

7.2.3 Experiences of relocation in coastal villages

Residents in both erosion areas had lived in the villages since they were born. When those residents were affected by coastal erosion, and because of an absence of effective methods to protect the coastline before the 2000s, they moved to live in areas within the villages but away from the sea. Bardsley and Hugo (2010), building upon the International Organisation for Migration's (IOM) (2007) work about people displaced because of climate change showed that people were forced to leave their home villages because their living areas and livelihood resources were completely degraded from the impacts of environmental change such as coastal erosion, sea level rise and flooding. In addition, natural hazards could destroy community infrastructure and other services such as security, health care and education (International Organization for Migration, 2007).

Most residents in coastal communities had low income status and completed only low levels of education. When residents' land was eroded, they were powerless to prevent the loss. The residents did not migrate to live far from their original places; they moved to safe areas within their villages or migrated to neighbouring villages where the residents could find a public area to rebuild their homes. O'Brien et al. (2012) stated that poor people made decisions to migrate to live in safe places as a necessary mechanism to respond to extreme events. Similarly, VanWey (2005) compared the size of landholdings and out-migration of landholders between Thailand and Mexico, concluding that land was property which acted as wealth and people who owned a small area could not migrate as far as people who owned a larger area. Lonergan (1998) and Piguet (2008) reported from their studies that people who had low income could not move away from their home places due to having low resources to invest for mobility. In addition, they had connections with their neighbours and places in terms of culture, society and history (International Organization for Migration, 2007).

Displacement of residents in the low and the high erosion areas affected the socio-economic profile and characteristics of remaining residents. Residents in the high erosion area often relocated inland, particularly to public spaces where they spent their resources to rebuild their houses, thereby depleting whatever reserves they had. Bardsley and Hugo (2010) and Smit and Wandel (2006) suggested that households and communities that responded to long term impacts of natural hazards could result in decreased livelihood opportunities and resources.

The patterns of displacement and characteristics of residents in the two erosion areas are presented below for understanding of how mobility and migration impacts on a community's

capacity to respond to coastal erosion. The migration experiences of residents in the low and the high erosion areas can be divided into three main groups: those who had not relocated, those who sold land and those who lost land (see Figure 7-3).

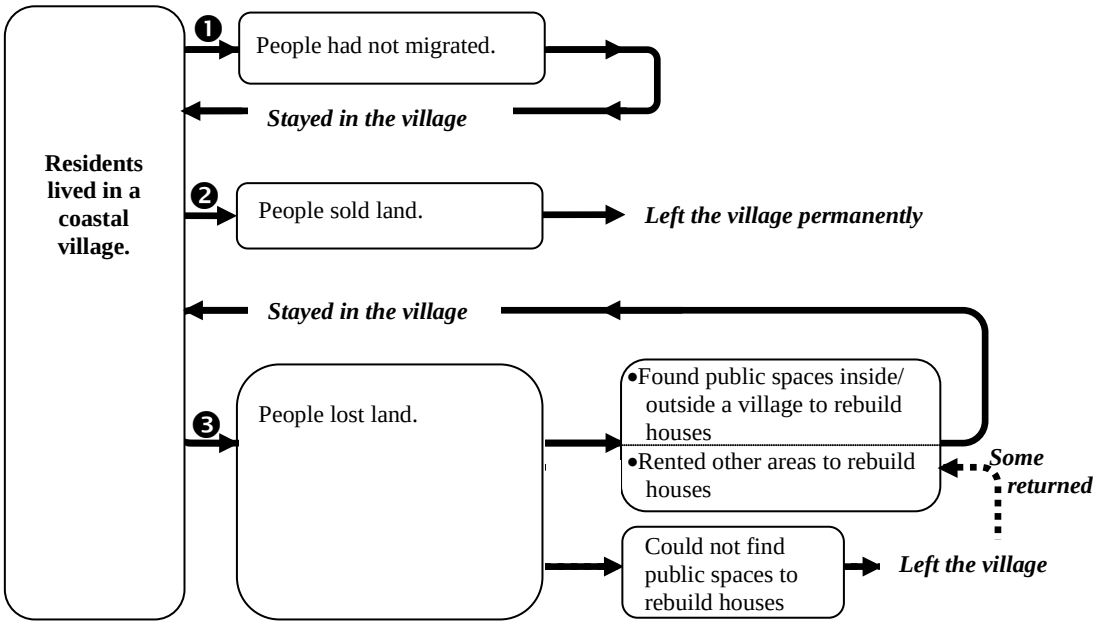


Figure 7-3. A relocation pattern of residents who live in coastal ecology, common to all coastal villages.

Note: The dotted line was only found for the high erosion area where skill sets for employment were inadequate and support household in new area.

Residents who had not been directly impacted by coastal erosion were long term residents in their villages. In the low erosion area, half of the villagers had not been impacted by coastal erosion so they did not experience relocation. They had lived in their villages for longer than 10 years without spending money for relocation so they could save their revenue and/or spend it on other things. Most of those villagers were fishermen and had low educational qualifications.

A second group of residents sold their land to wealthy landholders and migrated to settle in other areas permanently. Those residents took financial resources with them. In doing so, the control over land and power and rights of land were taken over by wealthy landholders. After leaving coastal villages, those residents did not return to live in the original communities. Various studies have pointed out that migration can affect the labour force and reduce human capital (International Organization for Migration, 2007; Mendola, 2008; Naik, Stigter, & Laczko, 2007). On the other hand, Bardsley and Hugo (2010) contended that in the circumstances of declining resources in local communities, relocation to other places could reduce pressures on local resources and services.

Residents who sold land to others and moved to live in external villages affected the financial and human resources in the whole region. Out-migration may have also reduced the pressure on community resources particularly in the high erosion area. Most residents in the high erosion area were fishermen who relied on coastal resources in terms of fish, cockle and other marine animals for feeding their families and providing income. If residents in the high erosion area relocated to live in external villages, pressure on resources in the coastal villages might decline. Meanwhile, residents in the low erosion area encountered fishery depletion so many residents worked in factories surrounding their villages. The residents who out-migrated took their financial resources from villages after selling land causing a reduction of opportunities to support the building of community capacity. This conclusion was based on IMO's (2007) work, which showed that loss of community members and resources by moving out of the previous communities affected abilities of communities to function and service those communities, leading to an enhancement of the out-migration of other residents.

Lastly, residents who experienced land loss were divided into two groups: lack of public space to rebuild houses and building houses on rental area or risk area. Prior to 1990, residents who lost land found public spaces to rebuild their houses within their villages, particularly in mangrove forest areas. For residents who lost land during the past 20 years, it was much more difficult to find public spaces for reconstructing houses because larger areas in villages had been sold to wealthy landholders and other areas were occupied by other residents. In the low erosion area, the residents who lost land left the coastal villages to live in other areas. Those residents did not return because they could not earn enough income from fishery pursuits due to fish resource depletion. The residents, therefore, having fewer local options, were forced to migrate and live in external villages. From the questionnaire, most respondents who experienced land loss and lived in the low erosion area were fishermen and one fifth were vendors. Most respondents who experienced land loss were poorly educated (see Table 4-4).

Most residents in the high erosion area lost land and had experienced relocation. Of those, most had lost their property more than twice. When villagers were impacted by coastal erosion in its early stages, they found and occupied public spaces for rebuilding houses within the same villages. In fact, villagers moved to reconstruct their houses in public spaces landwards perhaps several times, resulting in increasing difficulty to find safe public spaces. Villagers moved to rebuild houses on the banks of canals found in villages and other areas where residents were more at risk of high tides, flooding and river bank erosion. Bardsley and Hugo (2010) and Hugo (1996) stated that lack of land resources pushed people to live in hazard prone areas because they could not find safer areas. In this study, some residents in the high erosion area moved out from one village to rebuild their houses in public spaces in neighbouring villages particularly on banks of canals. Other residents who had sufficient income rented land from landowners for rebuilding houses. From the questionnaire, most respondents in the high erosion area who

experienced property loss and moved were long term residents, fishermen, with poor education, low income and no land ownership (see Table 4-4).

Some residents who had been affected by coastal erosion moved to live in external communities and worked in the factories there or in urban areas. Those residents received low incomes, thus making life difficult in their new areas because they lacked strong skills and knowledge to work in factories. When some residents realised that the revenue from working in factories or urban areas was lower than catching marine animals in coastal villages, they returned to the same coastal villages and rebuilt their houses on river banks or land they rented for constructing houses. The IMO (2007) suggested that people who were poor and lacked skills would not permanently live and work in new areas due to declining income, increasing food insecurity and reduced health provision. Extending this concept, the IMO reported that residents experiencing out-migration would have had social and historical relationships with their home villages, so they returned.

As described above, coastal erosion caused local residents to move from their original communities due to land and property loss. The more the coastal area eroded, the more the useful land was lost, the more people migrated out, the more the needed for infrastructure was ignored, the more the coast was eroded. Meadows (1999) maintained that this positive feedback loop could be related to change in the system from growth and explosion to erosion, resulting in a 'vicious cycle' (see Figure 7-4). Explaining the cycle in more detail will enable intervention points to be identified to ascertain how coastal erosion can be slowed or prevented. Figure 7-4, illustrates how coastal erosion is occurring in some communities in the upper Gulf of Thailand with low and high erosion rates (A). The major impact of coastal erosion was decrease of land available for land use (B). The loss of land for living, farming and social activities causing the residents affected to migrate inland to look for public spaces within communities to rebuild dwellings (C).

Land shortages drive up prices of land for dwellings and shrimp farms. In the 1980s, the economy in Thailand increased across the country dramatically (D), with many wealthy landholders interested in buying in coastal areas. These wealthy landholders bought land at very high prices (E), from local residents (F). These caused many residents who had sold their land to leave and live in urban areas or areas which were far from the coastline. The residents who moved out from communities were villagers who had already established some form of a sense of community and sense of place. These movements of people from communities meant an effective loss of human capital (G). In addition, these former residents took what money they had, with them, resulting in a loss of financial capital within communities (H). Meanwhile, land was purchased by wealthy landholders from external communities who did not have the same attachment to these village communities or sense of place.

Out-migration from communities because of the impacts of coastal erosion caused a lower number of remaining residents who therefore had less revenue and diminution of knowledge necessary to build infrastructure to respond to coastal erosion (I). The necessary official responses became less attractive ventures for the government to become involved in effective and expensive infrastructure needed to prevent further coastal erosion because of the relatively small number of residents remaining. Under these circumstances, the coastline was not protected appropriately, resulting in a continual loss of land (J).

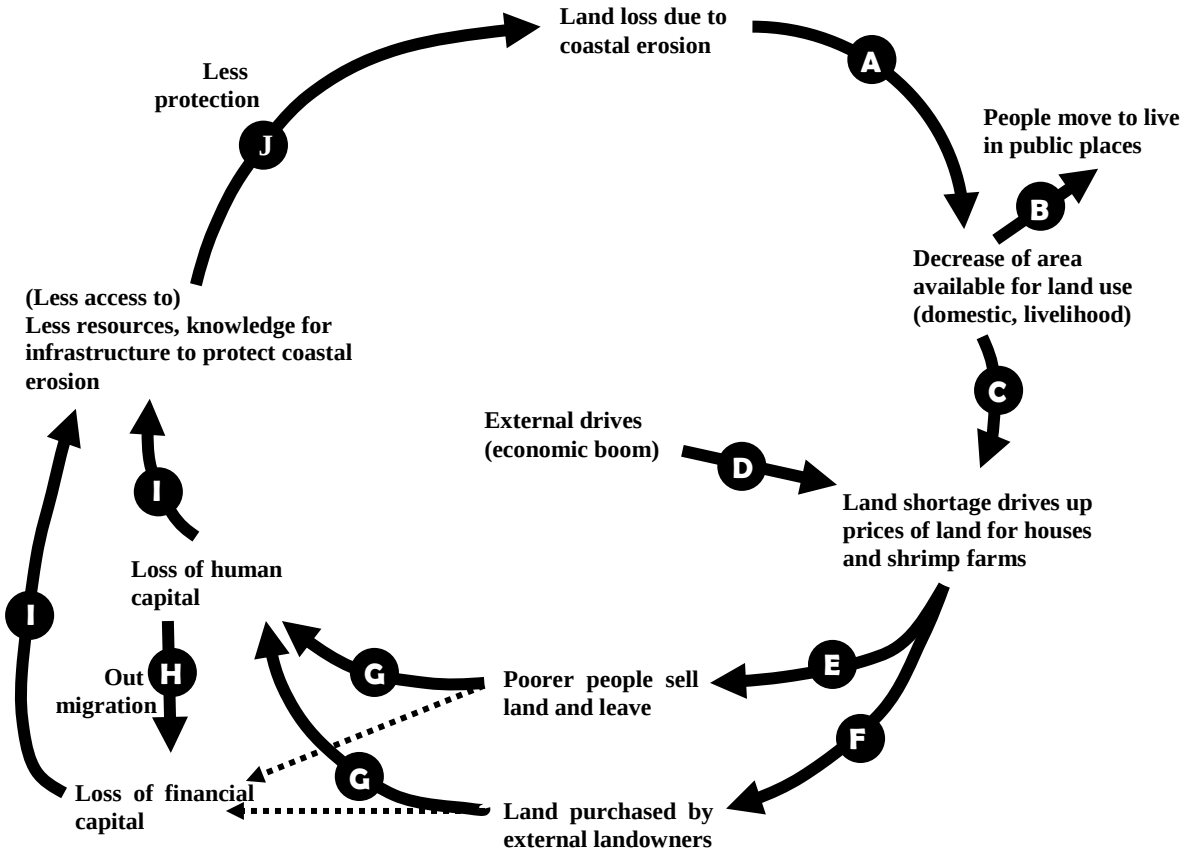


Figure 7-4. A positive feedback loop of coastal erosion

Meadows (1999, p. 1) suggested places to intervene in the feedback loop called “leverage points” which were points of power. The leverage points help delay in the feedback loops. Building physical structure in the system is not recommended to be the leverage points because changing a physical structure is difficult and expensive and it takes time, and these are characteristics that Meadows (1999) regards as ineffective.

From Figure 7-4, two leverage points could be identified to delay the impacts of coastal erosion in the feedback loop. Firstly, C-point changed the system by stopping land shortage and selling

land with high prices to people outside the community. The recommendations to intervene in the feedback loop at C-point can be drawn from the priority factors found in Chapter 6: coastal community resilience and sense of community factors. The coastal community resilience factor, if addressed, would help villagers to improve knowledge and to create participatory processes to protect coastal area in their communities. In addition, the villagers would improve their sense of community by connecting with other people and places, so villagers might not sell their land to others.

Secondly, I-point suggests that a mechanism to prevent out-migration of villagers, who sold land and who lost land would greatly assist the situation. The villagers who lived in coastal villages had less revenue and knowledge for building infrastructure to protect coastal area. The recommended priority factors drawn from Chapter 6, to improve the abilities of residents to access community resources and knowledge was Control over land, Leaders and Household socio-economic factors. Control over land help villagers own land and benefit from farming and rebuilding dwellings on land for short, medium and longer terms. Leaders paid attention in coastal erosion and coastal protection issues to ensure local community safety. Additionally, household socioeconomics helped villagers apply financial resources to prevent coastal erosion and build their houses in safe area. In addition, residents who increased household income could donate their revenue to community to address collective problems in their communities. These interventions will be discussed in more detail below.

7.3 Interventions to improve community capacity

Coastal communities were found to be still at risk from coastal erosion, flooding and storm surge. Most residents from the two erosion areas were poor and marginalised. On their own, poor people are vulnerable when attempting to address the natural hazards themselves (Adger, et al., 2007). Residents cope best when collaborating to deal with environmental hazards by using collective action to ensure the wellbeing of residents in the communities (Bowen, et al., 2000). In this study, the major finding from an analysis of significant variables between the low and the high erosion areas was that five components of community capacity were critical: control over land, leaders and leadership, coastal community resilience, sense of community and household socioeconomics.

Five components were established by computing and analysing from few groups of variables relevant to community capacity building, experiences in coastal erosion management and socio-demographic characteristics of local respondents. These components analysed and found from various groups of variables seemed to be more appropriate than considering a single group of variables. The five potential components were crucial to build capacity of community to respond to coastal erosion and they were strongly related to the factors of community capacity building in the literature review sections. These components could be applied to intervene in

communities to enhance their capacity to respond to natural hazards effectively. In addition, single interventions appeared inadequate for building community capacity successfully. Partial solutions to the five components are necessary for implementation to ensure appropriate degrees of community capacity to cope with changes (Resilience Alliance, 2007).

7.3.1 Control over land

"Residents, now, obtain permissions from wealthy landholders to reconstruct their houses. If the landholders do not allow the residents to rebuild houses, the residents have to migrate out, don't they?" Head of village in the high erosion area

Control over land was the key component found by this research. A large number of residents in coastal villages did not own land in their villages and larger areas in coastal villages were occupied by external landholders. Land ownership is related to the rights over land to make decisions for governing land resource use (Angell, et al., 2008). Decisions concerning all types of construction on lands owned by wealthy landholders could not be made by communities; a community needed to obtain permission from the landholders. Angell et al. (2008) pointed out that low income status villagers suffered from a lack of the right to control the resources which were necessary for their livelihoods. There is an imperative therefore, to find ways to enable communities to shift the ownership of land and decision-making processes over land and infrastructure from external landownership to the community.

Communities needed to hold the property rights to access, to use and to profit from land resources; and land tenure security for development should be of long term benefit for residents' or community's investment (Angell, et al., 2008; Boonyabancha, 2009; Durand-Lasserve & Selod, 2007). Communities must be in a position to respond quickly to unexpected hazards so as to minimise losses. It is important that they hold the property rights over land to be able to make these decisions.

Shifting the power attached to the property rights from external landowners to local communities has been related to the success of community-driven land tenure strategies. In the Philippines, such strategies were established to help low-income communities solve community problems of access to land in cities and help protect communities from displacement due to mega-infrastructure projects and natural disasters. There were three methods used in this program (Teodoro & Rayos-Co, 2009). Firstly, "the directly negotiated land purchase" meant buying land under agreement of terms and conditions between communities and landowners. Two main parties were involved in this transaction: communities and landholders. Secondly, a Community Mortgage Program was developed - a mortgage finance which allowed organised groups of low-income residents to purchase land by receiving 25 year loans from the federal organisations with flat interest rates. Lastly, a "usufruct" was developed. The term is rooted in the Latin Language and meant use and enjoyment, and refers to the rights of residents to access land and derive benefits from its use under a commitment to give the land back to its owner after a particular period of time (Teodoro & Rayos-Co, 2009). A usufruct was slightly different

from lease, being more flexible, compared with lease and other methods in terms of rights to use land which covered all types of use and enforceability which were created by law, contract or prescription (Teodoro & Rayos-Co, 2009). Meanwhile, Angell et al. (2008) and Boonyabancha (2009) have pointed out that a traditional lease was still an adequate alternative because of the long term status of a land lease which enhanced security of land use and were cheaper for residents than outright land purchases. These types of arrangements however require the cooperation and best intentions of wealthy landholders.

Land use plans and community plans were helpful in minimising conflict between residents and wealthy landholders (Beatley, 2009), provided all parties were involved in their preparation and adoption. These techniques helped transfer the rights to build infrastructure from wealthy landowners to communities, but the land use plans and infrastructure investment in communities should provide incentive and be effective in building resilience overall for the community. Durand-Lasserve and Selod (2007) outlined that community development and investment must conform to planning regulations, construction standards, characteristics of development in the contract and agreement between landowners and developers. Public investment in land improves livelihoods by reducing vulnerability and poverty (Reale & Handmer, 2011)

Therefore, to help a community hold property rights in areas suffering coastal erosion, government authorities can encourage and support the adoption of appropriate findings and successes of community-driven land tenure strategies, and create land use plans in communities. This would enhance the way residents, communities and landholders become directly involved in the control over land affected by coastal erosion. The role of local authorities would be to facilitate collaboration and agreement. Groups of residents could be established to apply for long term loans for mortgage finance from federal organisations. Together these approaches would provide communities with more control over their own destiny.

7.3.2 Leaders and leadership

"If leaders pay attention and sacrifice their time to work for communities, the communities will be improved somewhat." A resident in the low erosion area

Formal leaders in the two erosion areas were structurally important in coastal villages. They were interested in all community problems, promoted activities and decisions to residents and supported projects to develop communities with limited resources to achieve wellbeing. Leaders had roles to serve residents in communities to ensure they felt safe when impacted by natural changes (Popper & Mayseless, 2003), but these formal leaders in local communities also had active roles in improving communities, creating interesting activities and efficiently mobilising local resources for community development (Nypan, 1970). In fact, local communities needed effective leaders to develop them and address their problems successfully. Community development would be restrained, if communities lacked effective leaders (Aref & Redzuan, 2009) who had helpful, optimistic and self-confident characteristics, applying those to their

leadership positions (Judge, Piccolo, & Kosalka, 2009). Leadership supports the ability to translate a vision of communities in the future into implementation (Size, 2006). Sylvia et al. (2010, p. 23) state that "leadership occurs with informal authority and legally conferred power, but whether it is formally conferred or informal, it relies on influence-made possible by repeated interactions and development of trust-to get things done."

Communities affected by environmental hazards need effective leaders who have the power to guide direction and manage resources to respond to the hazards and reduce social and economic impacts. In the high erosion area, formal leaders presented themselves more effectively, managing community issues and seeking financial resources from external communities to build structures to prevent coastal erosion, when compared with the low erosion area. Additionally, in the high erosion area, women leaders were accepted to enhance power equality between genders, and young residents were promoted in leadership positions to improve leadership abilities by learning from previous activities and collaboration with other members to address environmental problems. In this way, leadership was improved by trial and error, as a process learned from successes and mistakes (Brungardt, 1997; Sylvia, et al., 2010). Residents in the low erosion area exhibited a notable reluctance both to accept women working as leaders and to promote young residents into leadership positions.

Formal leaders in the low erosion area, therefore, might need to improve their abilities to work in their roles, lead communities, and seek resources to address possible impacts of natural hazards efficiently in the future. In addition, women in leadership positions needed to be promoted in the low erosion area because such an action can be related to community viability (Sylvia, et al., 2010). Women capably displayed support roles in community activities and improved fundraising abilities (Vincent & Martin, 2000). Additionally, most young residents in the low erosion area were interested in working for their income in factories, whereas only older adults were leaders in the communities. The communities might have a lack of leaders with leadership abilities in the future, so young residents need to be mentored as future leadership prospects by early development of leadership skills by learning from the experiences of other leaders in the respective communities. These mentoring schemes can be promoted around decisions necessary to address coastal erosion, and local fisheries.

7.3.3 Coastal community resilience

> *"From current coastal erosion impacts, coastal communities need to protect the coastline by ourselves and we cannot wait for full support from the government. Villagers collaborate to embed bamboo stems offshore to prevent coastal erosion." Head of village in the high erosion area*

Coastal community resilience was a component that emphasised improving the capacity of individuals and social groups to learn and respond to impacts of coastal erosion to prevent them from the severe impact phase of coastal erosion. To increase community resilience, they needed to reduce their vulnerability and be robust in their reactions to erosion disturbances (Beatley, 2009). Communities which rated poorly in their economy, resources, self-organisation and

socio-demographic characteristics were highly vulnerable when exposed to natural hazards (Cardona, et al., 2012; Eriksen & Kelly, 2007). Disturbances encompassed impacts to livelihood in communities, loss of security and changes to physical environments (Adger, 2000). Building community resilience helped ameliorate the disturbances of environmental changes presently and in the future (Walker et al., 2002). Communities could build their resilience by improving knowledge and participating in community activities such as meetings, cleaning community activities, planting mangroves and ceremonies.

Residents in the high erosion area had more opportunities to improve their knowledge about coastal protection by attending training programs, workshops and seminars which were organised by external organisations or scientists. The scientists experienced impacts of coastal erosion in their studies, education and training programs (Luers & Moser, 2006; Elke U. Weber, 2010). In addition, the communities were interested in improving their knowledge on how to respond to coastal erosion, acquiring it by collaboration with external organisations as sources of the needed knowledge and information. This suggests that residents in the high erosion area would have the capacity to receive information and improve their knowledge for responding to negative environmental events of the future. Current trends indicated that residents in the low erosion area were less likely to respond appropriately to unexpected events in the future.

Residents in the low erosion area were less involved in community participation activities relevant to coastal protection. This is necessary, even though the erosion is characterised as 'low' in this study, it is still present and will be a significant challenge for communities in the future. Individuals and communities should be regularly engaged in community protection activities to help minimise environmental hazard impacts on their houses, neighbours or communities (S. L. Cutter, et al., 2012).

To improve community resilience, governmental organisations and other external organisations such as scientists and NGOs should provide support in terms of knowledge, funding and equipment to improve coastal communities through organising training programs, seminars and workshops relevant to prevention of coastal erosion. Coastal communities in the low erosion area needed to increase their collaboration with other external organisations and coastal communities to improve their knowledge, especially the communities in the high erosion area. Communities in the high erosion area should communicate their information and experiences of coastal erosion, coastal protection and organisational support to the low erosion area. As an example, villages and villagers in the low erosion area should apply for membership of the Coastal Community Networks to exchange experiences about coastal erosion issues with other coastal communities in the upper Gulf of Thailand.

7.3.4 Sense of community

"All households are members of groups in our villages such as saving groups, house-wife groups and coastal conservation networks and all groups are parts of community development." A resident in the high erosion area

The sense of community in residents is regarded as a necessary component of community (Davidson & Cotter, 1991). The concept of sense of community involves sharing and caring of community residents throughout their daily life (Chaskin, et al., 2001; Goodman, et al., 1998). Life satisfaction, safety and security, social participation and problem solving abilities were inherent parts of the quality of daily life associated with sense of community (Terri Mannarini, et al., 2006). People have higher degrees of sense of community because they have shared feelings of belonging to groups, have built linkages among members, enabled others to express opinions to others and received support from others when needed (Goodman, et al., 1998; McMillan & Chavis, 1986).

These characteristics were more commonly expressed by residents in the high erosion area than by residents in the low erosion area. Prezza et al. (2001) suggested that a higher degree of sense of community was concerned with neighbourhood relations, life satisfaction and area of residence. Bachrach and Zautra (1985) studied the responses to a proposed project of hazardous wastes treatment being built in a rural community finding that sense of community was stronger when people had a common understanding of, and wanted to cope with, their community problems. In the instance of their study, the hazardous wastes treatment facility was the community stressor and residents needed to address the community stressor by using collective action. People organised various active responses to halt the project, for example, circulating petitions, sending letters to legislators and participating in meetings.

Sense of community was associated with active participation among residents in a community (Chavis & Wandersman, 1990; Davidson & Cotter, 1997). Paton, Millar and Johnston (2001) and Kaniasty and Norris (1995) argued that sense of community in circumstances of environmental hazards related to involvement of the communities by responding to natural hazards, increasing ability to access sources of support from networks and receiving the support. The implication is that residents in all vulnerable coastal areas need to increase their active involvement in communities to improve their sense of community level. Sense of community was improved by: enhancing participation in community activities for environmental improvement; providing support to others when they needed help; communicating information about experiences of coastal protection to assist in preparation for adapting to erosion impacts; and cooperating with appropriate external organisations to receive assistance.

7.3.5 Household socioeconomics

"I have got income from cockle farming, but it is not enough to protect my house. When coastal erosion occurs in front of my house, I cannot afford to pay for structures to prevent the erosion." A resident in the high erosion area

Household socioeconomic element was a necessary component to help local residents have sufficient resources to respond to coastal erosion. Residents who had low income might be at risk of home destruction from natural hazards because the residents did not build their houses with strong structures, lacked maintenance of their old houses, and used low quality of materials

(Lindell & Prater, 2003). In addition, they had insufficient resources to afford for safer areas and were forced to live in a hazard prone area (E. L. Tompkins & Adger, 2004). Examples in the literature show that when the lower income earners are exposed to natural hazards, the impact tends to be more severe for them than other groups of people (Norris, et al., 2008). Those with a lower socio-economic status have a lower quality of life (Few & Tran, 2010). After being impacted by a natural hazard, those with lower income status are more vulnerable to recurring or different natural hazards (A. Fothergill & Peek, 2004), they recover their dwellings or properties more slowly due to lack of resources, and they are not qualified to meet loan criteria for borrowing money to invest in recovering their dwellings (Lindell & Prater, 2003).

The lower income households need financial assistance from their households or kin networks as the major source (Lindell & Prater, 2003). Lower income groups could obtain assistance from networks and outside but this is difficult (Few & Tran, 2010). Norris et al. (2008) argued that responsible organisations always supported local residents to ensure their survival and safety and to achieve well-being but it depended on the effectiveness of organisations. Local authorities could support local residents to respond to environmental hazards, but it depended on resources of the local authorities and the relationships with the states to receive assistance or the relationships with business sectors to establish collaborative support such as social care, environment, education and infrastructure (Wallis & Dollery, 2002).

To improve household income and reduce poverty, local residents for these villages were members of the Village Fund and they could borrow money from the fund to invest some business or activities before returning money to the village committee with no or very low interest (Boonperm, et al., 2007). Angell et al. (2008) who studied the improvement of community resilience suggested that household poverty reduction was improved by considering household interest, developing skills and capacities of residents and providing some support such as looking for new markets, improving land based transportation and supporting financial services.

7.4 Reflections and recommendations for future research

The study was conducted to understand previous coastal erosion impacts to learn from circumstances of change and uncertainty, to understand how scientific knowledge and traditional knowledge could be applied to prevent coastal erosion, where skills and experience could be integrated to respond to the problems people were encountering. Common factors to build the capacity of communities were derived from the literature and these were indeed found to be important in this study. These factors appear relevant and applicable where communities need to respond to development-related social and economic issues that are perceived as critical in communities.

However this study also shows that these factors need to be more carefully tuned and focused for community capacities to deal with long term impacts of environmental hazards like coastal

erosion, which may well be even more severe in the future due to sea level rise. The results from the study show new potential factors which seem to be more pragmatic to build capacity of community to address coastal erosion problems than these common factors described in the literature. The study also suggests intervention points in a positive feedback loop of coastal erosion by enhancing capacity of community through the new potential factors in order to slow and prevent coastal erosion impacts currently and in the future.

Coastal communities need significant amounts of support from external communities such as resources, knowledge, skills and experience to cope with the impacts. In many cases the reverse has been true; local communities with severe impacts of coastal erosion have been receiving less support from the government to prevent coastal erosion. The communities need to collaborate with external organisations, using multiple connections at different scales of an adaptive cycle because those external organisations have resources, store knowledge and gain experience. Helping communities improve their abilities to address the long term impacts, by maintaining and controlling community functions for responses to the next environmental hazard events. Above all, these external supports, and these collaborative ventures, need to address the diminishing control that people in communities have over their own land, where they live. Allowing people to make decisions over their own land, with these other forms of support, will improve the communities' capacity to respond to this environmental hazard, and arguably other environmental hazards as well.

It would have been beneficial to this study to include residents who were impacted by coastal erosion or who sold land and who migrated from their coastal villages. However, the researcher could not find those residents since they located in different areas across the country. It was difficult to look for the homes of those people because residents of the study area could not provide the researcher with reliable or correct information of their current locations. In addition, the relationships between residents in the study area and people who relocated externally were not strong so less attention was paid to the recognition of those persons' whereabouts. Therefore, the researcher did not interview people who moved out so as to collect information relevant to patterns of displacement and socio-demographic characteristics of out migrated residents.

Only three out of eighteen sub-districts in the upper Gulf of Thailand were selected for study; two sub-districts represented the low erosion area and one sub-district represented the high erosion area. It might be considered that samples from three sub-districts do not represent all coastal villages in the upper Gulf of Thailand because the samples were small. However, six subdistricts in the upper Gulf of Thailand were not affected by coastal erosion and twelve sub-districts were affected by coastal erosion with different rates. One out of three sub-districts was studied and represented a high erosion area and two out of nine sub-districts represented a low erosion area. In this study therefore, three out of twelve sub-districts were selected and the

samples can actually be regarded as more representative than what might seem like the case. In addition, all sub-districts in the upper Gulf of Thailand were not selected due to time restriction and budget limitation.

It is useful to investigate the functional relationships between organisational levels in adaptive cycles to improve understanding of how lower levels receive support from the higher levels to increasing capacity and action. Individuals and communities are exposed to natural hazards directly, and they must respond to impacts and consequences quickly to ameliorate the impacts (Burton, Soussan, & Hammill, 2003; S. L. Cutter, et al., 2012). Referring to the adaptive cycles, when the local community is in the release phase, the connection between the local community level and the higher hierarchical levels needs to be studied to ascertain criteria and conditions about the organisations' relationships and operations. Local communities manage environmental hazards by preventing social, cultural and economical marginalisation of local people (Mustafa, 1998). They promote income sources to reduce poverty, enhance collective security (Kelly & Adger, 1999), seek ways to improve knowledge, technology and financial resources (Adger, et al., 2009), and collaborate with higher hierarchical levels to receive assistance (B. Smit & Pilifosova, 2001). If local communities cannot address natural hazards, the communities apply for assistance from the upper hierarchical organisations which can access more resources, knowledge and technology. Organisations at the higher levels set policies, regulations and standards to manage environmental hazards, prevent maladaptation, enforce environmental regulations (Birkmann & von Teichman, 2010; Brooks & Adger, 2004), and support resources to improve abilities at lower levels (Beatley, 2009; B. Smit & Pilifosova, 2001). Future research must answer: when and how do the higher hierarchical organisations in the conservation phase provide assistance to the local community level in the reorganisation phase?

There is a need for an investigation of the reasons and processes to protect coastal erosion by applying the combined methods of embedding bamboo stems and planting mangroves or other permanent structures. This will provide the understandings and methods to select the appropriate means relative to livelihoods in communities in terms of policies, regulations, property rights, rules, norms, knowledge, investment and physical environment. Residents in communities often have different opinions about selecting the appropriate natural and permanent structures for preventing coastal erosion so achieving economic and environmental consequences, wellbeing and sustainability (Nicholls, et al., 2007). May (2003) argues that causes of unacceptable soft solutions to prevent coastal erosion were perception, attitudes and participation of residents in coastal management rather than engineering or technical issues, whereas hard solutions are costly. Various components cause or constrain the selection of structures such as property owners, knowledge of types of structure, cost, regulations, feasibility and local preference (Committee on Mitigating Shore Erosion along Sheltered Coasts, 2007).

Nicholls et al. (2007) point out that property rights, land use and socio-economic and cultural conditions are the main barriers to choosing structures for successful coast protection. Causes of barriers can be improved by providing knowledge for all groups and levels of stakeholders through training programs, seminars and workshops (Ife & Tesoriero, 2006; Nicholls, et al., 2007; E. L. Tompkins et al., 2005).

7.5 Conclusion

Most residents living in the low and the high erosion areas believed that natural causes were major causes of coastal erosion such as wind, wave and storm. In addition, residents acknowledged that land subsidence, sea level rise, tidal movements, decrease in sediment deposition and mangrove area loss were involved as other causes. As expected communities located close to mouth of rivers had higher degrees of coastal erosion than communities located far from mouths of rivers.

Coastal erosion affected individuals and communities physically, socially and socio-economically. In terms of physical characteristics, residents lost their property, infrastructure and mangrove area. Residents in the low erosion area experienced loss of property 1-2 times whereas those in the high erosion area migrated landwards approximately 3-4 times. Community infrastructure was damaged by the erosion: streets, electricity posts and schools. Mangrove forests deteriorated in the face of strong waves, high tides and human activities. Mangrove forests were very important for marine animals providing habitat shelter and food sources and their decline meant a decline in marine animals.

Coastal erosion impacted social aspects, eroding relationships between residents who were forced to migrate inland. When residents migrated to build their houses in external communities, they might not maintain close connections with their neighbours, nor could they participate in community activities

Coastal erosion impacted socio-economic characteristics of residents through the losses of income, occupation and educational opportunity. Coastal residents who were fishermen and lost their property needed to move inland far from the coastline. The residents spent their saving to pay for relocation and construction of new houses. Many residents changed their occupation from fishermen to work in factories to be unskilled labours. The residents experienced a decline in their income because they only received a minimum wage. Residents migrating to live inland lost their educational opportunities because new residents' houses were further from schools or were located where it was difficult to travel to schools.

Socio-economic characteristics of residents living in areas of different degrees of coastal erosion differed by education level, income, employment, land ownership and distance of residences to the coastline. Residents in the low erosion area had more opportunity to finish higher levels of education than the high erosion area because a school was very far from villages

in the high erosion area. In the low erosion area, residents commute to schools in urban areas by vehicles.

In addition, more residents in the low erosion area had higher income than residents in the high erosion area because of more limited employment opportunities in the high erosion area. Most residents in the high erosion area were fishermen and other residents were vendors and housewives. Over half of residents in the low erosion area were fishermen and others were vendors and factory employees. However, the number of fishermen in the low erosion area was decreasing because the fishermen could not get sufficient income from catching marine animals, attributed to poor sea water quality, the activities of fishermen from external communities and lack of mangrove habitat.

Over half of residents in the low erosion area owned land in their communities compared with ten percent of residents in the high erosion area because residents in the high erosion area often lost their property and sold land to wealthy landholders. People who relocated to landwards very often found it difficult to find safe public spaces, and they were still at risk if rebuilding houses in hazard prone areas. Some householders, by migrating to live in external villages because of the sale of their land to external wealthy landholders, created unplanned impacts to communities including a lost labour force, depletion of financial resources and an exchange of property rights on their former land to new landholders.

A large number of residences in the low erosion area were built close to the coastline compared to the high erosion area. This was because the low erosion area had built hard structures to prevent coastal erosion. Seawalls were installed to prevent coastal erosion for residential areas in the low erosion area whereas a soft solution was applied in the high erosion area to mitigate wave energy and reduce impacts of coastal erosion. However, communities in the high erosion area were encouraged to apply a combination of methods to prevent coastal erosion, like embedding bamboo stems to build-up soil layers and growing mangrove trees on the layers. The combination methods proved to be successful to protect coastal area, provided shelters for marine animals and increased fishermen' incomes from catching marine animals.

Factors known to build the capacity of community, established from the literature, and examined in all villages in both areas, were indeed present. Results from an examination of the degree of community capacity between low and high erosion areas showed that residents in the high erosion area had higher levels of expressions of these factors. Community capacity building factors such as trust, sense of community, participation, leaders and leadership, knowledge and networking were found in higher degrees in the high erosion areas. Two factors known to build the capacity of community, resources and infrastructure, were expressed more in the low erosion. This information showed that residents in the high erosion area were ready to respond to impacts of coastal erosion in terms of high skills of working in their community, good leadership and strong collaboration among residents. Residents in the low erosion area

would need to promote collaboration among residents and groups, provide training programs or workshops to improve knowledge and enhance leadership for community leaders.

Coastal erosion affected communities over a broad area and the communities could not respond to the impacts themselves because they lacked knowledge, financial resources and land ownership. The residents needed strong support from the government and external organisations in terms of resources and infrastructure. External organisations from local, provincial and national levels provided effective support to communities because they were reservoirs of stored knowledge, technology, resources and experience. Different types and sources of support from external organisations helped improve the capacity of communities to respond to coastal erosion impacts. Local authorities built permanent structures in the low erosion area, whereas various groups of people provided goods and money and improved knowledge for residents in the high erosion area.

Coastal erosion is likely to have more severe impacts in the future due to projected sea level rise and predicted increases in the intensity of tropical storms (McCarthy, Canziani, Leary, Dokken, & White, 2001). Knowing this, coastal communities in the low erosion area seem to be at risk of exposure to impacts of coastal erosion in the future due to the limited number of permanent structures and low levels of community capacity. Coastal communities in both areas are likely to suffer more losses from the erosion, unless communities improve their capacity. This study has identified five important components which will allow this to occur.

Firstly, residents and communities should be assisted to have decision-making procedures associated with property rights granted to them by external landholders; for example, land could be granted to communities under a leasing arrangement and a commitment to return land over a period of time. Secondly, communities need effective leaders with appropriate leadership skills. They must promote young residents to leadership positions to prepare them to be effective leaders in the future by developing experiences of coastal protection and collaborating with external organisations to receive appropriate assistance. Thirdly, communities must build resilience to ameliorate effects of negative changes by improving their knowledge base to respond to events by attending training programs, workshops and seminars organised by scientists, NGOs and other relevant organisations. In addition, participation in activities related to prevention of coastal erosion is necessary, for example, planting mangrove, monitoring the levels of coastal resources that are appropriated by external fishermen, and communicating experiences of coastal erosion prevention. Fourthly, communities must also improve their sense of community for residents so they are aware of possible environmental hazards which affect communities. It is necessary to create active participation activities to improve this sense of community by establishing groups, encouraging residents to be members with incentives, and arranging activities continuously. Lastly, household socioeconomic elements need to be improved to help residents have sufficient revenue to respond to natural hazards, live in safe

areas and improve their quality of life. Interventions using these five components will interrupt the vicious cycle (see Figure 7-4) that results in residents selling their land to external landholders, migrating to live in other areas, eroding community capacity. These interventions would function to allow a negative feedback in the system, levers to improve and maintain abilities to function securely to lead to a quick, powerful, direct and appropriate response to impacts (Meadows, 1999). These five important components will provide the basis for local residents and communities to improve their capacity to respond to coastal erosion and adapt to the impacts of natural hazards in the future. Local authorities must play their roles by supporting and facilitating activities which help communities build their capacity.

These results are based on data derived from the communities with impacts of low and high coastal erosion rates. In terms of communities elsewhere in the Gulf of Thailand, currently without impacts from coastal erosion, they may well be affected by such impacts in the future. The findings of this study might be applicable to enhance community capacity to address possible natural hazards. Relationships between communities and higher level hierarchical organisations need to be explored for communities to receive appropriate assistance. Additionally, resolutions for controlling constraints on the selection of structures to prevent coastal erosion are necessary to help communities themselves to select appropriate processes and structures to protect the coast in the future.

References

Adebowale, M., & Bhullar, L. (2009). Community capacity building and the envrionment: Sustainable development and environmental justice. In A. Noya, E. Clarence & G. Craig (Eds.), Community capacity building: Creating a better future together. Paris: OECD. Retrieved from http://www.oecd.org/document/31/0,3746,en_2649_34417_43882783_1_1_1_1,00.html.

Adejuwon, J., Azar, C., Baethgen, W., Hope, C., Moss, R., Leary, N. A., van Ypersele, J.-P. (2001). Overview of impacts, adaptation, and vulnerability to climate change. In J. J. McCarthy, O. F. Canziani, N. A. Leary, D. J. Dokken & K. S. White (Eds.), *Climate change 2001: Impacts, adaptation, and vulnerability* (pp. 75-103). Cambridge: Cambridge University Press.

Adger, W. N. (2000). Social and ecological resilience: Are they related? *Progress in Human Geography, 24*(3), 347–364.

Adger, W. N. (2003). Social capital, collective action, and adaptation to climate change. *Economic Geography, 79*(4), 387-404.

Adger, W. N., Agrawala, S., Mirza, M. M. Q., Conde, C., O'Brien, K., Pulhin, J., Takahashi, K. (2007). Assessment of adaptation practices, options, constraints and capacity. In M. L. Parry, O. F. Canziani, J. P. Palutikof, V. d. L. P. J. & C. E. Hanson (Eds.), *Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* (pp. 717-743). Cambridge: Cambridge University Press.

Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global Environmental Change, 15*, 77-86.

Adger, W. N., Brown, K., & Hulme, M. (2010). Maladaptation. *Global Environmental Change*(20), 211-213.

Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D., Wreford, A. (2009). Are there social limits to adaptation to climate change? *Climatic Change, 93*(3), 335-354. doi: 10.1007/s10584-008-9520-z

Alexander, J. A., Comfort, M. E., Weiner, B. J., & Bogue, R. (2001). Leadership in collaborative community health partnerships. *Nonprofit Management and Leadership, 12*(2), 159-175. doi: 10.1002/nml.12203

Allen, P., & Bennett, K. (2008). *SPSS for the health & behavioural sciences* Victoria, Australia: Thomson.

Anant, S. S. (1969). A cross-cultural study of belongingness, anxiety and self sufficiency. *Acta Psychologica, 31*(0), 385-393. doi: http://dx.doi.org/10.1016/0001-6918(69)90095-X

Anderson-Berry, L. J. (2003). Community vulnerability to tropical cyclones: Cairns, 1996–2000. *Natural Hazards, 30*, 209-232.

Anderson-Berry, L. J., & King, D. (2005). Mitigation of the impact of tropical cyclones in Northern Australia through community capacity enhancement. *Mitigation and Adaptation Strategies for Global Change, 10*, 367-392.

Angell, P., Mock, G., Withey, L., Cooper, E., Hanson, S., Lesar, J., Billings, H. (2008). *World resources 2008: Roots of resilience-growing the wealth of the poor*. Washington, DC: World Resources Institute, UNDP, UNEP, World Bank.

Aref, F., & Redzuan, M. (2009). Community leaders' characteristics and their effort in building community capacity for tourism development in local communities. *International Journal of Business and Management, 4*(10), 187-193.

Aref, F., & Redzuan, M. B. (2008). Barriers to community leadership toward tourism development in Shiraz, Iran. *European Journal of Social Sciences, 7*(2), 158-164.

Aref, F., Redzuan, M. B., & Emby, Z. (2009). Assessing sense of community dimension of community capacity building in tourism development in Shiraz, Iran. *European Journal of Social Sciences, 7*(3), 126-132.

Armitage, D. (2005). Forum: Adaptive capacity and community-based natural resource management. *Environmental Management, 35*(6), 703-715. doi: 10.1007/s00267-004-0076-z

Arnstein, S. R. (1969). A ladder of citizen participation. *Journal of the American Planning Association, 35*(4), 216-224.

Austen, P. (2003). Community capacity building and mobilization in youth mental health promotion Retrieved from http://www.phac-aspc.gc.ca/mh-sm/mhp-psm/pub/community-communautaires/pdf/comm-cap-build-mobil-youth.pdf

Bachrach, K. M., & Zautra, A. J. (1985). Coping with a community stressor: The threat of a hazardous waste facility. *Journal of Health and Social Behavior, 26*(2), 127-141. doi: 10.2307/2136602

Banuri, T., & Marglin, F. A. (1993). A systems-of-knowledge analysis of deforestation. In T. Banuri & F. A. Marglin (Eds.), *Who will save the forest? Knowledge, power and environmental destruction*. London: Zed books.

Barbier, E. B. (2006). Mangrove dependency and the livelihoods of coastal communities in Thailand. In C. T. Hoanh, T. P. Tuong & B. Hardy (Eds.), Environment and Livelihoods in Tropical Coastal Zones : Managing Agriculture-Fishery-Aquaculture Conflicts (pp. 126-139). Oxfordshire, England: CABI Publishing

Barbier, E. B. (2007). Natural capital and labor allocation. *The Journal of Environment & Development, 16*(4), 398-431. doi: 10.1177/1070496507307458

Bardsley, D., & Hugo, G. (2010). Migration and climate change: Examining thresholds of change to guide effective adaptation decision-making. *Population & Environment, 32*(2), 238-262. doi: 10.1007/s11111-010-0126-9

Bartlett, J. E., Kotrlik, J. W., & Higgins, C. C. (2001). Organizational research: Determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal, 19*(1), 43-50.

Bartlett, M. S. (1954). A note on the multiplying factors for various chi square approximations. *Journal of the Royal Statistical Society, 16*(Series B), 296-298.

Bazeley, P. (2007). *Qualitative data analysis with NVivo*. London: Sage Publications.

Beatley, T. (2009). *Planning for coastal resilience : Best practices for calamitous times*. Washington, DC: Island Press.

Beilharz, L. (2002). *Building community : The shared action experience* Victoria, Australia: Solutions Press.

Berkes, F. (1993). Traditional ecological knowledge in perspective. In J. T. Inglis (Ed.), *Traditional ecological knowledge: Concepts and cases*. Ottawa, Canada: IDRC Books

Berkes, F., Colding, J., & Folke, C. (2003). Introduction. In F. Berkes, J. Colding & C. Folke (Eds.), *Navigating social-ecological systems: Building resilience for complexity and change* (pp. 1-29). Cambridge: Cambridge University Press.

Berkes, F., & Folke, C. (2002). Back to the future: Ecosystem dynamics and local knowledge. In L. H. Gunderson & C. S. Holling (Eds.), *Panarchy: Understanding transformations in human and natural systems* (pp. 121-146). Washington, DC: Island Press.

Bijlsma, L., Ehler, C. N., Klein, R. J. T., Kulshrestha, S. M., McLean, R. F., Mimura, N., Warrick, R. A. (1996). Coastal zones and small islands. In R. T. Watson, M. C.

Zinyowera & R. H. Moss (Eds.), *Climate Change 1995: Impacts, adaptations, and mitigation of climate change* (pp. 289-324). Cambridge: Cambridge University Press.

Bird, E. C. F. (2000). *Coastal geomorphology : An introduction*. Chichester ; New York: Wiley.

Birkmann, J., & von Teichman, K. (2010). Integrating disaster risk reduction and climate change adaptation: key challenges-scales, knowledge, and norms. *Sustainability Science, 5*(2), 171-184. doi: 10.1007/s11625-010-0108-y

Bogdan, R., & Biklen, S. K. (1998). *Qualitative research for education: An introduction to theory and methods* (3rd ed.). London: Allyn and Bacon.

Boonperm, J., Haughton, J., & Khandker, S. R. (2007). Does the village fund matter in Thailand? (10 April, 2007 ed., pp. 28): World Bank.

Boonyabancha, S. (2009). Land for housing the poor — by the poor: Experiences from the Baan Mankong nationwide slum upgrading programme in Thailand. *Environment and Urbanization, 21*(2), 309-329. doi: 10.1177/0956247809342180

Bopp, M., & Bopp, J. (2004). Welcome to the swamp: Addressing community capacity in ecohealth research and intervention. *EcoHealth, 1*(2), 24-34.

Bopp, M., GermAnn, K., Bopp, J., Littlejohns, L. B., & Smith, N. (2000). Assessing community capacity for change (pp. 124). Alberta, Canada: the Four Worlds Centre For Development Learning, Cochrane, Alberta and the Research & Evaluation Department of Regional Public Health, the David Thompson Health Region.

Boruff, B. J., Emrich, C., & Cutter, S. L. (2005). Erosion hazard vulnerability of US coastal counties. *Journal of Coastal Research, 21*(5), 932-942.

Bowen, G. L., Martin, J. A., Mancini, J. A., & Nelson, J. P. (2000). Community Capacity. *Journal of Community Practice, 8*(2), 1-21. doi: 10.1300/J125v08n02_01

Brace, N., Kemp, R., & Snelgar, R. (2000). *SPSS for psychologists: A guide to data analysis using SPSS for Windows*. New York: Palgrave.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. doi: 10.1191/1478088706qp063oa

Brodsky, A. E. (1996). Resilient single mothers in risky neighborhoods: Negative psychological sense of community. *Journal of Community Psychology, 24*(4), 347-363. doi: 10.1002/(sici)1520-6629(199610)24:4<347::aid-jcop5>3.0.co;2-r

Brooks, N., & Adger, W. N. (2004). Assessing and enhancing adaptive capacity. In B. Lim (Ed.), *Adaptation policy frameworks (APF) for climate change: Developing strategies, policies and measures* (pp. 165-182). Cambridge: United Nations Development Programme.

Brown, H. C. P. (2009). Climate change and Ontario forests: Prospects for building institutional adaptive capacity. *Mitigation Adaptation Strategy Global Change*.

Brown, M., Kaplan, C., & Jason, L. (2012). Factor analysis of the Beck Depression Inventory-II with patients with Chronic Fatigue Syndrome. *Journal of Health Psychology, 17*(6), 799-808. doi: 10.1177/1359105311424470

Bruhn, J. G. (2005). *The sociology of community connections*. New Mexico: Springer.

Brungardt, C. (1997). The making of leaders: A review of the research in leadership development and education. *Journal of Leadership & Organizational Studies, 3*(3), 81-95. doi: 10.1177/107179199700300309

Buckingham, A., & Saunders, P. (2004). *The survey methods workbook: From design to analysis*. Cambridge: Polity Press.

Buckle, P., Marsh, G., & Smale, S. (2000). New approaches to assessing vulnerability and resiliences. *Australian Journal of Emergency Management, 15*(2), 8-14.

Bullen, P., & Onyx, J. (1998). Measuring social capital in five communities in NSW: Overview of a study. Sydney, Australia: Management Alternatives Pty Ltd. Retrieved from http://sydneyu3a.org/fileadmin/shared_docs/network_content/SocialCapitalPracGuideBullen_Onyx.pdf

Burby, R. J., Steinberg, L. J., & Basolo, V. (2003). The tenure trap: The vulnerability of renters to joint natural and technological disasters. *Urban Affairs Review, 39*(1), 32-58. doi: 10.1177/1078087403253053

Burke, C. S., Sims, D. E., Lazzara, E. H., & Salas, E. (2007). Trust in leadership: A multi-level review and integration. *The Leadership Quarterly, 18*(6), 606-632. doi: 10.1016/j.leaqua.2007.09.006

Burns, N., & Grove, S. K. (2001). *The practice of nursing research: Conduct, critique and utilisation* (5th ed.). Missouri: Elsevier.

Burton, I., Soussan, J., & Hammill, A. (2003). *Livelihoods and climate change: Combining disaster risk reduction, natural resource management and climate change adaptation in a new approach to the reduction of vulnerability and poverty*. Manitoba, Canada: International Institute for Sustainable Development.

Bush, R., Dower, J., & Mutch, A. (2002). Community capacity index manual: Version 2 (C. f. P. H. Care, Trans.): The University of Queensland.

Butterfoss, F. D. (2004). The coalition technical assistance and training framework: Helping community coalitions help themselves. *Health Promotion Practice, 5*(2), 118-126. doi: 10.1177/1524839903257262

Cardona, O. D., Van Aalst, M. K., Birkmann, J., Fordham, M., McGregor, G., Perez, R., Sinh, B. T. (2012). Determinants of risk: Exposure and vulnerability. In C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor & P. M. Midgley (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of working groups I and II of the Intergovernmental Panel on Climate Change (IPCC)* (pp. 65-108). Cambridge, UK: Cambridge University Press.

Carpenter, S. R., Brock, W. A., & Ludwig, D. (2002). Collapse, learning, and renewal. In L. H. Gunderson & C. S. Holling (Eds.), *Panarchy: Understanding transformations in human and natural systems* (pp. 173-194). Washington, DC: Island Press.

Carpenter, S. R., Walker, B., Anderies, J. M., & Abel, N. (2001). From metaphor to measurement: Resilience of what to what? *Ecosystems, 4*, 765-781.

Cernea, M. M. (1996). Eight main risks : Impoverishment and social justice in resettlement (pp. 61). Washington, DC: World Bank Environment Department.

Chantarasombat, C. (2009). PLAN Thailand: Community capacity assessment. *European Journal of Social Sciences, 10*(3), 435-455.

Charmaz, K. (2003). Grounded theory. In J. A. Smith (Ed.), *Qualitative psychology: A practical guide to research methods* (pp. 81-110). London: Sage Publications.

Chaskin, R. J., Brown, P., Venkatesh, S., & Vidal, A. (2001). *Building community capacity*. New York: Walter de Gruyter.

Chavis, D. M., & Wandersman, A. (1990). Sense of community in the urban environment: A catalyst for participation and community development. *American Journal of Community Psychology, 18*(1), 55-81. doi: 10.1007/bf00922689

Child, D. (1990). *The essentials of factor analysis* (2nd ed.). London: Cassell.

Chinman, M., Hannah, G., Wandersman, A., Ebener, P., Hunte, S. B., Imm, P., & Sheldon, J. (2005). Developing a community science research agenda for building community capacity for effective preventive interventions. *American Journal of Community Psychology, 35*(3/4), 143-157. doi: 10.1007/s10464-005-3390-6

Chotiyaputta, C. (2007). *Coastal erosion: Causes and options for mitigation.* Paper presented at the Natural Disasters: Challenges for Better Forecasting and Hazard Assessment, September 22-27, 2007, Chiang Rai, Thailand,.

Christopher, S., Watts, V., McCormick, A. K. H. G., & Young, S. (2008). Building and maintaining trust in a community-based participatory research partnership. *American Journal of Public Health, 98*(8), 1395-1406. doi: 10.2105/AJPH.2007.125757

Chunting, X. (2005). Causes of land loss in Tuvalu, a small island nation in the Pacific. *Journal of Ocean University of China (Oceanic and Coastal Sea Research), 4*(2), 115-123.

Cicin-Sain, B., & Knecht, R. W. (1998). *Integrated coastal and ocean management: Concepts and practices*. Washington: Island Press.

Clark, G. E., Moser, S. C., Ratick, S. J., Dow, K., Jin, W., Kasperson, J. X., Schwarz, H. E. (1998). Assessing the vulnerability of coastal communities to extreme storms: The case of Revere, MA., USA. *Mitigation and Adaptation Strategies for Global Change, 3*, 59-82.

Claude, G., & Marie-Christine, J. (1989). 88 Centimetres of coastal erosion per year: The case of Kildare (Alberton), Prince Edward Island, Canada. *GeoJournal, 18*(3), 297-303.

Coakes, S. J., Steed, L., & Ong, C. (2009). *SPSS: Analysis without anguish: Version 16 for Windows*. Milton, Queensland: John Wiley & Sons Australia.

Collyns, C., & Senhadji, A. (2002). Lending booms, real estate bubbles, and the Asian crisis *IMF Working Paper* (pp. 45): Asia and Pacific Department, IMF.

Committee on Mitigating Shore Erosion along Sheltered Coasts. (2007). *Mitigating shore erosion along sheltered coasts*. Washington, DC, USA: National Academies Press.

Commonwealth of Australia. (2007). 2005-2006 Local government national report: Commonwealth of Australia,.

Cooper, J. A. G., & McKenna, J. (2008). Working with natural processes: the challenge for coastal protection strategies. *The Geographical Journal, 174*, 315-331.

Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research and Evaluation, 10*(7), 1-9.

Cotula, L., Toulmin, C., & Quan, J. (2006). *Better land access for the rural poor: Lessons from experience and challenges ahead*: Internatinal Institute for Environment and Development, FAO.

Cox, F. M., Erlich, J. L., Rothman, J., & Tropman, J. E. (1987). *Strategies of community organization* (4th ed.). Illinois: F. E. Peacock Publishers, Inc.

Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research*. London: SAGE.

Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*. London: SAGE Publications.

Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change, 18*(4), 598-606. doi: 10.1016/j.gloenvcha.2008.07.013

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly, 84*(2), 242-261.

Cutter, S. L., & Emrich, C. T. (2006). Moral hazard, social catastrophe: The changing face of vulnerability along the hurricane coasts. *The ANNALS of the American Academy of Political and Social Science, 604*(1), 102-112. doi: 10.1177/0002716205285515

Cutter, S. L., Osman-Elasha, B., Campbell, J., Cheong, S. M., McCormick, S., Pulwarty, R., Ziervogel, G. (2012). Managing the risks from climate extremes at the local level. In C.

B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor & P. M. Midgley (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of working groups I and II of the Intergovernmental Panel on Climate Change (IPCC)* (pp. 291-338). Cambridge, UK: Cambridge University Press.

Dale, P. (1997). Land tenure issues in economic development. *Urban Studies, 34*(10), 1621-1633. doi: 10.1080/0042098975376

Dale, R. (2002). *People development through people's institution*. Bangkok: Asian Institue of Technology.

Dassopoulos, A., & Monnat, S. M. (2011). Do perceptions of social cohesion, social support, and social control mediate the effects of local community participation on neighborhood satisfaction? *Environment and Behavior, 43*(4), 546-565. doi: 10.1177/0013916510366821

Davenport, M. A., Leahy, J. E., Anderson, D. H., & Jakes, P. J. (2007). Building trust in natural resource management within local communities: A case study of the Midewin National Tallgrass Prairie. *Environ Manage, 39*, 353-368.

Davidson, W. B., & Cotter, P. R. (1991). The relationship between sense of community and subjective well-being: A first look. *Journal of Community Psychology, 19*(3), 246-253. doi: 10.1002/1520-6629(199107)19:3<246::aid-jcop2290190308>3.0.co;2-l

Davidson, W. B., & Cotter, P. R. (1997). Psychological sense of community and newspaper readership. *Psychological Reports, 80*, 659-665.

De Vaus, D. A. (2002). *Surveys in social researth* (5th ed.). New South Wales: Allen & Unwin.

Deane, P., & Davis, L. B. (1987). *Sociology* (3rd ed.). New York: Worth Publishers.

Department of Marine and Coastal Resources. (2009). Master plan on coastal erosion management for the upper Gulf of Thailand (Executive Summary). Bangkok: Department of Marine and Coastal Resources, Thailand.

Diduck, A. (2010). The learning dimension of adaptive capacity: Untangling the multi-level connections. In R. Plummer & D. Armitage (Eds.), Adaptive capacity and environmental governance. In B. N. Anderson, R. W. Howarth & L. R. Walker (Series Eds.), (pp. 119-221). New York: Springer-Verlag Berlin Heidelberg. doi: 10.1007/9783642121944

Dierberg, F., & Kiattisimkul, W. (1996). Issues, impacts, and implications of shrimp aquaculture in Thailand. *Environmental Management, 20*(5), 649-666. doi: 10.1007/bf01204137

Dorren, L. K. A., & Imeson, A. C. (2005). Soil erosion and the adaptive cycle metaphor. *Land Degradation and Development, 16*, 509-516. doi: 10.1002/ldr.705

Douglas, B. C. (2001). An introduction to sea level. In B. C. Douglas, M. S. Kearney & S. P. Leatherman (Eds.), *Sea level rise: History and consequences* (pp. 1-11). New York: Academic Press.

Dreyfus, H., & Dreyfus, S. (1986). Mind Over Machine: The power of human intuition and expertise in the era of the computer *New York: The Free Press* (pp. 50).

Dubrin, A. J. (2010). *Leadership: Research findings, practice, and skills* (6th ed.). Mason, Ohio, USA: South-Western CENGAGE Learning.

Durand-Lasserve, A., & Selod, H. (2007). *The formalisation of urban land tenure in developing countries*. Paper presented at the The World Bank's 2007 Urban Research Symposium, May 14-16, Washington, DC. http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1269364687916/6892589-1269394475210/durand_lasserve.pdf

Durkheim, E. (1982). *The rules of sociological method* (8th ed.): Free Press.

Durongdej, S. (2001). Land use changes in coastal areas of Thailand. *Proceedings of the APN/SURVAS/LOICZ Joint Conference on Coastal Impacts of Climate Change and Adaptation in the Asia - Pacific Region*, 113-117.

Edwards, R. W. (2004). *Measuring social capital: An Australian framework and indicators.* Canberra: Australian Bureau of Statistics, Commonwealth of Australia.

El Ansari, W., Oskrochi, R., & Phillips, C. J. (2010). One size fits all partnerships? What explains community partnership leadership skills? *Health Promotion Practice, 11*(4), 501-514. doi: 10.1177/1524839908318289

Engkagul, S. (1993). Flooding features in Bangkok and vicinity: Geographical approach. *GeoJournal, 31*(4), 335-338.

Ericson, J. P., Vörösmarty, C. J., Dingman, S. L., Ward, L. G., & Meybeck, M. (2006). Effective sea-level rise and deltas: Causes of change and human dimension implications. *Global and Planetary Change, 50*(1–2), 63-82. doi: 10.1016/j.gloplacha.2005.07.004

Eriksen, S. H., & Kelly, P. M. (2007). Developing credible vulnerability indicators for climate adaptation policy assessment. *Mitigation and Adaptation Strategies for Global Change, 12*, 495-524.

European Commission. (2004). Living with coastal erosion in Europe: Sediment and space for sustainability *PART I - major findings and policy recommendations of the EUROSION project* (pp. 54). Cambridgeshire, UK: National Institute for Coastal and Marine Management of the Netherlands (RIKZ), EUCC – The Coastal Union, IGN France International, Autonomous University of Barcelona (UAB), French Geological Survey (BRGM), French Institute of Environment (IFEN), EADS Systems & Defence Electronics.

Ewing, L., Flick, R. E., & Synolakis, C. E. (2010). A review of coastal community vulnerabilities toward resilience benefits from disaster reduction measures. *Environmental Hazards, 9*, 222-232.

FAO. (2007). *Good governance in land tenure and administration*. Rome, Italy: FAO.

FAO. (2012). National aquaculture sector overview: Thailand Retrieved 1 October 2012, from http://www.fao.org/fishery/countrysector/naso_thailand/en

Feinberg, M. E., Riggs, N. R., & Greenberg, M. T. (2005). Social networks and community prevention coalitions. *The Journal of Primary Prevention, 26*(4), 279-298.

Feldman, R. M. (1990). Settlement-identity: Psychological bonds with home places in a mobile society. *Environment and Behavior, 22*(2), 183-229.

Feng, A., Xia, D., Xue, Z., & Yin, P. (2009). Coastal erosion induced by human activities: A Northwest Bohai Sea case study. [ ]. *Journal of Coastal Research, 25*(3), 723-733.

Fenwick, T. (2006). Learning as grounding and flying: Knowledge, skill and transformation in changing work contexts. *Journal of Industrial Relations, 48*(5), 691-706. doi: 10.1177/0022185606070112

Ferguson, E., & Cox, T. (1993). Exploratory factor analysis: A users'guide. *International Journal of Selection and Assessment, 1*(2), 84-94. doi: 10.1111/j.1468-2389.1993.tb00092.x

Few, R., Brown, K., & Tompkins, E. (2006). Public participation and climate change adaptation. *Tyndall Centre for Climate Change Research Working Paper No. 15*, 1-17.

Few, R., & Tran, P. G. (2010). Climatic hazards, health risk and response in Vietnam: Case studies on social dimensions of vulnerability. *Global Environmental Change, 20*(3), 529-538. doi: http://dx.doi.org/10.1016/j.gloenvcha.2010.02.004

Field, C. D. (1995). Impact of expected climate change on mangroves. *Hydrobiologia, 295*, 75-81.

Field, C. D. (1999). Mangrove rehabilitation: Choice and necessity. *Hydrobiologia, 413*, 47-52.

Fielding, N. G., & Lee, R. M. (1998). *Computer analysis and qualitative research*. London: Sage Publications.

Flora, C. B., Flora, J. L., Spears, J. D., & Swanson, L. E. (1992). *Rural communities: Legacy & change*. San Francisco: Westview Press.

Floyd, F. J., & Widaman, K. F. (1995). Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment, 7*(3), 286-299. doi: 1040-3590/95

Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. *Global Environmental Change, 16*(3), 253-267. doi: 10.1016/ j.gloenvcha.2006.04.002

Folke, C., Colding, J., & Berkes, F. (2003). Synthesis: Building resilience and adaptive capacity in social-ecological systems. In F. Berkes, J. Colding & C. Folke (Eds.), *Navigating social-ecological systems: Building resilience for complexity and change* (pp. 352-387). Cambridge: Cambridge University Press.

Ford, J. D., & Smit, B. (2004). A framework for assessing the vulnerability of communities in the Canadian Arctic to risks associated with climate change. *The Arctic Institute of North America, 57*(4), 389– 400.

Fothergill, A., Maestas, E. G. M., & Darlington, J. D. (1999). Race, ethnicity and disasters in the United States: A review of the literature. *Disasters, 23*(2), 156-173.

Fothergill, A., & Peek, L. A. (2004). Poverty and disasters in the United States: A review of recent sociological findings. *Natural Hazards, 32*, 89-110.

Fouillet, A., Rey, G., Wagner, V., Laaidi, K., Empereur-Bissonnet, P., Le Tertre, A., Hémon, D. (2008). Has the impact of heat waves on mortality changed in France since the European heat wave of summer 2003? A study of the 2006 heat wave. *International Journal of Epidemiology, 37*(2), 309-317.

Frank, F., & Smith, A. (2006). *Community development and partnerships: A handbook for building community capacity*. Western Australia: Curtin University of Technology.

Frankfort-Nachmias, C., & Nachmias, D. (1999). *Research methods in the social sciences* (6th ed.): Worth Publishers.

French, P. W. (1997). *Coastal and estuarine management*. London: Routledge.

Freudenberg, N. (2004). Community capacity for environmental health promotion: Determinants and implications for practice. *Health Education & Behavior, 31*, 472-490.

Fuchs, R. J. (2010). Cities at risk: Asia's coastal cities in an age of climate change. *Asia Pacific Issues, 96*(July), 1-12.

Gaillard, J., Maceda, E. A., Stasiak, E., Berre, I. L., & Espaldon, M. V. O. (2009). Sustainable livelihoods and people's vulnerability in the face of coastal hazards. *Journal of Coastal Conservation, 13*(2-3), 119-129. doi: 10.1007/s11852-009-0054-y

Garcia, C., Lindgren, S., & Pintor, J. K. (2011). Knowledge, skills, and qualities for effectively facilitating an adolescent girls' group. *The Journal of School Nursing, 27*(6), 424-433. doi: 10.1177/1059840511419369

Garson, G. D. a. (2008, 18 July 2009). Factor analysis Retrieved 26 November 2009, 2009, from http://faculty.chass.ncsu.edu/garson/PA765/factor.htm

Gibbon, M., Labonte, R., & Laverack, G. (2002). Evaluating community capacity. *Health and Social Care in the Community, 10*(6), 485-491.

Gibbs, G. R. (2007). *Analyzing qualitative data*. London: Sage Publications.

Giessner, S. R., van Knippenberg, D., & Sleebos, E. (2009). License to fail? How leader group prototypicality moderates the effects of leader performance on perceptions of leadership

effectiveness. *The Leadership Quarterly, 20*(3), 434-451. doi: http://dx.doi.org/10.1016/j.leaqua.2009.03.012

Gilman, E., lavieren, H. V., Ellison, J., Jungblut, V., Wilson, L., Areki, F., Yuknavage, K. (2006). Pacific island mangroves in a changing climate and rising sea. Nairobi, Kenya: United Nations Environment Programme, Regional Seas Programme, .

Gilson, L. (2003). Trust and the development of health care as a social institution. *Social Science & Medicine, 56*(7), 1453-1468. doi: 10.1016/s0277-9536(02)00142-9

Goodman, R. M., Speers, M. A., McLeroy, K., Fawcett, S., Kegler, M., Parker, E., Wallerstein, N. (1998). Identifying and defining the dimensions of community capacity to provide a basis for measurement. *Health Education & Behavior, 25*(3), 258-278.

Gorsuch, R. L. (1997). Exploratory factor analysis: Its role in item analysis. *Journal of Personality Assessment, 68*(3), 532.

Green, J., Willis, K., Hughes, E., Small, R., Welch, N., Gibbs, L., & Daly, J. (2007). Generating best evidence from qualitative research: The role of data analysis. *Australian and New Zealand Journal of Public Health, 31*(6), 545-550.

Grindle, M. S., & Hilderbrand, M. E. (1995). Building sustainable capacity in the public sector: What can be done? *Public Administration and Development, 15*, 441-463.

Gunderson, L. H. (2008). Panarchy. In S. E. Jørgensen & B. D. Fath (Eds.), *Encyclopedia of Ecology* (Vol. 4, pp. 2634-2638). Oxford: Elsevier.

Gunderson, L. H., Holling, C. S., & Light, S. S. (1995). Barriers broken and bridges built: A synthesis. In L. H. Gunderson, C. S. Holling & S. S. Light (Eds.), *Barriers and Bridges: To the renewal of ecosystems and institutions* (pp. 489-532). Cambridge: Cambridge University Press.

Hahn, T., Olsson, P., Folke, C., & Johansson, K. (2006). Trust-building, knowledge generation and organizational innovations: The role of a bridging organization for adaptive comanagement of a wetland landscape around Kristianstad, Sweden. *Human Ecology, 34*, 573-592.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1995). *Multivariate data analysis: With readings*. New Jersey: Prentice-Hall.

Hallegatte, S. (2011). How economic growth and rational decisions can make disaster losses grow faster than wealth (pp. 1-21). Washington, DC: The World Bank.

Hamblin, W. K., & Christiansen, E. H. (2001). *Earth's dynamic systems* (9th ed.). New Jersey: Prentice-Hall.

Handmer, J. (2007). Using law to reduce vulnerability to natural disasters. *Georgetown Journal on Poverty Law and Policy, 14*(1), 13-38.

Hargrove, R. (2008). *Masterful coaching* (3rd ed.). San Francisco, CA, USA.: Jossey-Bass/Pfeiffer, Wiley.

Harvey, N., & Woodroffe, C. D. (2008). Australian approaches to coastal vulnerability assessment. *Sustainability Science, 3*(1), 67-87.

Hay, R. (1998). Sense of place in developmental context. *Journal of Environmental Psychology, 18*(1), 5-29. doi: 10.1006/jevp.1997.0060

Head, L. (2009). Cultural ecology: Adaptation – retrofitting a concept? *Progress in Human Geography* 1-10. doi: 10.1177/0309132509338978

Henderson, K. (1991). *Dimensions of choice: A qualitative approach to recreation parks and leisure research* State College, PA: Venture Publishing.

Hisschemoller, M., Hoppe, R., Dunn, W. N., & Ravetz, J. R. (2001). An introduction. In M. Hisschemoller, R. Hoppe, W. N. Dunn & J. R. Ravetz (Eds.), *Knowledge, power, and participation in environmental policy analysis* (Vol. 12, pp. 1-28). London: Transaction.

Holling, C. S. (2001). Understanding the complexity of economic, ecological, and social systems. *Ecosystems, 4*(5), 390-405.

Holling, C. S. (2010). The resilience of terrestrial ecosystem. In L. H. Gunderson, C. R. Allen & C. S. Holling (Eds.), *Foundations of Ecological Resilience* (pp. 67-118). Washington, DC: Island Press.

Holling, C. S., & Gunderson, L. H. (2002). Resilience and adaptive cycle. In L. H. Gunderson & C. S. Holling (Eds.), *Panarchy: Understanding transformations in human and natural systems* (pp. 25-62). Washington, DC: Island Press.

Homan, M. S. (2008). *Promoting community change: Making it happen in the real world* (4th ed.). Belmont, California: Thomson Brooks/Cole.

Horton, P. B., & Hunt, C. L. (1972). *Sociology* (2nd ed.). Ohio: McGraw-Hill.

Howell, D. C. (2002). *Statistical methods for psychology* (5th ed.). California, USA: Wadsworth Cengage Learning.

Howlett, R. J. (2010). Knowledge transfer between UK university and business. In R. J. Howlett (Ed.), *Innovation through knowledge transfer* (pp. 1-14). Chennai, India: Springer-Verlag Berlin Heidelberg.

Hughes, P., Black, A., Kaldor, P., Bellamy, J., & Castle, K. (2007). *Building stronger communities*. New South Wales: A UNSW Press Book.

Hugo, G. (1996). Environmental concerns and international migration. *International Migration Review, 30*(1), 105-131.

Hung, K., Sirakaya-Turk, E., & Ingram, L. J. (2011). Testing the efficacy of an integrative model for community participation. *Journal of Travel Research, 50*(3), 276-288. doi: 10.1177/0047287510362781

Hwang, S., Cao, Y., & Xi, J. (2010). Project-induced migration and depression: A panel analysis. *Social Science & Medicine, 70*(11), 1765-1772. doi: 10.1016/j.socscimed.2010.02.005

Ife, J., & Tesoriero, F. (2006). *Community development: Community-based alternatives in an age of globalisation* (3rd ed.). New South Wales, Australia: Pearson Education Australia.

International Organization for Migration. (2007). Discussion note: Migration and the environment (pp. 8).

IPCC. (2007). *Climate change 2007: Impacts, adaptation and vulnerability*. Cambridge: Cambridge University Press.

Jackson, S. F., Cleverly, S., Poland, B., Burman, D., Edwards, R., & Robertson, A. (2003). Working with Toronto neighbourhoods toward developing indicators of community capacity. *Health Promotion International, 18*(4), 339-350.

Jamal, T. B., & Getz, D. (1995). Collaboration theory and community tourism planning. *Annuals of Tourism Research, 22*(1), 186-204. doi: 10.1016/0160-7383(94)00067-3

Japan International Research Center for Agricultural Sciences. (2010). Local vegetables of Thailand Retrieved 25 September, 2011, from http://www.jircas.affrc.go.jp/project/value_addition/Vegetables/100.html

Jarungrattanapong, R., & Manasboonphempool, A. (2008). Adaptation strategies for coastal erosion/flooding: A case study of two communities in Bang Khun Thian District, Bangkok. *TDRI Quarterly Review*.

Jarupongsakul, T. (1999). *Potential impacts of sea-level rise and the coastal zone management in the upper Gulf of Thailand.* Paper presented at the Thai-Japanese Geological Meeting, November 30-December 4, 1999, Phetchaburi, Thailand.

Jarupongsakul, T., Chaimanee, N., & Suphawajruksakul, A. (2004). *Field trip guidebook.* Paper presented at the 5th International Conference on ASIAN Marine Geology, 13-18 January 2004, Bangkok, Thailand.

Jayal, N. G. (1999). *Democracy and the state: Welfare, secularism and development in contemporary India*: Oxford University Press.

Jenkins, S., Smith, P. T., Tookwinas, S., & Phillips, M. J. (1999). An assessment of the status of the shrimp farming industry in Thailand. In P. T. Smith (Ed.), *Coastal shrimp aquaculture in Thailand: Key issues for research* (pp. 14-68). Canberra: Australian Centre for International Agricultural Research.

Jorgensen, B. S., & Stedman, R. C. (2001). Sense of place as an attitude: Lakeshore owners attitudes toward their properties. *Journal of Environmental Psychology, 21*(3), 233-248. doi: 10.1006/jevp.2001.0226

Judge, T. A., Piccolo, R. F., & Kosalka, T. (2009). The bright and dark sides of leader traits: A review and theoretical extension of the leader trait paradigm. *The Leadership Quarterly, 20*(6), 855-875. doi: 10.1016/j.leaqua.2009.09.004

Kaniasty, K., & Norris, F. H. (1995). In search of altruistic community: Patterns of social support mobilization following Hurricane Hugo. *American Journal Community Psychology, 23*(4), 447-477. doi: 0091-0562/9510800-044

Kaniasty, K., & Norris, F. H. (2004). Social support in the aftermath of disasters, catastrophes, and acts of terrorism: Altruistic, overwhelmed, uncertain, antagonistic, and patriotic communities. In R. Ursano, A. Norwood & C. Fullerton (Eds.), *Bioterrorism: Psychological and public health interventions* (pp. 200-229). New York: Cambridge University Press.

Kates, R. W. (2000). Cautionary tales: Adaptation and the global poor. *Climate Change, 45*, 5-17.

Kegler, M. C., Steckler, A., Malek, S. H., & McLeroy, K. (1998). A multiple case study of implementation in 10 local Project ASSIST coalitions in North Carolina. *Health Education Research, 13*(2), 225-238.

Kelle, U. (2004). Computer-assisted analysis of qualitative data. In U. Flick, E. von Kardorff & I. Steinke (Eds.), *A companion to qualitative research*: Sage Publications.

Kelly, P. M., & Adger, W. N. (1999). *Assessing vulnerability to climate change and facilitating adaptation*. Economic and Social Research Council, UK Retrieved from http://www.cserge.ac.uk/sites/default/files/gec_1999_07.pdf.

Kenny, S. (2006). *Developing commuities for the future* (3rd ed.). Victoria, Australia: Thomson.

Kestenberg, M., & Kestenberg, J. S. (1988). The sense of belonging and altruism in children who survived the Holocaust. *Psychoanalytic Review, 75*(4), 533-560.

King, S. E., & Lester, J. M. (1995). The value of salt-marsh as a sea defence. *Marine Pollution Bulletin, 30*(3), 180-189.

Kirkby, M. J., Imeson, A. C., Bergkamp, G., & Cammeraat, L. H. (1996). Scaling up processes and models from the field plot to the watershed and regional areas. *Journal of Soil and Water Conservation, 51*(5), 391-391.

Kishore, R., Clarke-Marshall, M., Ramsundar, H., de Souza, G., Haylock, H., & Finlay, J. (2006). Political organisation and socioeconomics of fishing communities of Trinidad and Tobago, Belize, and Grenada. In Y. Breton, D. Brown, B. Davy, M. Haughton & L. Ovares (Eds.), *Coastal resource management in the wider Caribbean: Resilience, adaptation, and community diversity* (pp. 191-222). Ottawa, Canada: IDRC Books.

Klein, R. J. T., Nicholls, R., Ragoonaden, S., Capobianco, M., Aston, J., & Buckley, E. N. (2001). Technological options for adaptation to climate change in coastal zones. *Journal of Coastal Research, 17*(3), 531-543.

Kleinosky, L. R., Yarnal, B., & Fisher, A. (2007). Vulnerability of Hampton Roads, Virginia to storm-surge flooding and sea-level rise. *Natural Hazards, 40*, 43-70. doi: 10.1007/s11069-006-0004-z

Köhn, J., & Gowdy, J. (1999). Coping with complex and dynamic systems: An approach to a transdisciplinary understanding of coastal zone developments. *Journal of Coastal Conservation, 5*, 163-170.

Kolmannskog, V. O. (2008). Future floods of refugees: A comment on climate change, conflict and forced migration (pp. 44). Oslo, Norway.

Kreimer, A. (1979). Low-income housing under "normal" and post-disaster situations: Some basic continuities. *Habitat International, 4*(3), 273-283. doi: http://dx.doi.org/10.1016/0197-3975(79)90037-7

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*, 607-610.

Krongkaew, M. (2002). Alienated life: Socioeconomic characteristics of the ultra poor in Thailand. *Journal of Asian and African Studies, 37*(2), 128-146. doi: 10.1177/002190960203700206

Kumar, R. (2005). *Research methodology: A step-by-step guide for beginners* (2nd ed.). NSW: Pearson Education Australia.

Labonte, R., & Laverack, G. (2001). Capacity building in health promotion, part 2: Whose use? And with what measure? *Critical Public Health, 11*(2), 129-138. doi: 10.1080/09581590110039847

Lang, J. (1999). *Local government's role in urban infrastructure*. Canberra: Australian Government Publishing Service.

Lavell, A., Oppenheimer, M., Diop, C., Hess, J., Lempert, R., Li, J., Myeong, S. (2012). Climate change: New dimensions in disaster risk, exposure, vulnerability, and resilience. In C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor & P. M. Midgley (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of working groups I and II of the Intergovernmental Panel on Climate Change (IPCC)* (pp. 25-64). Cambridge, UK: Cambridge University Press.

Laverack, G. (2005). Evaluating community capacity: Visual representation and interpretation. *Community Development Journal, 41*(3), 266-276. doi: 10.1093/cdj/bsi047

Laverack, G., & Thangphet, S. (2007). Building community capacity for locally managed ecotourism in Northern Thailand. *Community Development Journal, 44*(2), 172-185. doi: 10.1093/cdj/bsm058

Leatherman, S. P. (2001). Socail and economic costs of sea level rise. In B. C. Douglas, M. S. Kearney & S. P. Leatherman (Eds.), *Sea level rise: History and consequences* (pp. 181-223). New York: Academic Press.

Leech, N. L., Barrett, K. C., & Morgan, G. A. (2011). IBM SPSS for intermediate statistics : Use and interpretation Retrieved from http://ECU.eblib.com.au/patron/FullRecord.aspx?p=692398

Lempa, M., Goodman, R. M., Rice, J., & Becker, A. B. (2008). Development of scales measuring the capacity of community-based initiatives. *Health Education and Behavior, 35*, 298-315. doi: 10.1177/1090198106293525

Levi, M. (1996). Social and unsocial capital: A review essay of Robert Putnam's making democracy work. *Politics & Society, 24*(1), 45-55. doi: 10.1177/0032329296024001005

Levine, J. N., Esnard, A., & Sapat, A. (2007). Population displacement and housing dilemmas due to catastrophic disasters. *Journal of Planning Literature, 22*(1), 3-15. doi: 10.1177/0885412207302277

Levy, J. S. (1994). Learning and foreign policy: Sweeping a conceptual minefield. *International Organization, 48*(2), 279-312.

Liamputtong, P. (2010). *Qualitative research method.* Victoria, Australia: Oxford University Press.

Lin, K., & Chang, C. (2013). Everyday crises: Marginal society livelihood vulnerability and adaptability to hazards. *Progress in Development Studies, 13*(1), 1-18. doi: 10.1177/146499341201300101

Lindell, M. K., & Prater, C. S. (2003). Assessing community impacts of natural disasters. *Natural Hazards Review, 4*(4), 176-185. doi: 10.1061/~ASCE!1527-6988

Liu, G. S., & Silvester, R. (1977). *Sand sausages for beach defence work.* Paper presented at the The 6th Australasian Hydraulics and Fluid Mechanics Conference, 5-9 December Adelaide, Australia.

Lonergan, S. (1998). The role of environmental degradation in population displacement. *Environmental Change and Security Project Report*(4), 5-15.

Lorenzoni, I., Pidgeon, N. F., & O'Connor, R. E. (2005). Dangerous climate change: The role for risk research. *Risk Analysis, 25*(6), 1387-1398. doi: 10.1111/j.1539-6924.2005.00686.x

Low, S. M. (1992). Symbolic ties that bind: Place attachment in the plaza. In I. Altman & S. M. Low (Eds.), *Place attachment* (pp. 165-185). New York: Plenum Press.

Low, S. M., & Altman, I. (1992). Place attachment: A conceptual inquiry. In I. Altman & S. M. Low (Eds.), *Place attachment* (pp. 1-12). New York: Plenum Press.

Loza, J. (2004). Business–community partnerships: The case for community organization capacity building. *Journal of Business Ethics, 53*, 297-311.

Luers, A. L., & Moser, S. C. (2006). Preparing for the impacts of climate change in California: opportunities and constraints for adaptation: California Climate Change Center.

Machlup, F. (1980). *Knowledge and knowledge production*. Princeton, New Jersey: Princeton University Press.

Mahan, B. B., Garrard, W. M., Lewis, S. E., & Newbrough, J. R. (2002). Sense of community in a university setting. In A. T. Fisher, C. C. Sonn & B. J. Bishop (Eds.), *Psychological sense of community: Research, applications, and implications* (pp. 123-140). New York: Kluwer Academic/Plenum Publishers.

Mai, C. V., Stive, M. J. F., & Van Gelder, P. H. A. J. M. (2009). Coastal protection strategies for the Red River Delta. *Journal of Coastal Research, 25*(1), 105-116.

Malanit, P. (2009). *The suitability of Dendrocalamus asper Backer for oriented strand lumber.* Doctor of Natural Science, University of Hamburg, Hamburg. Retrieved from http://ediss.sub.uni-hamburg.de/volltexte/2009/4296/pdf/Dissertation.pdf

Mannarini, T., S., T., Fedi, A., & Greganti, K. (2006). Image of neighborhood, self-image and sense of community. *Journal of Environmental Psychology, 26*, 202-214.

Mannarini, T., Tartaglia, S., Fedi, A., & Greganti, K. (2006). Image of neighborhood, self-image and sense of community. *Journal of Environmental Psychology, 26*(3), 202-214. doi: 10.1016/j.jenvp.2006.07.008

Marfai, M. A., King, L., Singh, L. P., Mardiatno, D., Sartohadi, J., Hadmoko, D. S., & Dewi, A. (2008). Natural hazards in Central Java Province, Indonesia: An overview. *Environ Geol, 56*, 335-351.

Masae, A., & McGregor, J. A. (1998). Sustainability of a fishery in southern Thailand. In V. T. King (Ed.), *Environmental Challenges in South- East Asia* (pp. 283-304). Surrey: Curzon Press.

Mason, S. G. (2010). Can community design build trust? A comparative study of design factors in Boise, Idaho neighborhoods. *Cities, 27*(6), 456-465. doi: 10.1016/j.cities.2010.07.003

Masselink, G., & Hughes, M. G. (2003). *An introduction to coastal processes and geomorphology*: Oxford University Press.

Matthews, R., & Sydneysmith, R. (2010). Adaptive capacity as a dynamic institutional process: Conceptual perspectives and their application. In R. Plummer & D. Armitage (Eds.), Adaptive capacity and environmental governance. In B. N. Anderson, R. W. Howarth & L. R. Walker (Series Eds.), (pp. 223-242). New York: Springer -Verlag Berlin Heidelberg. doi: 10.1007/9783642121944

Maxwell, D., & Wiebe, K. (1999). Land tenure and food security: Exploring dynamic linkages. *Development and Change, 30*(4), 825-849. doi: 10.1111/1467-7660.00139

May, V. (2003). Softer solutions to coastal erosion: Making the transition from resistance to resilience In C. L. Goudas (Ed.), *Soft shore protection: An environmental innovation in coastal engineering* (pp. 398). Boston: Kluwer Academic Publishers.

Mayseless, O. (2010). Attachment and the leader-follower relationship. *Journal of Social and Personal Relationships, 27*(2), 271-280. doi: 10.1177/0265407509360904

Mazda, Y., Magi, M., Kogo, M., & Hong, P. N. (1997). Mangroves as a coastal protection from waves in the Tong King delta, Vietnam. *Mangroves and Salt Marshes, 1*(2), 127-135. doi: 10.1023/a:1009928003700

McCarthy, J. J., Canziani, O. F., Leary, N. A., Dokken, D. J., & White, K. S. (2001). *Climate change 2001: Impacts, adaptation, and vulnerability: Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*: Cambridge University Press.

McLean, R. F., & Tsyban, A. (2001). Coastal zones and marine ecosystem. In V. Burkett, J. O. Codignotto, D. L. Forbes, N. Mimura, R. J. Beamish & V. Ittekkot (Eds.), *Climate change 2001: Impacts, adaptation and vulne.rability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate change* (pp. 343-379). Cambridge: Cambridge University Press.

McLeman, R., & Smit, B. (2006). Migration as an adaptation to climate change. *Climatic Change, 76*, 31-53. doi: 10.1007/s10584-005-9000-7

McLeod, E., & Salm, R. V. (2006). *Managing mangroves for resilience to climate change.* Gland, Switzerland: IUCN.

McMillan, D. W., & Chavis, D. M. (1986). Sense of community: A definition and theory. *Journal of Community Psychology, 14*(1), 6-23. doi: 10.1002/1520-6629(198601)14:1<6::aid-jcop2290140103>3.0.co;2-i

Me´heux, K., Dominey-Howes, D., & Lloyd, K. (2007). Natural hazard impacts in small island developing states: A review of current knowledge and future research needs. *Nat Hazards, 40*, 429-446.

Meadows, D. (1999). Leverage points: Places to intervene in a system (pp. 19). Hartland, Vermont, USA: The Sustainability Institute.

Mendelsohn, R., Basist, A., Kurukulasuriya, P., & Dinar, A. (2007). Climate and rural income. *Climatic Change, 81*(1), 101-118. doi: 10.1007/s10584-005-9010-5

Mendola, M. (2008). Migration and technological change in rural households: Complements or substitutes? *Journal of Development Economics, 85*(1–2), 150-175. doi: 10.1016/j.jdeveco.2006.07.003

Mileti, D. S. (1999). *Disasters by design: A reassessment of natural hazards in the United States*. Washington, DC, USA: Joseph Henry Press.

Mileti, D. S., & Gailus, J. L. (2005). Sustainable development and hazards mitigation in the United States: Diasters by design revisited. *Mitigation and Adaptation Strategies for Global Change, 10*, 491-504.

Minkler, M., Vásquez, V. B., Tajik, M., & Petersen, D. (2008). Promoting environmental justice through community-based participatory research: The role of community and partnership capacity. *Health Education & Behavior, 35*, 119-137.

Misztal, B. A. (2000). *Informality: Social theory and contemporary practice*. London: Routledge.

Mohseni, M., & Lindstrom, M. (2007). Social capital, trust in the health-care system and self-rated health: The role of access to health care in a population-based study. *Social Science & Medicine, 64*, 1373-1383.

Molyneux, C. S., Peshu, N., & Marsh, K. (2005). Trust and informed consent: Insights from community members on the Kenyan coast. *Social Science & Medicine, 61*, 1463-1473.

Moody, J., & White, D. R. (2003). Structural cohesion and embeddedness: A hierarchical concept of social groups. *American Sociological Review, 68*(1), 103-127. doi: 10.2307/3088904

Morse, J. M., & Richards, L. (2002). *Readme first for a user's guide to qualitative methods*. London: SAGE.

Murphy, P. W., & Cunningham, J. V. (2003). *Organizing for community controlled development: Renewing civil society*. London: Sage Publications.

Mustafa, D. (1998). Structural causes of vulnerability to flood hazard in Pakistan. *Economic Geography, 74*(3), 289-305. doi: 10.2307/144378

Naik, A., Stigter, E., & Laczko, F. (2007). *Migration, development and natural disasters: Insights from the Indian Ocean tsunami* (Vol. 30). Geneva: International Organization for Migration.

Nardi, P. M. (2006). *Doing survey research: A guide to quantitative methods* (2nd ed.). Sydney: Pearson Education, Inc.

National Statistical Office of Thailand. (2007) Retrieved 15 June 2011, from http://web.nso.go.th/

Nicholls, R. J., & Lowe, J. A. (2006). Climate stabilisation and impacts of sea-level rise. In H. J. Schellnhuber, W. Cramer, N. Nakicenovic, T. Wigley & G. Yohe (Eds.), *Avoiding dangerous climate change* (pp. 195-202). Cambridge: Cambridge University Press.

Nicholls, R. J., & Tol, R. S. J. (2006). Impacts and responses to sea-level rise: A global analysis of the SRES scenarios over the twenty-first century. *Philosophical Transaction of a Royal Society, 364*, 1073-1095. doi: 10.1098/rsta.2006.1754

Nicholls, R. J., Wong, P. P., Burkett, V. R., Codignotto, J. O., Hay, J. E., McLean, R. F., Woodroffe, C. D. (2007). Coastal systems and low-lying areas. In M. L. Parry, O. F. Canziani, J. P. Palutikof, v. d. L. P. J. & C. E. Hanson (Eds.), *Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 315-356). Cambridge: Cambridge University Press.

Nissapa, A., Masae, A., Boromthanarat, S., & Jungrungrot, V. (2002). Institutional and policy perspectives in the management of fisheries and coastal resources in Thailand. In M. Torell & A. M. Salamanca (Eds.), Institutional Issues and Perspectives in the Management of Fisheries and Coastal Resources in Southeast Asia (pp. 143-182). Penang: ICLARM-The World Fish Center. Retrieved from http://www.worldfishcenter.org/Pubs/institutional_sea/pub_insea6.pdf.

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal Community Psychology, 41*, 127-150.

Norusis, M. J. (1993). *SPSS for Windows: Base system user's guide, release 6.0*. Illinois, USA: SPSS.

Noya, A., & Clarence, E. (2009). Putting community capacity building in context. In A. Noya, E. Clarence & G. Craig (Eds.), Community capacity building : Creating a better future together (pp. 15-35). Paris: OECD. Retrieved from http://ECU.eblib.com.au/ patron/FullRecord.aspx?p=474040.

Nunnally, J., & Bernstein, I. (1994). *Psychometric theory* (3rd ed.). New York: McGraw-Hill.

Nypan, A. (1970). Diffusion of innovation and community leadership in East Africa. *Acta Sociologica, 13*(4), 253-268. doi: 10.1177/000169937001300403

O'Brien, K., Pelling, M., Patwardhan, A., Hallegatte, S., Maskrey, A., Oki, T., Yanda, P. Z. (2012). Toward a sustainable and resilient future. In C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G. K. Plattner, S. K. Allen, M. Tignor & P. M. Midgley (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of working groups I and II of the Intergovernmental Panel on Climate Change (IPCC)* (pp. 437-486). Cambridge, UK: Cambridge University Press.

O'Toole, K., & Macgarvey, A. (2003). Rural women and local economic development in South-West Victoria. *Journal of Rural Studies, 19*(2), 173-186. doi: 10.1016/s0743-0167(02)00072-4

Ohno, E. (2001). Economic evaluation of impact of land loss due to sea level rise in Thailand. *Preceedings of the APN/SURVAS/LOICZ Joint conference on Coastal impacts of Climate Change and Adaptation in the Asia-Pacific Region*, 231-235.

Owens, S., Rayner, T., & Bina, O. (2004). New agendas for appraisal: Reflections on theory, practice, and research. *Environment and Planning A, 36*(11), 1943-1959.

Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change, 19*, 354-365. doi: 10.1016/j.gloenvcha.2009.06.001

Pallant, J. (2007). *SPSS survival manual: A step by step guide to data analysis using SPSS for Windows* (3rd ed.). Berkshire, England: Open University Press.

Parker, E. A., Eng, E., Schulz, A. J., & Israel, B. A. (1999). Evaluating community-based health programs that seek to increase community capacity. *New Directions for Evaluation, 1999*(83), 37-54. doi: 10.1002/ev.1144

Parry, M. L., Canziani, O. F., Palutikof, J. P., Van der Linden, P. J., & Hanson, C. E. (2007). Summary for policymakers *Climate change 2007: Impacts, adaptation and vulnerability. Contributing of working group II to the fourth assessment report of the Interogovernment Panel on Climate Change* (pp. 7-22). Cambridge: Cambridge University Press.

Patmasiriwat, D., Bennis, M., & Pednekar, S. (1999). International trade, environmental issues and the impact on sustainability of shrimp culture in Thailand. In P. T. Smith (Ed.), *Towards sustainable shrimp culture in Thailand and the region* (Vol. 90, pp. 132-141). Canberra, Australia: Australian Centre for International Agricultural Research.

Paton, D., & Johnson, D. (2001). Disasters and communities: Vulnerability, resilience and preparedness. *Disaster Prevention and Management, 10*(4), 270-277.

Paton, D., & Johnston, D. (2006). Identifying the characteristics of a disaster resilient society. In D. Paton & D. Johnston (Eds.), *Disaster resilience: An integrated approach* (pp. 11-18). Illinois, USA: Charles C Thomas

Paton, D., Millar, M., & Johnston, D. (2001). Community resilience to volcanic hazard consequences. *Natural Hazards, 24*, 157-169.

Pearson, L. (1994). *Local government law in New South Wales*. Sydney: The Federation Press.

Peck, R., & Devore, J. (2008). *Statistics: The exploration and analysis of data* (6th ed.). Duxbury, Massachusetts, USA: Thomsom Brooks/Cole.

Pelling, M. (1998). Participation, social capital and vulnerability to urban flooding in Guyana. *Journal of International Development, 10*, 469-486.

Pett, M. A. (2003). *Making sense of factor analysis: The use of factor analysis for instrument development in health care research*. California: Sage Publication.

Phien-wej, N., Giao, P. H., & Nutalaya, P. (2006). Land subsidence in Bangkok, Thailand. *Engineering Geology, 82*(4), 187-201. doi: 10.1016/j.enggeo.2005.10.004

Phillips, K. (1993). Self-development in organizations: Issues and actions. *Journal of European Industrial Training, 17*(5), 3-5. doi: 10.1108/03090599310032772

Piguet, E. (2008). Climate change and forced migration (pp. 15): Policy Development and Evaluation Service, The UN Refugee Agency, UNHCR.

Popper, M., & Mayseless, O. (2003). Back to basics: Applying a parenting perspective to transformational leadership. *The Leadership Quarterly, 14*(1), 41-65. doi: 10.1016/s1048-9843(02)00183-2

Potter, R. (1985). *Urbanisation and planning in the third world: Spatial perceptions and public participation*. New York: Taylor & Francis.

Pretty, G. H., Chipuer, H. M., & Bramston, P. (2003). Sense of place amongst adolescents and adults in two rural Australian towns: The discriminating features of place attachment, sense of community and place dependence in relation to place identity. *Journal of Environmental Psychology, 23*(3), 273-287. doi: 10.1016/s0272-4944(02)00079-8

Prezza, M., Amici, M., Roberti, T., & Tedeschi, G. (2001). Sense of community referred to the whole town: Its relations with neighboring, loneliness, life satisfaction, and area of residence. *Journal of Community Psychology, 29*(1), 29-52. doi: 10.1002/1520-6629(200101)29:1<29::aid-jcop3>3.0.co;2-c

Prezza, M., & Costantini, S. (1998). Sense of community and life satisfaction: Investigation in three different territorial contexts. *Journal of Community & Applied Social Psychology, 8*(3), 181-194. doi: 10.1002/(sici)1099-1298(199805/06)8:3<181::aid-casp436> 3.0.co;2-4

Provan, K. G., Veazie, M. A., Teufel-Shone, N. I., & Huddleston, C. (2004). Network analysis as a tool for assessing and building community capacity for provision of chronic disease services. *Health Promotion Practice, 5*, 174-181.

Punch, K. F. (1998). *Introduction to social research: Quantitative and qualitative approaches.* London: SAGE Publications

Raihan, M. S., Hug, M. J., Alsted, N. G., & Andreasen, M. H. (2010). *Understanding climate change from below, addressing barriers from above: Practical experience and learning from a community-based adaptation project in Bangladesh*. Dhaka, Bangladesh: ActionAid Bangladesh.

Reale, A., & Handmer, J. (2011). Land tenure, disasters and vulnerability. *Disasters, 35*(1), 160-182. doi: 10.1111/j.1467-7717.2010.01198.x

Reichard, R. J., & Johnson, S. K. (2011). Leader self-development as organizational strategy. *The Leadership Quarterly, 22*(1), 33-42. doi: http://dx.doi.org/10.1016/ j.leaqua.2010.12.005

Reid, J. N. (2000). Community participation: How people power brings sustainable benefits to communities (pp. 13): USDA Rural Development, Office of Community Development.

Reimann, C., & Filzmoser, P. (2000). Normal and lognormal data distribution in geochemistry: Death of a myth. Consequences for the statistical treatment of geochemical and environmental data. *Environmental Geology, 39*(9), 1001-1014. doi: 10.1007/ s002549900081

Reimann, C., Filzmoser, P., Garrett, R., & Dutter, R. (2008). Statistical data analysis explained : Applied environmental statistics with R Retrieved from http://ECU.eblib.com.au/patron/FullRecord.aspx?p=470074

Resilience Alliance. (2007, 29 October 2002). Assessing resiliencein social-ecological systems: Workbook for scientists. *Version 1.1* Retrieved 10 October 2012, from http://www.resalliance.org/3871.php

Resilience Alliance. (2010, 29 October 2002). Assessing resiliencein social-ecological systems: Workbook for practitioners. *Version 2.0* Retrieved 10 October 2012, from http://www.resalliance.org/3871.php

Restall, S. J., Jackson, L. A., Heerten, G., & Hornsey, W. P. (2002). Case studies showing the growth and development of geotextile sand containers: An Australian perspective. *Geotextiles and Geomembranes, 20*(5), 321-342. doi: 10.1016/s0266-1144(02)00030-4

Rich, R. F. (1981). Knowledge creation: knowledge in society. In R. F. Rich (Ed.), *The knowledge cycle* (pp. 11-39). London: Sage.

Richardson, B. D. (1995). Soft engineering on the coast: Where to now? In C. A. Fleming (Ed.), *Coastal management: Putting policy into practice* (pp. 219-247). London: Thomas Telford Publishing.

Rickard, D. (2008). *Community based coastal monitoring: Developing tools for sustainable management.* Master of Science, The University of Waikato, Waikato, New Zealand. Retrieved from thesis/19July2009/coastal monitoring/thesis.pdf

Riger, S., & Lavrakas, P. J. (1981). Community ties: Patterns of attachment and social interaction in urban neighborhoods. *American Journal of Community Psychology, 9*(1), 55-66. doi: 10.1007/bf00896360

Riley, R. B. (1992). Attachment to the ordinary landscape. In I. Altman & S. M. Low (Eds.), *Place attachment* (pp. 13-35). New York: Plenum Press.

Roscoe, P. (2008). The comparative method. *Religion Compass, 2*(4), 734-753. doi: 10.1111/j.1749-8171.2008.00093.x

Rosenthal, C. S. (1998). Determinants of collaborative leadership: Civic engagement, gender or organizational norms? *Political Research Quarterly, 51*(4), 847-868. doi: 10.2307/449108

Rosenzweig, C., & Casassa, G. (2007). Assessment of observed changes and responses in natural and managed systems. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden & C. E. Hanson (Eds.), *Climate change 2007: Impacts, adaptation and vulnerability* (pp. 79-131). Cambridge: Cambridge University Press.

Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. *The Academy of Management Review, 23*(3), 393-404.

Ruggiero, P., Voigt, B., & Kaminsky, G. (2000). *Beach monitoring for enhanced decision-making*. Paper presented at the the Coastal Society 17th Conference Coasts at the Millennium, Portland, Oregon. http://www.ecy.wa.gov/programs/sea/swces/products/publications/papers/ruggiero_tcs00.pdf

Sabhasri, S., & Suwarnarat, K. (1996). Impact of sea level rise on flood control in Bangkok and vicinity In J. D. Milliman & B. U. Haq (Eds.), *Sea level rise and coastal subsidence* (Vol. 2, pp. 343-355). Boston: Kluwer Academic Publishers.

Saito, Y. (2001). Deltas in Southeast and East Asia: Their evolution and current problems. *Proceedings of the APN/SURVAS/LOICZ Joint Conference on Coastal Impacts of Climate Change and Adaptation in the Asia - Pacific Region*, 185-191.

Sanders, S., Bowie, S. L., & Bowie, Y. D. (2003). Lessons learned on forced relocation of older adults: the impact of hurricane Andrew on Health, mental health, and social support of public housing residents. *Journal of Gerontological Social Work, 40*(4), 23-35.

Sarantakos, S. (2005). *Social research* (3rd ed.). New York: Falgrave Macmillan.

Sarros, J. C. (2009). *Contemporary perspectives on leadership: Focus and meaning for ambiguous times*. Victoria, Australia: Tilde University Press.

Schuman, H., & Presser, S. (1981). *Questions and answers in attitude surveys: Experiments on question form, wording, and context*. New York: Academic Press.

Sexton, J. P., Schwartz, M. W., & Winterhalder, B. (2010). Incorporating sociocultural adaptive capacity in conservation hotspot assessments. *Diversity and Distributions, 16*(3), 439-450. doi: 10.1111/j.1472-4642.2010.00656.x

Shaw, R. B. (1997). *Trust in the balance: Building successful organizations on results, integrity, and concern*. San Francisco: Jossey-Bass Publishers.

Siegel, S., & Castellan, N. J. (1988). *Nonparametric statistics for the behavioral sciences* (2nd ed.). New York: McGraw-Hill.

Simpson, S. R. (1976). *Land low and registration*. Cambridge: Cambridge University Press.

Six, F. (2005). *The trouble with trust: The dynamics of interpersonal trust building*. Massachusetts: Edward Elgar Publishing.

Size, T. (2006). Leadership development for rural health. *North Carolina Medical Journal, 67*(1), 71-76.

Small, C., & Nicholls, R. J. (2003). A global analysis of human settlement in coastal zones. *Coastal Research, 19*(3), 584-599.

Smit, B., Burton, I., Klein, R. J. T., & Wandel, J. (2000). An anatomy of adaptation to climate change and variability. *Climatic Change, 45*(1), 223-251. doi: citeulike-article-id:6286882

doi: 10.1023/A:1005661622966

Smit, B., & Pilifosova, O. (2001). Adaptation to climate change in the context of sustainable development and equity. In J. J. McCarthy, O. F. Canziani & N. A. (Eds.), *Climate change 2001: Impacts, adaptation, and vulnerability-contribution of working group II to the third Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 876-912). Cambridge: Cambridge University Press.

Smit, B., & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change, 16*(3), 282-292. doi: 10.1016/j.gloenvcha.2006.03.008

Smith, N., Littlejohns, L. B., & Roy, D. (2003). Measuring community capacity: State of the field review and recommendations for future research (H. C. The Health Policy Research Program, Trans.) (pp. 76). Alberta, Canada: David Thompson Health Region.

Solomon, S. M., & Forbes, D. L. (1999). Coastal hazards and associated management issues on South Pacific Islands. *Ocean & Coastal Management, 42*, 523-554.

Spence, P. R., Lachlan, K. A., & Griffin, D. R. (2007). Crisis communication, race, and natural disasters. *Journal of Black Studies, 37*, 539-554.

Sriprasertkul, W. (2010). *The impact of coastal erosion on community changes : A case study of Ban Khunsamutchin community, Samut Prakan Province*. Master Degree, Chulalongkorn University, Bangkok. Retrieved from http://cuir.car.chula.ac.th/handle/123456789/18787

Stive, M. J. F. (2004). How important is global warming for coastal erosion? An editorial comment. *Climatic Change, 64*, 27-39.

Storey, J. (2010). Leadership in organizations : Current issues and key trends Retrieved from http://ECU.eblib.com.au/patron/FullRecord.aspx?p=589645

Sylvia, E., Grund, C., Kimminau, K. S., Ahmed, A., Marr, J. M., & Cooper, T. (2010). Rural women leaders. *Journal of Leadership Studies, 4*(3), 23-31. doi: 10.1002/jls.20174

Syvitski, J. P. M. (2008). Deltas at risk. *Sustainability Science, 3*, 23-32.

Szuster, B. W. (2006). Coastal shrimp farming in Thailand: Searching for sustainability. In C. T. Hoanh, T. P. Tuong & B. Hardy (Eds.), Environment and livelihoods in tropical coastal zones: Managing agriculture-fishery-aquaculture conflicts (pp. 86-98). Wallingford, Oxfordshire, GBR: CABI Publishing

Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.). Boston: Pearson Education.

Talen, E. (1999). Sense of community and neighbourhood form: An assessment of the social doctrine of new urbanism. *Urban Studies, 36*(8), 1361-1379. doi: 10.1080/0042098993033

Tanner, T. N., & Mitchell, T. (2008). Introduction: Building the case for pro-poor adaptation. *IDS Bulletin, 39*(4), 1-5.

Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences.* California: SAGE Publications, Inc.

Teodoro, J. I. E., & Rayos-Co, J. C. (2009). Community-driven land tenure strategies: The experiences of the Homeless People's Federation of the Philippines. *Environment and Urbanization, 21*(2), 415-441. doi: 10.1177/0956247809344362

Thampanya, U., Vermaat, J. E., Sinsakul, S., & Panapitukkul, N. (2006). Coastal erosion and mangrove progradation of Southern Thailand. *Estuarine, Coastal and Shelf Science, 68*, 75-85.

The World Bank. (2001). World development report 2000/2001: Attacking poverty. New York. Retrieved from http://siteresources.worldbank.org/INTPOVERTY/Resources/WDR/English-Full-Text-Report/toc.pdf

The World Bank. (2007). Thailand environment monitor 2006: Marine and coastal resources. Washington, DC: The World Bank.

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. Washington, DC: American Psychological Association.

Tompkins, E. L. (2005). Planning for climate change in small islands: Insights from national hurricane preparedness in the Cayman Islands. *Global Environmental Change, 15*(2), 139-149. doi: 10.1016/j.gloenvcha.2004.11.002

Tompkins, E. L., & Adger, W. N. (2004). Does adaptive management of natural resources enhance resilience to climate change? *Ecology and Society, 9*(2), 10.

Tompkins, E. L., Nicholson-Cole, S. A., Hurlston, L., Boyd, E., Brooks Hodge, G., Clarke, J., Varlack, L. (2005). *Surviving climate change in small islands: A guidebook.* Norwich, UK: Tyndall Centre for Climate Change Research.

Tookwinas, S. (1996). *Shrimp culture in Thailand-Present status and future directions for research.* Paper presented at the Towards sustainable shrimp culture in Thailand and the region, Hat Yai, Songkhla, Thailand, 28 October-1 November 1996.

Tosun, C. (2000). Limits to community participation in the tourism development process in developing countries. *Tourism Management, 21*(6), 613-633. doi: 10.1016/s0261-5177(00)00009-1

Tranter, B. (2006). Sampling. In M. Walter (Ed.), *Social research methods* (2nd ed.). Victoria, Australia: Oxford University Press.

Travers, M. (2006). Qualitative interview methods. In M. Walter (Ed.), *Social research methods* (2nd ed.). Victoria, Australia: Oxford University Press.

UN. (2006). The impacts of fishing on vulnerable marine ecosystems: Actions taken by states and regional fisheries management organizations and arrangements to give effect to

paragraphs 66 to 69 of general assembly resolution 59/25 on sustainable fisheries, regarding the impacts of fishing on vulnerable marine ecosystems (pp. 44).

UNESCAP. (2000). Thailand information Retrieved 2 August, 2011, from http://www.unescap.org/jobs/internships/information.asp

Uzzell, D., Pol, E., & Badenas, D. (2002). Place identification, social cohesion, and enviornmental sustainability. *Environment and Behavior, 34*(1), 26-53. doi: 10.1177/0013916502034001003

Valiela, I. (2006). *Global coastal change*. Oxford: Wiley-Blackwell.

Vandas, S. (1998). Coastal hazards: Hurricanes, tsunamis, coastal erosion. *Science Scope, 21*(8), 28-28.

VanWey, L. K. (2005). Land ownership as a determinant of international and internal migration in Mexico and internal migration in Thailand. *International Migration Review, 39*(1), 141-172. doi: 10.1111/j.1747-7379.2005.tb00258.x

Verdery, A. M., Entwisle, B., Faust, K., & Rindfuss, R. R. (2012). Social and spatial networks: Kinship distance and dwelling unit proximity in rural Thailand. *Social Networks, 34*(1), 112-127. doi: 10.1016/j.socnet.2011.04.003

Verity, F. (2007). Community capacity building – A review of the literature (G. o. S. A. Department of Health, Trans.): School of Social Administration and Social Work, Flinder University.

Vincent, C., & Martin, J. (2000). School-based parents' groups - a politics of voice and representation? *Journal of Education Policy, 15*(5), 459-480. doi: 10.1080/026809300750001649

Vongvisessomjai, S. (2006a). Physical environment in the Gulf of Thailand with emphasis on three important ports. In E. Wolanski (Ed.), *The environment in Asia Pacific Harbours* (pp. 229-247): Springer Netherlands.

Vongvisessomjai, S. (2006b). Will sea-level really fall in the Gulf of Thailand? *Songklanakarin Journal Science and Technology, 28*(2), 227-248.

Walker, B., Carpenter, S. R., Anderies, J., Abel, N., Cumming, G. S., Janssen, M., . . . Pritchard, R. (2002). Resilience management in social-ecological systems: A working hypothesis for a participatory approach. *Conservation Ecology, 6*(1), 14.

Walker, B., Gunderson, L. H., Kinzig, A. P., Folke, C., Carpenter, S. R., & Schultz, L. (2006). A handful of heuristics and some propositions for understanding resilience in social-ecological systems. *Ecology and Society 11*(1).

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. P. (2004). Resilience, adaptability and transformability in social–ecological systems. *Ecology and Society, 9*(2). Retrieved from http://www.ecologyandsociety.org/vol9/iss2/art5

Walker, B., & Salt, D. (2006). *Resilience thinking: Sustaining ecosystems and people in a changing world*. Washington, DC: Island Press.

Walliman, N. (2006). *Social research methods*. London: Sage.

Wallis, J., & Dollery, B. (2002). Social capital and local government capacity. *Australian Journal of Public Administration, 61*(3), 76-85.

Walter, M. (2006). Surveys. In M. Walter (Ed.), *Social research methods* (2 ed.). Victoria: Oxford Unviersity Press.

Watson, R. T., Zinyowera, M. C., Moss, R. H., Moreno, R. A., Adhikary, S., Adler, M., Arnell, N. (1996). Summary for policymakers: Scientific-Technical analyses of impacts, adaptations, and mitigation of climate change. In R. T. Watson, M. C. Zinyowera, R. H. Moss & D. J. Dokken (Eds.), *Climate change 1995: Impacts, adaptations and mitigation of climate change: Scientific-Technical Analyses* (pp. 1-18). New York: Cambridge University Press.

Weber, E. U. (2006). Experience-based and description-based perceptions of long-term risk: Why global warming does not scare us (yet). *Climatic Change, 77*, 103-120.

Weber, E. U. (2010). What shapes perceptions of climate change? *Wiley Interdisciplinary Reviews: Climate Change, 1*(3), 332-342. doi: 10.1002/wcc.41

Wesley, F., Carpenter, S. R., Brock, W. A., Holling, C. S., & Gunderson, L. H. (2002). Why systems of people and nature are not just social and ecological systems. In L. H. Gunderson & C. S. Holling (Eds.), *Panarchy: Understanding transformations in human and natural systems* (pp. 103-120). Washington, DC: Island Press.

White-Cooper, S., Dawkins, N. U., Kamin, S. L., & Anderson, L. A. (2009). Community-institutional partnerships: Understanding trust among partners. *Health Education & Behavior, 36*(2), 334-347. doi: 10.1177/1090198107305079

Wickrama, K. A. S., & Wickrama, T. (2011). Perceived community participation in tsunami recovery efforts and the mental health of tsunami-affected mothers: Findings from a study in rural Sri Lanka. *International Journal of Social Psychiatry, 57*(5), 518-527. doi: 10.1177/0020764010374426

Wilkinson, D., & Birmingham, P. (2003). *Using research instruments: A guide for researchers*. London: Routledge Falmer.

Williams, J. J. (2006). Community participation: Lessons from post-apartheid South Africa. *Policy Studies, 27*(3), 197-217. doi: 10.1080/01442870600885982

Winterwerp, J. C., Borst, W. G., & de Vries, M. B. (2005). Pilot study on the erosion and rehabilitation of a mangrove mud coast. *Journal of Coastal Research, 21*(2), 223-230.

Wisner, B., & Adam, J. (2002). *Environmental health in emergencies and disasters: A practical guide*. Geneva: World Health Organization.

Wituk, S., Warren, M., Heiny, P., Clark, M. J., Power, C., & Meissen, G. (2003). Developing communities of leaders: Outcomes of a statewide initiative. *Journal of Leadership & Organizational Studies, 9*(4), 76-86. doi: 10.1177/107179190300900407

Wong, K. (2001). *Housing market bubbles and currency crisis: The case of Thailand*. Paper presented at the The Asian crisis: The economics front, Seattle, USA.

World Bank. (2012). Physical capital: The role of infrastructure in green growth strategiesInclusive green growth: The pathway to sustainable development (pp. 133-152). Washington DC: The World Bank. Retrieved from http://siteresources.worldbank.org/EXTSDNET/Resources/Inclusive_Green_Growth_May_2012.pdf. doi: 10.1596/978-0-8213-9551-6

World Health Organisation. (2007, 6 August 2007). Country health system profile: Thailand Retrieved 4 August, 2011, from http://www.searo.who.int/en/Section313/Section1525_10862.htm

Wright, L. D., & Thom, B. G. (1977). Coastal depositional landforms: A morpho-dynamic approach. *Progress in Physical Geography*(1), 412-459. doi: 10.1177/030913337700100302

Wu, Z., Hou, F., & Schimmele, C. M. (2011). Racial diversity and sense of belonging in urban neighborhoods. *City & Community, 10*(4), 373-392. doi: 10.1111/j.1540-6040.2011.01374.x

Xeidakis, G. S., Delimani, P., & Skias, S. (2007). Erosion problems in Alexandroupolis coastline, North-Eastern Greece. *Environmental Geology, 53*, 835-848. doi: 10.1007/s00254-007-0697-7

Yiengprugsawan, V., Carmichael, G. A., Lim, L. L. Y., Seubsman, S., & Sleigh, A. C. (2010). Has universal health insurance reduced socioeconomic inequalities in urban and rural health service use in Thailand? *Health and Place, 16*(5), 1030-1037. doi: 10.1016/j.healthplace.2010.06.010

Yohe, G., & Tol, R. S. J. (2002). Indicators for social and economic coping capacity—moving toward a working definition of adaptive capacity. *Global Environmental Change, 12*(1), 25-40. doi: 10.1016/s0959-3780(01)00026-7

Yukl, G. A. (2002). *Leadership in organizations* (5th ed.). New York: Prentice Hall.

Yunlong, C. (1990). Land use and management in PR China: Problems and strategies. *Land Use Policy, 7*(4), 337-350. doi: http://dx.doi.org/10.1016/0264-8377(90)90023-R

Zakocs, R. C., & Guckenburg, S. (2007). What coalition factors foster community capacity? Lessons learned from the fighting back initiative. *Health Education & Behavior, 34*, 354-375.

Zwicker, G., & Marlin, A. (2009). Understanding and building community capacity in New Brunswick's forestry communities (t. F. M. Forest, Trans.): The Rural and Small Town Programme, Mount Allison University, Canada.

Appendices: Chapter 2

Appendix 2-1: Rate of coastal change in each sub-district in the upper Gulf of Thailand between 1952 and 2006

Province	District	Subdistrict	Rate of changes (m/y)			
			Year 1952-1974	Year 1952-1995	Year 1952-2002	Year 1952-2006
Samut Songkhram	Mueang Samut Songkhram	Bang Chakreng	2.36	0.70	0.31	1.25
		Bang Kaeo	-0.52	-1.10	-1.06	-0.51
Samut Sakhon	Mueang Samut Sakhon	Na Khok	-7.69	-4.60	-4.07	-4.02
		Ka Long	-13.14	-5.87	-5.17	-4.65
		Bang Thorat	-11.07	-5.60	-4.76	-3.89
		Ban Bo	-4.17	-3.35	-4.09	-3.52
		Bang Kachao	-0.20	-3.34	-3.70	-3.26
		Bang Ya Praek	14.15	9.50	6.46	6.07
		Khok Kham	6.00	0.75	0.06	0.31
		Panthai Norasing	-1.63	-5.21	-4.92	-4.57
Bangkok	Bang Khun Tian	Thakham	-12.48	-11.04	-10.74	-9.83
Samut Prakan	Phra Samut Chedi	Laem Fa Pa	-4.99	-6.89	-10.02	-10.17
	Mueang Samut Prakan	Taiban	1.48	-0.62	0.86	1.12
		Bangpoomai	0.50	2.06	1.88	2.11
		Bangpoo	-5.96	-5.32	-5.55	-4.87
	Bang Bo	Khlong Dan	-4.32	-8.08	-11.40	-10.88
Chachoengsao	Bang Pakong	Song Khlong	0.20	-2.64	-3.82	-3.55
		Bang Pakong	12.53	7.94	7.05	6.86

Note: Minus value indicates the coastal erosion.

Source: Department of Marine and Coastal Resources (2009).

Appendix 2-2: Questionnaire

Factors influencing the capacity of communities to respond to coastal erosion in the upper Gulf of Thailand

Survey questionnaire

Name of Interviewer:.....

Date: .....Time.....

Respondent No.: ☐ ☐ ☐3

Province: ☐1 Samut Prakarn

Subdistrict: *Laem Fa Pha*

Village: ☐1 Village 8

☐2 Village 9

☐3 Village 10

☐4 Village 11

Province: ☐2 Samut Sakhorn

Subdistrict: *Ban Ka Long*

Village: ☐5 Village 7

Subdistrict: *Ban Na Khok*

Village: ☐6 Village 4

☐7 Village 5

The questionnaire is divided into 3 sections; geographic information, community capacity and coastal erosion. In geographic information section I will ask you about your personal and household information. In community capacity and coastal erosion sections, I will read statements and you will express your opinions about experience in living in a village and coastal erosion. The interview will take approximately 30 minutes.

Section A: Demographic Information

I will start asking you about yourself and your household for 9 questions to collect general information about participants in the study area.

1.Gender (*Observe*): ☐1Male☐2Female ☐

2.How old are you?……. ☐☐

3.How long have you lived in this village? years..... months ☐☐☐☐

4.Who else live in your house? ☐☐☐ ☐☐☐

☐1No-one ☐2Spouse

☐3Children ☐4Parents

☐5Grandparents ☐6Others

5.Can you tell me what the highest education level you have? (tick only one) ☐

☐1Primary school ☐2Secondary school

☐31 – 2 years of college or training programs

☐43 – 4 years of college ☐5Bachelor"s Degree

☐6Postgraduate degree ☐7None

☐8Other

6. What is your usual occupation?..... ☐

7. Could you estimate your current monthly income of the household (before tax)? (tick only one box) ☐

☐1 less than ฿ 10,000 ☐2 ฿ 10,000 - ฿ 19,999

☐3 ฿ 20,000 - ฿ 29,999 ☐4 ฿ 30,000 - ฿ 39,999

☐5 ฿ 40,000 and over ☐6 Don't know

8. Is your home owned, rented or something else? (tick only one box) ☐

☐1 Owned ☐2 Rent your home ☐3 Public

☐4 Other .....

Is your land owned, rented or something else? (tick only one box) ☐

☐1 Owned ☐2 Rent other ☐3 Public area

☐4 Temple ☐5 Other .....

9.In metres, how far do you think your home is from the coastline (estimate)? ☐☐☐☐

("Coastline" means the land on the edge of the coast.)

…….metres.

Section B: Community Capacity

In this section, I will ask you about your opinions about the building capacity of community and your personal experience of living in a village. I will read you a statement and could you please select a suitable answer in each statement relating to your opinion such as Strongly agree, agree, neutral, disagree, Strongly disagree and don't know. (Please, show and point at the answer card to a participant while explaining it).

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't know	
Community Capacity							
10.You know most people in this community.	5	4	3	2	1	9	☐
11.Most people do not know each other in this community.	1	2	3	4	5	9	☐
12.Most people in this community can be trusted.	5	4	3	2	1	9	☐
13.Most people in this community honestly share points of view with each other.	5	4	3	2	1	9	☐
14.You believe the community can manage most problems by itself.	5	4	3	2	1	9	☐
15.You feel welcome new residents in this community.	5	4	3	2	1	9	☐
16.All sectors in your community work together	5	4	3	2	1	9	☐
17.You usually go to other villages to visit friends.	5	4	3	2	1	9	☐
18.People with different incomes work together to make the community a better place.	5	4	3	2	1	9	☐
19.The community demonstrates a willingness to seek help from the external community.	5	4	3	2	1	9	☐
20.You always support the village through donation of money.	5	4	3	2	1	9	☐
21.You haven't participated in activities to improve your village such as meeting, planting and cleaning.	1	2	3	4	5	9	☐
22.You always support the village through donation of goods.	5	4	3	2	1	9	☐
23.You do not tolerate others with different perspectives in your community when discussing a matter at a meeting.	1	2	3	4	5	9	☐
24.All ages participate in events in your community.	5	4	3	2	1	9	☐
25.You have no chance to participate in decision-making about development projects in your village.	1	2	3	4	5	9	☐

Community capacity attitude scale adapted from Zwicker, G., & Marlin, A. (2009). Understanding and building community capacity in New Brunswick"s forestry communities: The Rural and Small Town Programme, Mount Allison University, Canada, p. 31-32. Used with permission of the principal author.

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't know	
Community Capacity							
26.A local government is responsive to the needs of the people well.	5	4	3	2	1	9	☐
27.In your community, information about community activities will usually be made public.	5	4	3	2	1	9	☐
28.Community leaders build on the positive things in your community.	5	4	3	2	1	9	☐
29.Many residents take informal leadership roles in this community when there are community activities.	5	4	3	2	1	9	☐
30.Women are not accepted when they work as leaders in the community.	1	2	3	4	5	9	☐
31.This community has never encouraged a younger generation in leadership positions.	1	2	3	4	5	9	☐
32.Community leaders are interested in solving every problem in a community.	5	4	3	2	1	9	☐
33. No residents in this village take informal leadership roles in community activities.	1	2	3	4	5	9	☐
34.The local government carefully uses funds to develop new projects.	5	4	3	2	1	9	☐
35.Your village has a lot of members with skills to work for a community.	5	4	3	2	1	9	☐
36.Your village has sufficient equipment to organise community activities.	1	2	3	4	5	9	☐
37.You use sources of information in your community to help you make a life decisions such as working.	5	4	3	2	1	9	☐
38.If you work in a group, you welcome questions or alternatives from members in a group.	5	4	3	2	1	9	☐
39.In the past 3 years, the conditions of roads in the village have improved.	5	4	3	2	1	9	☐
40.In the past 3 years, the conditions of the public lighting on streets have worsened.	1	2	3	4	5	9	☐

The following questions ask direct questions about you and your experiences in the village.

Statements	**Yes**	**No**	**Don't know**	
41.Do you volunteer to help out any local group or community activities?	1	2	9	☐
42.Does your village feel like home?	1	2	9	☐
43.Do you feel safe walking down on the street after dark?	1	2	9	☐
44.Have you ever picked up other people's rubbish in a public place?	1	2	9	☐
45.Have you attended a local community event such as community festival in the past 12 months?	1	2	9	☐
46.Are you an active member of a group or organisation in the village?	1	2	9	☐
47.Are you on a management committee for a local group or organisation in the village?	1	2	9	☐
48.If you disagree with what everyone else agreed on, would you feel free to speak out?	1	2	9	☐
49.Are you interested in seeking information to improve the environment in your village?	1	2	9	☐
50.Have you ever attended training programs to develop your environment in the past 12 months	1	2	9	☐
51.Do you agree it is important to improve leadership skills for members in your village such as organising the meeting or conflict management?	1	2	9	☐

Community capacity attitude scale adapted from Bullen, P. & Onyx, J. (2005). Measuring Social Capital in Five Communities in NSW: New South Wales, p. 88-92. Used with permission of the principal author.

Section C: Coastal Erosion

In questions 52-58 I will ask you about your knowledge and views about coastal erosion in your village.

52. What do you think "coastal erosion" mean?

.....

.....

.....

53. What do you think the major cause of coastal erosion in your village is? (only 4 answers) ☐☐

☐1 Sea level rise ☐2 Storm ☐3 Tide ☐4 Wave ☐☐

☐5 Wind ☐6 Decreasing sedimentation

☐7 Farming ☐8 Loss of Mangrove area

☐9 Human Activities ☐10 Natural Causes

☐11 Land Subsidence ☐12 Unsuitable Revetment

☐13 Ship transportation ☐14 Water Gate Building

☐15 Others.....

54. Have you personally experienced losses of land or property due to coastal erosion? ☐

☐1 No (if answer No go to question 56)

☐2 Yes (go to question 55).....times ☐

55. Do you have any methods to put into action to protect your land and property? ☐

☐1 No

☐2 Yes (please specify methods)..... ☐

56. Do you think coastal erosion will physically affect your property in the future? ☐

☐1 No (if answer No go to question 58)

☐2 Yes (go to question 57) ☐

☐3 Don't know

57. When do you think coastal erosion will physically affect your property? ☐

☐1 It has been affecting my property

☐2 It might affect me next year

☐3 It might affect me in the next 5 year

☐4 It might affect me in the next 10 years

☐5 It might affect me over the next 10 years

☐6 Don't know

58. Are you interested in improving your knowledge on the coastal erosion issue? ☐

☐1 Never thought about it before ☐2 No (go to question 61)

☐3 Yes ☐4 Don't know

If you answered "yes" in question 59, please indicate the statements that most apply to your level of interest in improving knowledge about coastal erosion.

Statements	Very interested	Somewhat interested	Neutral	Somewhat uninterested	Very uninterested	Don't know	
59. How interested are you in the causes of coastal erosion?	1	2	3	4	5	9	☐
60. How interested are you in coastal erosion protection?	1	2	3	4	5	9	☐

Coastal erosion perception adapted from Rickard, D. (2008). Community based coastal monitoring: Developing tools for sustainable management, The University of Waikato. Used with permission of the principal author.

Statements	Yes	No	Don't know	
61. Have you talked about coastal erosion with others in your village in the past 12 months?	1	2	9	☐
62. Have you involved in training programs for coastal protection in the past 12 months?	1	2	9	☐
63. Have you participated in activities for planting vegetation to protect coastal areas in the past 12 months?	1	2	9	☐
64. Have you listened to people who talk or do activities for coastal protection in the past 12 months?	1	2	9	☐
65. Have you talked about your experience about coastal protection to others in your village in the past 12 months?	1	2	9	☐

In question 66-71, I will ask you about your experience in your village and how to deal with possible coastal erosion. I will read you a statement and could you please select a suitable answer in each statement relating to your opinion such as Strongly agree, agree, neutral, disagree, Strongly disagree and don't know. (Please, show and point at the answer card to a participant while explaining it).

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't know	
66. You know where you get information about coastal erosion.	1	2	3	4	5	9	☐
67. You know where you get information about coastal protection.	1	2	3	4	5	9	☐
68. Planting vegetation is a famous technique that you use to protect coastal area in your village.	1	2	3	4	5	9	☐
69. Community leaders are interested in coastal erosion protection.	1	2	3	4	5	9	☐
70. The local government works hard to help communities prevent coastal erosion.	1	2	3	4	5	9	☐
71. Coastal areas in this village are sufficiently protected from coastal erosion.	1	2	3	4	5	9	☐

Please tell me some more about your understanding of the following

72. What do you think a "**community**" means?

73. What do you think a "**leader**" means?

74. Is there anything you would like to tell us about your experiences in your village?

Thank you for taking your time to complete the questionnaire.

Appendix 2-3: Results of the pilot study

Pilot trial of the questionnaire

The pilot study was conducted in areas adjacent to the study areas of low and high erosion areas. In the low erosion area, the border village of Nakhok subdistrict was village 7 in Kalong subdistrict where there were 86 households totally. In the high erosion area, the border village of Laem Fa Pa subdistrict, village 9 of Bang Khun Tian subdistrict, Bangkok where there were 96 households totally (see Table 1).

Table 1: Responses of villagers in the pilot study

Villages	No. of households	No. of residents	Decline to respond	Volunteers to in-depth interview
Bang Khun Tian, Bangkok (31 May- 2 June 2010)	96	15	2	14
Kalong Subdistrict (27 May - 30 May 2010)	86	15	3	14
Total	182	30	5	28

The researcher had only employed a research assistant to help interview in the pilot trial of questionnaire for a week. Before conducting the pilot study, the researcher informed the heads of the villages in Kalong and Bang Khun Tian subdistricts that the research would be conducted in their areas. When the researcher and a research assistant who was trained to conduct the survey went to residents' houses, doorknocking was used to recruit villagers. When residents were at home, the interviewer briefly introduced himself and explained the purpose of the visit. They might be doubtful about an interviewer at first sight. Introducing the interviewer, the aims of the research and how they were chosen was an important process to achieving cooperation (Frankfort-Nachmias & Nachmias, 1999). Heads of households were invited to complete the questionnaire.

Fifteen residents from each village were selected by targeted sampling. Of the two villages door knocked, 30 residents of a possible 35 agreed to respond to the questionnaire. Three households in Kalong subdistrict and two households in Bang Khun Tian subdistrict declined to respond to the questionnaire because they believed the research was not useful for their villages and the interview interrupted their work and recreation.

The pilot questionnaire was administered in 40 minutes. The first five minutes was spent introducing the interviewer, explaining the research purposes, degree of respondent involvement and research consent. All questions were asked of villagers within thirty minutes. During the final five minutes the residents were asked about their feelings towards the information sought in the interview and the impacts of coastal erosion in their village. Before finishing the interview, the

researcher asked residents to be volunteers for in-depth interviews. Fourteen villagers agreed to participate in providing more details in the semi-structured interview in each subdistrict.

Many residents in Kalong subdistrict were not at home because they were fishermen and went out to gather cockles at the mud beach or catch fish and crustaceans. Residents in Bang Khun Tian worked in their own shrimp farms and were regularly at home. After completing the interview guided by the questionnaire instrument, the interviewer asked residents whether they were worried or concerned about the information they provided. All of them replied they had no negative feelings and that the questions were easy to understand and answer.

The findings from the pilot study were used to modify the questionnaire to help residents appropriately respond to questions in the main study stage (see Table 2). Most residents understood the meanings of questions but some questions needed further editing to help residents better understand the questions. Four questions were modified and two questions were added.

The first question edited was the question about the residents' age, the year of birth being asked of residents in the pilot study. Most residents replied using the Zodiac year which was difficult to interpret. The second question edited was about house ownership but most residents gave information about both house and land ownership. Therefore, the question was separated into two separate parts asking residents to inform about their house and land ownership status.

The third question modified was a multiple choice type asking residents to select from several their definition of coastal erosion. Each definition of coastal erosion among the multiple choices was slightly different so it was difficult for residents to understand and select the appropriate answer. Therefore, the question was modified from this format to an open-ended question; residents could define coastal erosion according to their understanding of the phenomenon.

The final question modified asked residents to indicate their experiences of coastal erosion impacts. Some residents outlined migration numbers as the impacts of coastal erosion. Therefore, a question was added asking residents who experienced coastal erosion impacts to approximate the number of migrants displaced because of coastal erosion.

Two open-ended questions were added to investigate opinions of residents about their community and their leaders. Residents could explain the meaning of community and leaders from their understanding of the terms. Regarding the definition of community, it was presented in terms of the characteristics of a community, such as community from a group with similar interest, or a group by occupation or village. In addition, the definition of leaders illustrated the characteristics of leaders in communities such as formal or informal leaders.

Table 2: Questionnaire was modified after conducting the pilot study

Question No.	Questions in the pilot study	Issues and reasons to change the question	Questions were modified
2	When were you born?	Twenty five respondents who were over 30 years old replied the Zodiac years. They did not properly convert the Zodiac year into B.C. years and took time to calculate the B.C. year. However, when asking respondents' ages, they could immediately answer. Therefore, this question was changed to ask years of age of respondents.	How old are you?
8	Is your home owned, rented or something else? (tick only one box) ☐1 Owned ☐2 Rent home ☐3 Public ☐4 Other	Many respondents owned houses but some respondents built their houses on other areas such as public area, temples' land and relatives' area. It was very important to understand land ownership in coastal villages with coastal erosion impacts because land owners might be interested in investment of different coastal protection methods. Consequently, a question about land ownership was added to ask the respondents.	Is your home owned, rented or something else? (tick only one box) ☐1 Owned ☐2 Rent home ☐3 Public ☐4 Other Is your land owned, rented or something else? (tick only one box) ☐1 Owned ☐2 Rent other ☐3 Public area ☐4 Other
Introduct-ion of section B	Words in the statements were defined to help respondents understand the questions as follows: "Community" refers to a village or a village boundary that respondents live in. "Leadership" means the position of being a leader of the villager in a village such as chief of village, senior citizen and monk. "Leaders" mean formal or informal persons who are able to direct or organise the village.	After explaining how to respond to the statements in the Section B, the researcher described the definition of community, leaders and leadership to respondents. Many respondents were not interested in the explanation. The respondents felt inconvenient because they often took deep breath out, stared at a door and watched clocks. After finishing reading the definitions, one respondent complained that these definitions made him little worry because they looked like academic meanings. Therefore, the definitions were eliminated. These words were asked respondents in open-ended question patterns.	72) What do you think a "community" means? 73) What do you think a "leader" means?
52	What do you think "coastal erosion" is? ☐1 Loss of land from coasts ☐2 Coastal environment deterioration	This question was asked to examine knowledge and understanding about coastal erosion of respondents. Twenty one respondents replied answer number 3, and 8 respondents replied answer number 1, and a	What do you think "coastal erosion" means?

Question No.	Questions in the pilot study	Issues and reasons to change the question	Questions were modified
	☐3 Both loss of land from coasts and coastal environment deterioration ☐4 Neither ☐5 Don't know	remaining replied "don't know". Most respondents explained that they did not understand the answer number 2 and its meaning was broad. They selected answer number 3. However, they preferred to explain the meaning of "coastal erosion" from their understanding and experiences in daily lives. Therefore, the question was modified from closed-ended to open-ended question.	
53	What do you think the major cause of coastal erosion in your village is? (only 1 answer) ☐1 Sea level rise ☐2 Storm ☐3 Tide ☐4 Wave ☐5 Wind ☐6 Human activities ☐7 Others	The question was asked to understand the causes of coastal erosion in each village. Twenty of 30 respondents replied wave in answer number 4 and others provided different answers. From the pilot study, several causes of coastal erosion were added in the multiple answer choices; sedimentation decreased, shrimp farms, mangrove area degradation, natural causes, land subsidence, ship transportation and water-gate construction. Consequently, the causes of coastal erosion were included in the multiple choices. To know other main causes of coastal erosion in the study area, each respondent could select 4 answers.	What do you think the major causes of coastal erosion in your village are? (only 4 answers) ☐1 Sea level rise ☐2 Storm ☐3 Tide ☐4 Wave ☐5 Wind ☐6 Sediment decreased ☐7 Shrimp Farms ☐8 Mangrove area degradation ☐9 Human activities ☐10 Natural causes ☐11 Land subsidence ☐12 Ship transportation ☐13 Water gate Construction ☐14 Others.....
54	Have you personally experienced losses of property due to coastal erosion? ☐1 No (if answer No go to question 56) ☐2 Yes (go to question 55).	In this question, 23 respondents replied "yes". This meant respondents experiencing land loss from coastal erosion. They specified the number of land losses from coastal erosion. Therefore, numbers of property loss were asked to investigate details of respondents experiencing impacts of the erosion.	Have you personally experienced losses of land or property due to coastal erosion? ☐1 No (if answer No go to question 56) ☐2 Yes (go to question 55) .....times

The researcher then coded all responses collected in both villages by following the codebook which was developed to explain numerical codes assigned for questions to ensure consistency with data collection. In addition, the codebook was useful for data entry, interpreting results

from statistical analyses and acting as a reference guide for others using this data set (Nardi, 2006; Wilkinson & Birmingham, 2003). After coding, the data were transferred to computer through MS-Access version 2007 before exporting it to SPSS version 19.

The results of the pilot study in both villages showed that 70% of residents were male. Most residents were less than 60 years old. Almost all residents had lived in the villages longer than 10 years or since they were born. Approximately 53% of respondents completed primary school and 27% completed a standard higher than primary school. Almost 50% of residents working in villages were fishermen. Most residents had monthly incomes of less than 10,000 Baht, approximately 335 dollars.

Residents' houses in village 9 were far from a coastline because of the shrimp ponds between the coastline and the village; residents' houses in village 7 were close to the coastline. Most residents in both villages experienced loss of properties from erosion. Most villagers did not protect their properties but seven villagers protected their houses by placement of rocks.

In terms of testing internal consistency of scalar questions, Pallant (2007) suggests that Cronbach's alpha coefficient should be greater than 0.7. The coefficient alpha in the pilot was a satisfactory 0.72. Regarding validity of questions, these were adopted from those studied by experts in areas of community capacity building (Bullen & Onyx, 1998; Zwicker & Marlin, 2009).

Pilot trial of semi-structured interview

Two key informants were invited to participate in the semi-structured interview of the pilot study: a villager and an official. Regarding the key informant villager, 14 of 15 residents in village 9 of Bang Khun Tian volunteered to respond to the semi-structured interview. A key informant was randomly selected by giving an equal chance to every person. In this stage, the selected sample was a 54 years old fisherman who had lived in the village since his birth. An invitation letter and an information sheet were brought to the informant's house to explain the purpose of the research. The researcher revisited the informant's house to obtain agreement to participate and consent for the 50 minute interview.

For an official, the interviewer mailed the office of Community Development in Samut Prakarn province providing details of the research and seeking a person involved in building the community's capacity and working with local people. Two weeks later, the interviewer visited the office to meet the chief of Community Development and ask for permission to conduct the interview. The chief suggested interviewing an official (a man 52 years old who had ten years of experience working with local communities).

The researcher sent an invitation letter and an information form explaining the purposes of the interview to the key informant. After agreeing to participate in the interview, he provided time to be interviewed in his office. Before starting the interview, a consent form was signed and the interview was recorded. When the key informant responded to the questions, the researcher took

notes and carefully listened to the answers to follow-up if necessary. The interview took 45 minutes.

The records from both interviewees were transcribed and coded; then the transcript was considered for appropriateness of questioning and the responses. The data available were categorised according to such variables in community capacity building as participation, leaders, resources available, sense of community, knowledge, skills and village activities.

Appendix 2-4: Semi-Structure Interview Schedule
(For heads of villages and volunteer villages)
Factors influencing community capacity to respond to coastal erosion in the upper Gulf of Thailand

Pseudonym:

Date:

Time:

1.Please tell me a little bit about yourself? And how long do you live here?

2.Has this area always been like this (i.e. land use, land owner, land area)?

3.How has it been changed?

4.Can you describe your responses to the change that you have mention?

5.Do you have a relationship with your neighbour?

6.Can you tell me about your community?

7.Are there any issues that you concern in this community?

8.How do you get involve in your community issues?

9.How do you interact with people in a community and other communities? (networks)

10.How are you satisfied to get support from the local authority?

11.What could be done to improve your community?

12.Further comments/questions.

Appendix 2-4: Semi-Structure Interview Schedule
(For Officials, NGOs and scientists)
Factors influencing community capacity to respond to coastal erosion in the upper Gulf of Thailand

Pseudonym:

Date:

Time:

1.Please tell me a little bit about yourself?

2.How long do you experience in this position?

3.What roles of your organisation are related to community capacity or coastal erosion issues?

4.How do you get involve in coastal community?

5.How do you get involve in coastal erosion impacts in communities?

6.Further comments/questions.

Appendix 2-5: Validity test in the questionnaire

Comparison of two questions by applying the chi-square test to examine validity of questions in the questionnaire (Expected frequencies in parentheses)

Items	Responses from respondents			
	Disagree	Neutral	Agree	Total
29) Many residents take informal leadership roles in this community when there are community activities.	27 (32)	21 (19)	310 (307)	358
33 No residents in this village take informal leadership roles in community activities.	37 (32)	17 (19)	304 (307)	358
Total	64	38	614	716

The calculation of the chi-square is applied from:

$$X^2 = \frac{\sum (\text{observe frequency} - \text{expected frequency})^2}{\text{expected frequency}}$$

$$= \frac{(27-32)^2}{32} + \frac{(21-19)^2}{19} + \frac{(310-307)^2}{307} + \frac{(37-32)^2}{32} + \frac{(17-19)^2}{19} + \frac{(304-307)^2}{307}$$

$$= 0.78 + 0.21 + 0.03 + 0.78 + 0.21 + 0.03$$

$$= 2.04$$

In Table 3-5, there were 4 df because (R-1)(C-1) = (2-1)(3-1) = 2.
The critical value was $\chi^2_{0.05} = 5.99$ when df = 2 (Howell, 2002, p. 736).

Appendix 2-6: Parent node categories from the semi-structured interviewed

Primary tree nodes	Secondary nodes	
Coastal erosion	(1) History of coastal area	
	(2) Causes of coastal erosion	
	(3) Impacts of coastal erosion	
	(4) Responses to coastal erosion	
Livelihoods	Socio-economic data of residents	(5) Time of residency
		(6) Employment
		(7) Income
		(8) Educational qualification
	Leaders	(9) Leaders' roles
		(10) Leadership
	(11) Relationships of residents	
	(12) Public involvement	
	(13) Sense of places	
	(14) Skills and knowledge	
	Community activities	(15) Develop community
		(16) Festivals/ceremonies
		(17) Meetings
	Community issues	(18) Social issues
		(19) Environmental issues
Environmental circumstances	(20) Infrastructure in communities	
	Resources in communities	(21) Marine animals
		(22) Mangrove forest
External networks	Governmental organisation support	(23) Local level
		(24) Provincial level
		(25) Regional level
		(26) National level
	Collaboration with others	(27) NGOs
		(28) Scientists
		(29) Civic groups
Land in villages	(30) Land ownership	
	(31) Land used	
	(32) Land issues	

Appendix: Chapter 3

Appendix 3-1: Demographic information between low and high erosion areas

Table 1: Genders of respondents in selected villages in low and high erosion areas

Gender	A high erosion area				A low erosion area			Total
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
Male	10	44	7	33	41	25	37	**197**
	(50%)	*(51%)*	*(70%)*	*(52%)*	*(62%)*	*(57%)*	*(55%)*	***(55%)***
Female	10	43	3	31	25	19	30	**161**
	(50%)	*49%)*	*(30%)*	*(48%)*	*(38%)*	*(43%)*	*(45%)*	***(45%)***
Total	**20**	**87**	**10**	**64**	**66**	**44**	**67**	**358**

Table 2: Years of age of respondents in selected villages in low and high erosion areas

Years	A high erosion area				A low erosion area			Total
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
Means	*49*	*49*	*49*	*44*	*48*	*46*	*47*	
20 - 29	2	7	0	6	5	7	8	35
	10%	8%	0%	9%	7%	16%	12%	10%
30 - 39	2	15	2	18	11	9	9	66
	10%	17%	20%	28%	17%	20%	13%	18%
40 - 49	3	22	5	20	21	9	18	98
	15%	25%	50%	31%	32%	20%	27%	27%
50 - 59	9	23	1	11	16	12	24	96
	45%	26%	10%	17%	24%	27%	36%	27%
60 +	4	20	2	9	13	7	8	63
	20%	23%	20%	14%	20%	16%	12%	18%
Total	20	87	10	64	66	44	67	358

Table 3: Time of residency of respondents in selected villages in low and high erosion areas

Years in a village	A high erosion area				A low erosion area			Total
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
≤ 10 years	2	7	2	5	8	4	2	30
	10%	8%	20%	8%	12%	9%	3%	8%
> 10 years	18	80	8	59	58	40	65	328
	90%	92%	80%	92%	88%	91%	97%	92%
Total	20	87	10	64	66	44	67	358

Table 4: Living arrangement of respondents in selected villages in low and high erosion areas

Living arrangement	**A high erosion area**				**A low erosion area**			**Total**
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
Live alone or with others	14 *(70%)*	26 *(30%)*	4 *(40%)*	26 *(41%)*	25 *(38%)*	22 *(50%)*	24 *(36%)*	**141** ***(39%)***
Live with family	6 *(30%)*	61 *(70%)*	6 *(60%)*	38 *(59%)*	41 *(62%)*	22 *(50%)*	43 *(64%)*	**217** ***(61%)***
Total	**20**	**87**	**10**	**64**	**66**	**44**	**67**	**358**

Table 5: Educational qualification of respondents in selected villages in low and high erosion areas

Educational qualification	**A high erosion area**				**A low erosion area**			**Total**
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
None	1 *(5%)*	8 *(10%)*	0 *(0%)*	2 *(3%)*	4 *(6%)*	8 *(18%)*	7 *(10%)*	**30** *(8%)*
Primary school	16 *(80%)*	68 *(78%)*	10 *(100%)*	58 *(91%)*	49 *(74%)*	27 *(61%)*	48 *(72%)*	**276** *(77%)*
Higher than primary school	3 *(15%)*	11 *(13%)*	0 *(0%)*	4 *(6%)*	13 *(20%)*	9 *(21%)*	12 *(18%)*	**52** *(15%)*
Total	**20**	**87**	**10**	**64**	**66**	**44**	**67**	**373**

Table 6: Employment of respondents in selected villages in low and high erosion areas

Employment	**A high erosion area**				**A low erosion area**			**Total**
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
Fishermen	19 95%	73 84%	9 90%	60 94%	36 55%	26 59%	36 54%	259 72%
Seller	1 5%	7 8%	0 0%	1 2%	11 17%	6 14%	14 21%	40 11%
Housewife	0 0%	3 3%	1 10%	3 5%	3 5%	5 11%	7 10%	22 6%
Factory employee	0 0%	0 0%	0 0%	0 0%	11 17%	3 7%	9 13%	23 6%
Other careers	0 0%	1 1%	0 0%	0 0%	0 0%	3 7%	1 1%	5 1%
Unemployment	0 0%	3 3%	0 0%	0 0%	5 8%	1 2%	0 0%	9 3%
Total	20	87	10	64	66	44	67	358

Table 7: Monthly income of respondents in selected villages in low and high erosion areas

Monthly income	A high erosion area				A low erosion area			Total
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
< 10,000 Baht	14	64	4	39	28	24	32	205
	70%	74%	40%	61%	42%	55%	48%	57%
≥ 10,000 Baht	5	23	6	25	38	20	35	152
	25%	26%	60%	39%	58%	45%	52%	43%
Do not know	1	0	0	0	0	0	0	1
	5%	0%	0%	0%	0%	0%	0%	0%
Total	20	87	10	64	66	44	67	358

Table 8: Houses ownership of respondents in selected villages in low and high erosion areas

House ownership	A high erosion area				A low erosion area			Total
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
Yes	18	85	10	63	62	39	67	344
	90%	98%	100%	98%	94%	89%	100%	96%
No	2	2	0	1	4	5	0	14
	10%	2%	0%	2%	6%	11%	0%	4%
Total	**20**	**87**	**10**	**64**	**66**	**44**	**67**	**358**

Table 9: Land ownership of respondents in selected villages in low and high erosion areas

Land ownership	A high erosion area				A low erosion area			Total
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
Yes	0	4	6	9	48	36	13	116
	0%	5%	60%	14%	73%	82%	19%	32%
No	20	83	4	55	18	8	54	242
	100%	95%	40%	86%	27%	18%	81%	68%
Total	**20**	**87**	**10**	**64**	**66**	**44**	**67**	**358**

Table 10: Respondents estimated distance from their houses to a coastline between low and high erosion areas

Distance from houses to a coastline	A high erosion area				A low erosion area			Total
	Village 8	Village 9	Village 10	Village 11	Village 7	Village 4	Village 5	
≤ 200 metres	17	46	4	23	40	34	52	216
	85%	53%	40%	36%	61%	77%	78%	60%
> 200 metres	3	41	6	41	26	10	15	142
	15%	47%	60%	64%	39%	23%	22%	40%
Total	**20**	**87**	**10**	**64**	**66**	**44**	**67**	**358**

Appendix 3-2: Population in the census

The census collected from 4 provinces in the upper Gulf of Thailand such as Chachoengsoa, Samut Prakarn, Samut Sakorn and Samut Songkram provinces

Variables	Chachoengsoa (%)	Samut Prakarn (%)	Samut Sakhorn (%)	Samut Songkram (%)	Sum	Average (%)
Gender	100	100	100	100	400	100
male	71	76	73	54	274	69
female	29	24	27	46	126	32
Age	100	100	100	100	400	100
20-29	4	30	7	1	42	11
30-39	18	30	18	9	75	19
40-49	29	20	25	22	96	24
50-59	21	12	23	25	81	20
60+	28	8	27	43	106	27
Living arrangement	100	100	100	100	400	100
live with others	30	19	25	56	130	33
live with family, children	70	81	75	44	270	68
Education qualify	100	100	100	100	400	100
None	3	2	7	5	17	4
Primary school	56	21	60	60	197	49
> Primary school	41	77	33	35	186	47
Monthly income	100	100	100	100	400	100
< 10,000	31	18	27	52	128	32
≥ 10,000	69	82	73	48	272	68
House ownership	100	100	100	100	400	100
yes	84	28	36	94	242	61
No	16	72	64	6	158	40
Land ownership	100	100	100	100	400	100
yes	76	23	31	75	205	51
No	24	77	69	25	195	49

The census data was conducted by the National Statistics Office, Ministry of Interior, Thailand, 2006.

Appendix: Chapter 4

Appendix 4-1: Causes of coastal erosion

Respondents replied four major causes of coastal erosion in coastal villages from their opinions

Causes of coastal erosion	Frequency
1.Wave	356
2.Wind	351
3.Strom	249
4.Natural causes	170
5.Sea Level Rise	119
6.Land Subsidence	41
7.Mangrove area loss	39
8.Water Gate to protect flooding	31
9.Tide	24
10.Farming	22
11.Sediment is decreased	13
12.Human activities	12
13.Big ship transportation	1
Total	**1,428**

Appendix 4-2: Loss of property from coastal erosion

Table (1): Respondents lost property from coastal erosion

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Loss of property from coastal erosion						
Yes	94%	*169*	51%	*90*	73%	*259*
No	6%	*12*	49%	*87*	27%	*99*
Total	100%	*181*	100%	*177*	100%	*358*

Table (2): Respondents informed frequency of property loss

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Frequency of loss						
1 - 2 times	24%	*40*	84%	*76*	45%	*116*
More than 2 times	76%	*129*	16%	*14*	55%	*143*
Total		*169*	100%	*90*	100%	*259*

Appendix 4-3: Respondents were interested in coastal erosion and coastal protection issues

Table 1: Respondents talked about coastal erosion with others

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Yes	98%	*178*	63%	*111*	81%	*289*
No	2%	*3*	37%	*66*	19%	*69*
Total		*181*		*177*	100%	*358*

Table 2: Respondents listened to others talking about coastal erosion

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Yes	95%	*172*	62%	*109*	78%	*281*
No	5%	*9*	38%	*68*	22%	*77*
Total		*181*		*177*	100%	*358*

Table 3: Respondents talked about experience coastal protection to others

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Yes	81%	*147*	53%	*94*	67%	*241*
No	19%	*34*	47%	*83*	33%	*117*
Total		*181*		*177*	100%	*358*

Table 4: Respondents participated in training programs about coastal erosion

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Yes	55%	*99*	16%	*29*	36%	*128*
No	45%	*82*	84%	*148*	64%	*230*
Total		*181*		*177*	100%	*358*

Table 5: Respondents participated in planting vegetation

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Yes	53%	*96*	41%	*73*	47%	*169*
No	47%	*85*	59%	*104*	53%	*189*
Total		*181*		*177*	100%	*358*

Table 6: Respondents knew persons who provided information about coastal erosion causes.

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Yes	64%	*112*	29%	*50*	47%	*162*
No	36%	*62*	71%	*122*	53%	*184*
Total	100%	*174*		*172*	100%	*346*

Table 7: Respondents knew persons who provided information about coastal protection

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Yes	62%	*112*	29%	*51*	46%	*163*
No	34%	*62*	69%	*122*	51%	*184*
Total	96%	*174*	98%	*173*	97%	*347*

Table 8: Planting vegetation was used to protect a coastline in villages.

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Agree	84%	*152*	72%	*127*	78%	*279*
Disagree	14%	*25*	20%	*36*	17%	*61*
Total	98%	*177*	92%	*163*	95%	*340*

Table 9: Community leaders were interested in coastal protection.

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Agree	98%	*177*	81%	*144*	90%	*321*
Disagree	1%	*1*	2%	*3*	1%	*4*
Total	98%	*178*	83%	*147*	91%	*325*

Table 10: Local government supported coastal protection

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Agree	85%	*153*	77%	*137*	81%	*290*
Disagree	4%	*8*	3%	*5*	4%	*13*
Total	89%	*161*	80%	*142*	85%	*303*

Table 11: A coastline was sufficient protected in the village.

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Agree	0%	*0*	10%	*17*	5%	*17*
Disagree	100%	*181*	85%	*150*	92%	*331*
Total	100%	*181*	94%	*167*	97%	*348*

Table 12: Respondents were interested in improving coastal erosion issues

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Yes	99%	*178*	63%	*110*	81%	*288*
No	1%	*2*	37%	*65*	19%	*67*
Total	100%	*180*	100%	*175*	100%	*355*

Table 13: Degrees of interested in coastal erosion knowledge

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Strongly agree	69%	*123*	60%	*66*	66%	*189*
Agree	31%	*55*	40%	*44*	34%	*99*
Total		*178*		*110*	100%	*288*

Table 14: Degrees of interested in coastal protection knowledge

Variables	High erosion area		Low erosion area		Total	
	(%)	No.	(%)	No.	(%)	No.
Strongly agree	70%	*124*	60%	*66*	66%	*190*
Agree	30%	*54*	40%	*44*	34%	*98*
Total		*178*		*110*	100%	*288*

Appendix: Chapter 5

Appendix 5-1: Respondents responded to the attitude scales

Statements	Degree of opinions	High erosion area			Low erosion area		
		Count	Column (N %)	Row (N%)	Count	Column (N%)	Row (N%)
1) You know most people in this community	Strongly Disagree	0	.0%	.0%	1	.6%	100.0%
	Disagree	1	.6%	11.1%	8	4.5%	88.9%
	Neutral	0	.0%	.0%	0	.0%	.0%
	Agree	29	16.0%	53.7%	25	14.1%	46.3%
	Strongly Agree	151	83.4%	51.4%	143	80.8%	48.6%
		181			177		
2) Most people know each other in this community	Strongly agree	0	.0%	.0%	2	1.1%	100.0%
	Agree	0	.0%	.0%	2	1.1%	100.0%
	Neutral	0	.0%	.0%	5	2.8%	100.0%
	Disagree	30	16.6%	47.6%	33	18.6%	52.4%
	Strongly disagree	151	83.4%	52.8%	135	76.3%	47.2%
		181			177		
3) Most people in this community can be trusted	Strongly Disagree	0	.0%	.0%	8	4.5%	100.0%
	Disagree	24	13.3%	52.2%	22	12.4%	47.8%
	Neutral	7	3.9%	15.6%	38	21.5%	84.4%
	Agree	53	29.3%	47.7%	58	32.8%	52.3%
	Strongly Agree	97	53.6%	65.5%	51	28.8%	34.5%
		181			177		
4) Most people in this community honestly share points of view with each other	Strongly Disagree	0	.0%	.0%	9	5.1%	100.0%
	Disagree	29	16.0%	56.9%	22	12.4%	43.1%
	Neutral	15	8.3%	25.9%	43	24.3%	74.1%
	Agree	57	31.5%	52.8%	51	28.8%	47.2%
	Strongly Agree	80	44.2%	60.6%	52	29.4%	39.4%
		181			177		
5) You believe the community can manage most problems by itself	Strongly Disagree	3	1.7%	20.0%	12	6.8%	80.0%
	Disagree	3	1.7%	20.0%	12	6.8%	80.0%
	Neutral	15	8.3%	39.5%	23	13.0%	60.5%
	Agree	83	45.9%	51.2%	79	44.6%	48.8%
	Strongly Agree	77	42.5%	60.2%	51	28.8%	39.8%
		181			177		
6) You feel welcome new residents in this community	Strongly Disagree	0	.0%	.0%	2	1.1%	100.0%
	Disagree	0	.0%	.0%	3	1.7%	100.0%
	Neutral	5	2.8%	31.3%	11	6.2%	68.8%
	Agree	77	42.5%	51.0%	74	41.8%	49.0%
	Strongly Agree	99	54.7%	53.2%	87	49.2%	46.8%
		181			177		

Statements	Degree of opinions	High erosion area			Low erosion area		
		Count	Column (N %)	Row (N%)	Count	Column (N%)	Row (N%)
7) All sectors in your community work together such as local government, senior citizen groups, schools and temples	Strongly Disagree	0	.0%	.0%	1	.6%	100.0%
	Disagree	1	.6%	33.3%	2	1.1%	66.7%
	Neutral	0	.0%	.0%	6	3.4%	100.0%
	Agree	70	38.7%	50.0%	70	39.5%	50.0%
	Strongly Agree	110	60.8%	52.9%	98	55.4%	47.1%
		181			177		
8) You usually go to other villages to visit friends or relatives	Strongly Disagree	12	6.6%	23.5%	39	22.0%	76.5%
	Disagree	20	11.0%	35.7%	36	20.3%	64.3%
	Neutral	2	1.1%	100.0%	0	.0%	.0%
	Agree	79	43.6%	55.2%	64	36.2%	44.8%
	Strongly Agree	68	37.6%	64.2%	38	21.5%	35.8%
		181			177		
9) People with different incomes work together to make the community a better place	Strongly Disagree	0	.0%	.0%	2	1.1%	100.0%
	Disagree	0	.0%	.0%	3	1.7%	100.0%
	Neutral	0	.0%	.0%	5	2.8%	100.0%
	Agree	71	39.2%	50.7%	69	39.0%	49.3%
	Strongly Agree	110	60.8%	52.9%	98	55.4%	47.1%
		181			177		
10) The community demonstrates a willingness to seek help from the external community such as private business, governmental organisations	Strongly Disagree	0	.0%	.0%	0	.0%	.0%
	Disagree	0	.0%	.0%	1	.6%	100.0%
	Neutral	2	1.1%	20.0%	8	4.5%	80.0%
	Agree	71	39.2%	51.8%	66	37.3%	48.2%
	Strongly Agree	108	59.7%	51.4%	102	57.6%	48.6%
		181			177		
11) You always support the village through donation of money	Strongly Disagree	0	.0%	.0%	9	5.1%	100.0%
	Disagree	4	2.2%	33.3%	8	4.5%	66.7%
	Neutral	0	.0%	.0%	7	4.0%	100.0%
	Agree	110	60.8%	51.6%	103	58.2%	48.4%
	Strongly Agree	67	37.0%	57.3%	50	28.2%	42.7%
		181			177		
12) You always participated in activities to improve your village such as meeting, planting and cleaning	Strongly agree	0	.0%	.0%	14	7.9%	100.0%
	Agree	4	2.2%	40.0%	6	3.4%	60.0%
	Neutral	0	.0%	.0%	2	1.1%	100.0%
	Disagree	66	36.5%	52.8%	59	33.3%	47.2%
	Strongly disagree	111	61.3%	53.6%	96	54.2%	46.4%
		181			177		

Statements	Degree of opinions	High erosion area			Low erosion area		
		Count	Column (N %)	Row (N%)	Count	Column (N%)	Row (N%)
13) You always support the village through donation of goods	Strongly Disagree	0	.0%	.0%	17	9.6%	100.0%
	Disagree	3	1.7%	16.7%	15	8.5%	83.3%
	Neutral	4	2.2%	40.0%	6	3.4%	60.0%
	Agree	118	65.2%	56.2%	92	52.0%	43.8%
	Strongly Agree	56	30.9%	54.4%	47	26.6%	45.6%
		181			177		
14) You tolerate others with different perspectives in your community when discussing a matter at a meeting	Strongly agree	0	.0%	.0%	4	2.3%	100.0%
	Agree	3	1.7%	60.0%	2	1.1%	40.0%
	Neutral	3	1.7%	15.0%	17	9.6%	85.0%
	Disagree	95	52.5%	57.6%	70	39.5%	42.4%
	Strongly disagree	80	44.2%	48.8%	84	47.5%	51.2%
		181			177		
15) All ages participate in events in your community	Strongly Disagree	0	.0%	.0%	1	.6%	100.0%
	Disagree	1	.6%	50.0%	1	.6%	50.0%
	Neutral	0	.0%	.0%	2	1.1%	100.0%
	Agree	68	37.6%	56.2%	53	29.9%	43.8%
	Strongly Agree	112	61.9%	48.3%	120	67.8%	51.7%
		181			177		
16) You have chance to participate in decision-making about development projects in your village	Strongly agree	1	.6%	5.6%	17	9.6%	94.4%
	Agree	8	4.4%	23.5%	26	14.7%	76.5%
	Neutral	7	3.9%	46.7%	8	4.5%	53.3%
	Disagree	96	53.0%	54.9%	79	44.6%	45.1%
	Strongly disagree	69	38.1%	59.5%	47	26.6%	40.5%
		181			177		
17) A local government is responsive to the needs of the people well	Strongly Disagree	0	.0%	.0%	0	.0%	.0%
	Disagree	1	.6%	100.0%	0	.0%	.0%
	Neutral	2	1.1%	50.0%	2	1.1%	50.0%
	Agree	103	56.9%	55.1%	84	47.5%	44.9%
	Strongly Agree	75	41.4%	45.2%	91	51.4%	54.8%
		181			177		
18) In your community, information about community activities will usually be made public	Strongly Disagree	5	2.8%	35.7%	9	5.1%	64.3%
	Disagree	5	2.8%	20.8%	19	10.7%	79.2%
	Neutral	1	.6%	50.0%	1	.6%	50.0%
	Agree	67	37.0%	61.5%	42	23.7%	38.5%
	Strongly Agree	103	56.9%	49.3%	106	59.9%	50.7%
		181			177		

Statements	Degree of opinions	High erosion area			Low erosion area		
		Count	Column (N %)	Row (N%)	Count	Column (N%)	Row (N%)
19) Community leaders build on the positive things in your community	Strongly Disagree	0	.0%	.0%	7	4.0%	100.0%
	Disagree	4	2.2%	57.1%	3	1.7%	42.9%
	Neutral	2	1.1%	22.2%	7	4.0%	77.8%
	Agree	69	38.1%	51.1%	66	37.3%	48.9%
	Strongly Agree	106	58.6%	53.0%	94	53.1%	47.0%
		181			177		
20) Many people take informal leadership roles in this community	Strongly Disagree	5	2.8%	41.7%	7	4.0%	58.3%
	Disagree	4	2.2%	26.7%	11	6.2%	73.3%
	Neutral	6	3.3%	28.6%	15	8.5%	71.4%
	Agree	87	48.1%	50.9%	84	47.5%	49.1%
	Strongly Agree	79	43.6%	56.8%	60	33.9%	43.2%
		181			177		
21) Women are accepted when they work as leaders in the community	Strongly agree	2	1.1%	11.8%	15	8.5%	88.2%
	Agree	4	2.2%	23.5%	13	7.3%	76.5%
	Neutral	2	1.1%	18.2%	9	5.1%	81.8%
	Disagree	77	42.5%	47.2%	86	48.6%	52.8%
	Strongly disagree	96	53.0%	64.0%	54	30.5%	36.0%
		181			177		
22) This community has encouraged a younger generation in leadership positions	Strongly agree	2	1.1%	11.8%	15	8.5%	88.2%
	Agree	13	7.2%	34.2%	25	14.1%	65.8%
	Neutral	9	5.0%	19.6%	37	20.9%	80.4%
	Disagree	91	50.3%	55.5%	73	41.2%	44.5%
	Strongly disagree	66	36.5%	71.0%	27	15.3%	29.0%
		181			177		
23) Community leaders are interested in solving every problem in a community	Strongly Disagree	0	.0%	.0%	3	1.7%	100.0%
	Disagree	4	2.2%	30.8%	9	5.1%	69.2%
	Neutral	22	12.2%	43.1%	29	16.4%	56.9%
	Agree	99	54.7%	53.5%	86	48.6%	46.5%
	Strongly Agree	56	30.9%	52.8%	50	28.2%	47.2%
		181			177		
(No)body in this village takes informal leadership roles in community activities	Strongly Disagree	7	3.9%	50.0%	7	4.0%	50.0%
	Disagree	9	5.0%	39.1%	14	7.9%	60.9%
	Neutral	4	2.2%	23.5%	13	7.3%	76.5%
	Agree	113	62.4%	56.2%	88	49.7%	43.8%
	Strongly Agree	48	26.5%	46.6%	55	31.1%	53.4%
		181			177		

Statements	Degree of opinions	High erosion area			Low erosion area		
		Count	Column (N %)	Row (N%)	Count	Column (N%)	Row (N%)
24) The local government carefully uses funds to develop new projects	Strongly Disagree	4	2.2%	66.7%	2	1.1%	33.3%
	Disagree	8	4.4%	66.7%	4	2.3%	33.3%
	Neutral	77	42.5%	57.0%	58	33.0%	43.0%
	Agree	56	30.9%	48.3%	60	34.1%	51.7%
	Strongly Agree	36	19.9%	40.9%	52	29.5%	59.1%
		181			176		
25) Your village has a lot of members with skills to work for a community	Strongly Disagree	1	.6%	50.0%	1	.6%	50.0%
	Disagree	3	1.7%	60.0%	2	1.1%	40.0%
	Neutral	5	2.8%	33.3%	10	5.6%	66.7%
	Agree	115	63.5%	55.8%	91	51.4%	44.2%
	Strongly Agree	57	31.5%	43.8%	73	41.2%	56.2%
		181			177		
26) Your village has insufficient equipment to support community activities	Strongly agree	99	54.7%	54.7%	82	46.3%	45.3%
	Agree	77	42.5%	68.8%	35	19.8%	31.3%
	Neutral	2	1.1%	14.3%	12	6.8%	85.7%
	Disagree	3	1.7%	7.7%	36	20.3%	92.3%
	Strongly disagree	0	.0%	.0%	12	6.8%	100.0%
		181			177		
27) You use sources of information in your community to help you make a life decisions such as working	Strongly Disagree	15	8.3%	23.1%	50	28.2%	76.9%
	Disagree	50	27.6%	56.2%	39	22.0%	43.8%
	Neutral	24	13.3%	58.5%	17	9.6%	41.5%
	Agree	61	33.7%	57.5%	45	25.4%	42.5%
	Strongly Agree	31	17.1%	54.4%	26	14.7%	45.6%
		181			177		
28) If you work in a group, you welcome questions or alternatives from members in a group	Strongly Disagree	2	1.1%	50.0%	2	1.1%	50.0%
	Disagree	1	.6%	33.3%	2	1.1%	66.7%
	Neutral	0	.0%	.0%	4	2.3%	100.0%
	Agree	106	58.6%	60.6%	69	39.0%	39.4%
	Strongly Agree	72	39.8%	41.9%	100	56.5%	58.1%
		181			177		
29) In the past 3 years, the conditions of roads in the village have improved	Strongly Disagree	6	3.3%	75.0%	2	1.1%	25.0%
	Disagree	16	8.8%	100.0%	0	.0%	.0%
	Neutral	6	3.3%	66.7%	3	1.7%	33.3%
	Agree	95	52.5%	66.9%	47	26.6%	33.1%
	Strongly Agree	58	32.0%	31.7%	125	70.6%	68.3%
		181			177		

Statements	Degree of opinions	High erosion area			Low erosion area		
		Count	Column (N %)	Row (N%)	Count	Column (N%)	Row (N%)
30) In the past 3 years, the conditions of the public lighting on streets have improved	Strongly agree	8	4.4%	80.0%	2	1.1%	20.0%
	Agree	16	8.8%	57.1%	12	6.8%	42.9%
	Neutral	34	18.8%	87.2%	5	2.8%	12.8%
	Disagree	90	49.7%	58.1%	65	36.7%	41.9%
	Strongly disagree	33	18.2%	26.2%	93	52.5%	73.8%
		181			177		
31) Do you volunteer to help out any local group or community activities?	Yes	181	100.0%	50.6%	177	100.0%	49.4%
	No	0	.0%	.0%	0	.0%	.0%
		181			177		
32) Does your village feel like home?	Yes	181	100.0%	50.7%	176	100.0%	49.3%
	No	0	.0%	.0%	0	.0%	.0%
		181			176		
33) Do you feel safe walking down on the street after dark?	Yes	181	100.0%	51.1%	173	97.7%	48.9%
	No	0	.0%	.0%	4	2.3%	100.0%
		181			177		
34) Have you ever picked up other people's rubbish in a public place?	Yes	162	89.5%	49.8%	163	92.1%	50.2%
	No	19	10.5%	57.6%	14	7.9%	42.4%
		181			177		
35) Have you attended a local community event such as community festival in the past 12 months?	Yes	181	100.0%	52.0%	167	94.4%	48.0%
	No	0	.0%	.0%	10	5.6%	100.0%
		181			177		
36) Are you an active member of a group or organisation in the village?	Yes	99	54.7%	69.2%	44	24.9%	30.8%
	No	82	45.3%	38.1%	133	75.1%	61.9%
		181			177		
37) Are you on a management committee for a local group or organisation in the village?	Yes	35	19.3%	47.9%	38	21.5%	52.1%
	No	146	80.7%	51.2%	139	78.5%	48.8%
		181			177		
38) If you disagree with what everyone else agreed on, would you feel free to speak out?	Yes	166	91.7%	57.8%	121	69.1%	42.2%
	No	15	8.3%	21.7%	54	30.9%	78.3%
		181			175		

Statements	Degree of opinions	High erosion area			Low erosion area		
		Count	Column (N %)	Row (N%)	Count	Column (N%)	Row (N%)
39) Are you interested in seeking information to improve the environment in your village?	Yes	139	76.8%	53.7%	120	67.8%	46.3%
	No	42	23.2%	42.4%	57	32.2%	57.6%
		181			177		
40) Have you ever attended training programs to develop your environment in the past 12 months	Yes	111	61.3%	63.8%	63	35.6%	36.2%
	No	70	38.7%	38.0%	114	64.4%	62.0%
		181			177		
41) Do you agree it is important to improve leadership skills for members in your village such as organising the meeting or conflict management?	Yes	179	98.9%	50.7%	174	98.9%	49.3%
	No	2	1.1%	50.0%	2	1.1%	50.0%
		181			176		

Appendix 5-2: Graphs of response on statements about trust between low and high erosion areas

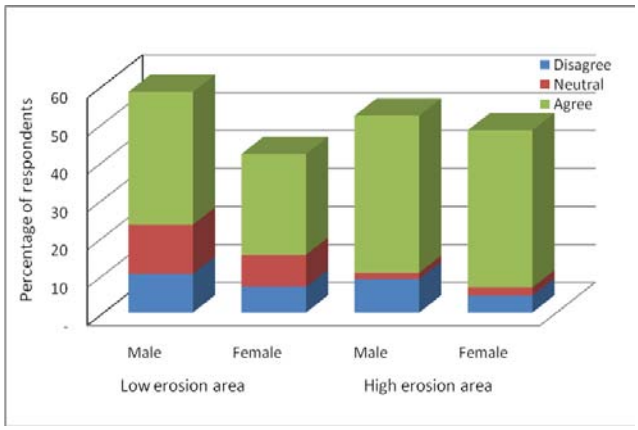


Figure 5-1: Participants with different genders responding to the statement “most people in this community could be trusted”

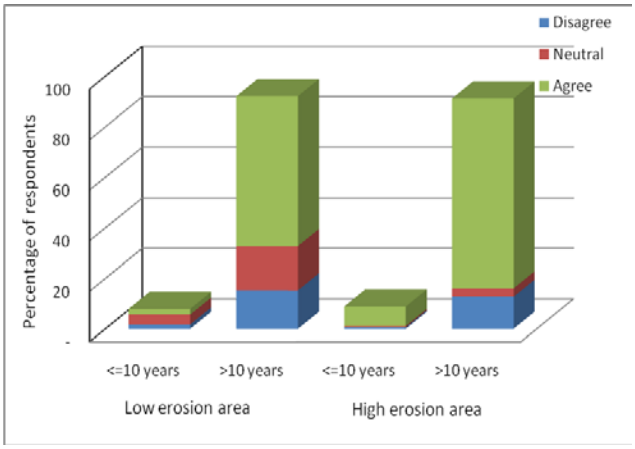


Figure 5-2: Participants with different groups of time of residency responding to the statement “most people in this community could be trusted”

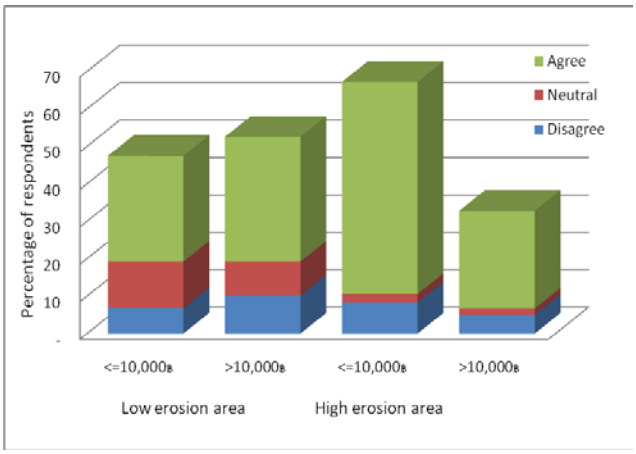


Figure 5-3: Participants with different groups of income responding to the statement “most people in this community could be trusted”

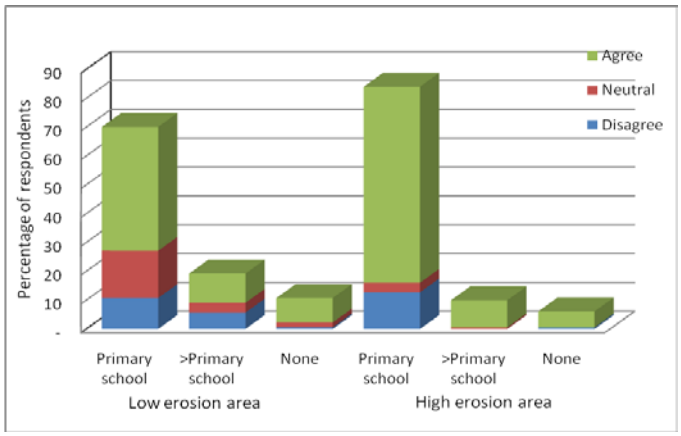


Figure 5-4: Participants with different groups educational qualification responding to the statement “most people in this community could be trusted”

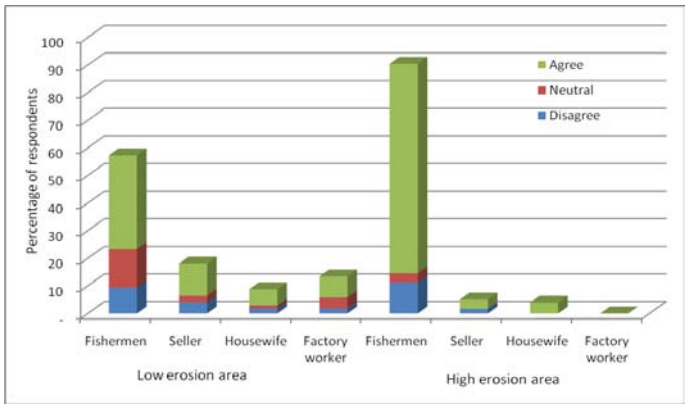


Figure 5-5: Participants with different occupations responding to the statement “most people in this community could be trusted”

Appendix 5-3: Graphs of response on statements about sense of community between low and high erosion areas

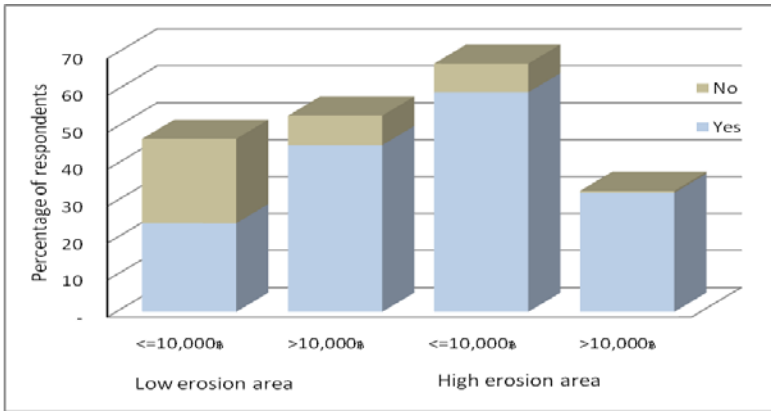


Figure 5-6: Participants with different groups of income responding to the statement "if you disagree with what everyone else agreed on, would you feel free to speak out"

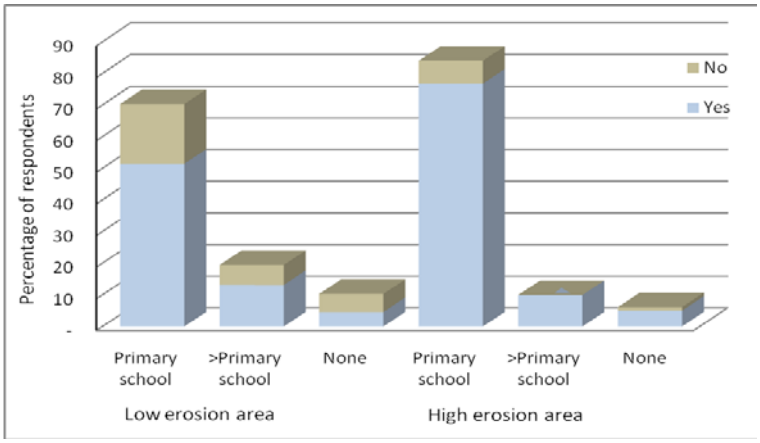


Figure 5-7: Participants with different groups of educational qualification responding to the statement "if you disagree with what everyone else agreed on, would you feel free to speak out"

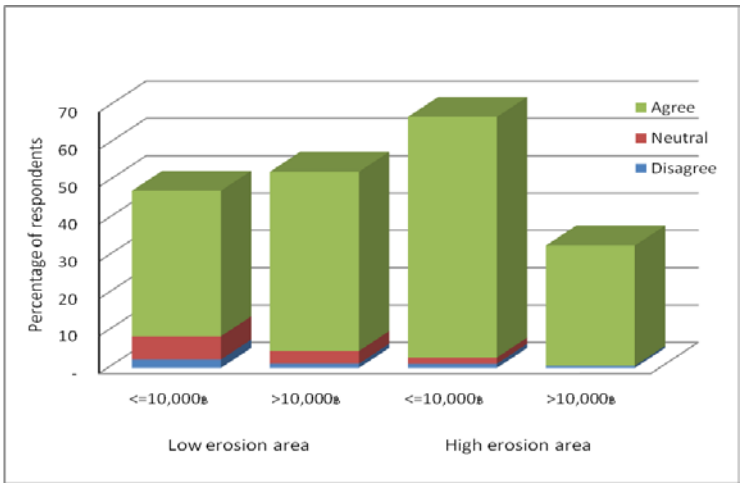


Figure 5-8: participants with different incomes responded to a statement "you tolerated different opinions from other members in meetings**"**

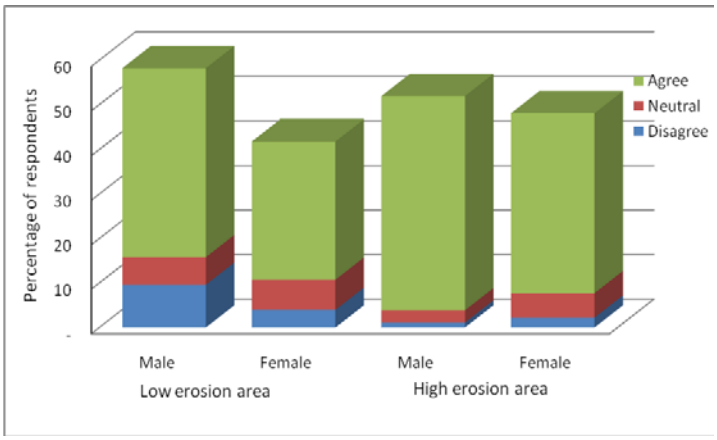


Figure 5-9: Participants with different genders responding to the statement “you believe the community can manage most problems itself”

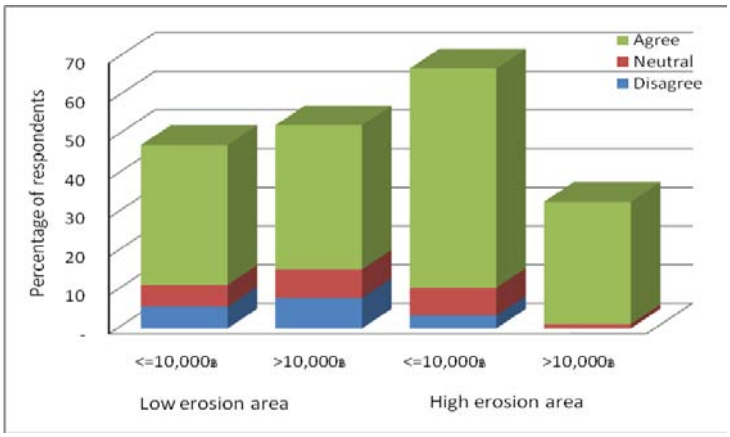


Figure 5-10: Participants with different groups of income responding to the statement “you believe the community can manage most problems itself”

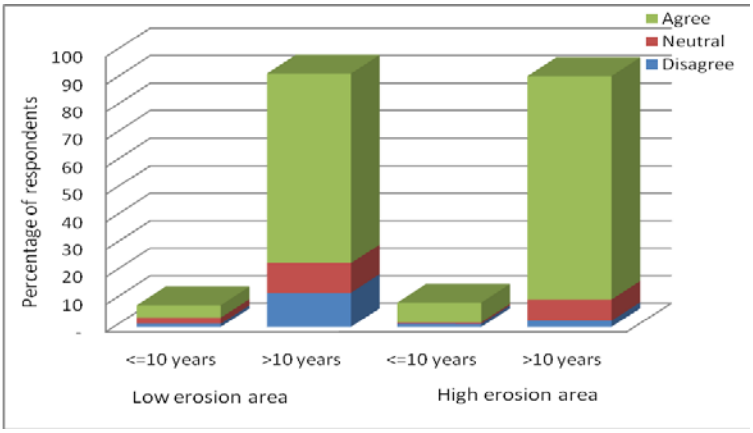


Figure 5-11: Participants with different groups of time of residency responding to the statement “you believe the community can manage most problems itself”

Appendix 5-4: Graphs of response on statements about skills and knowledge between low and high erosion areas

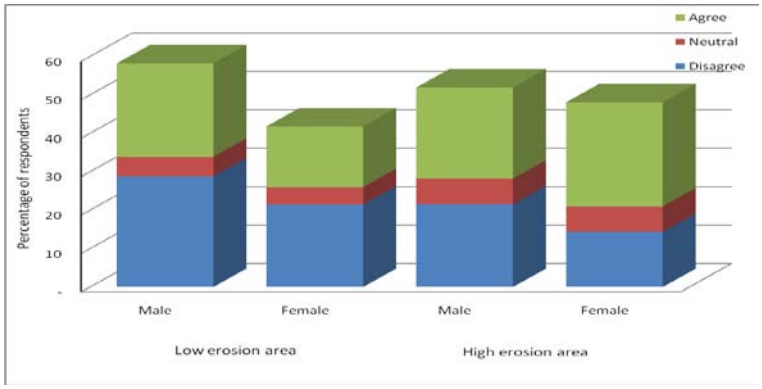


Figure 5-12: Participants with different genders responding to the statement "you could ask soneone to give information to help you make a decision in your community"

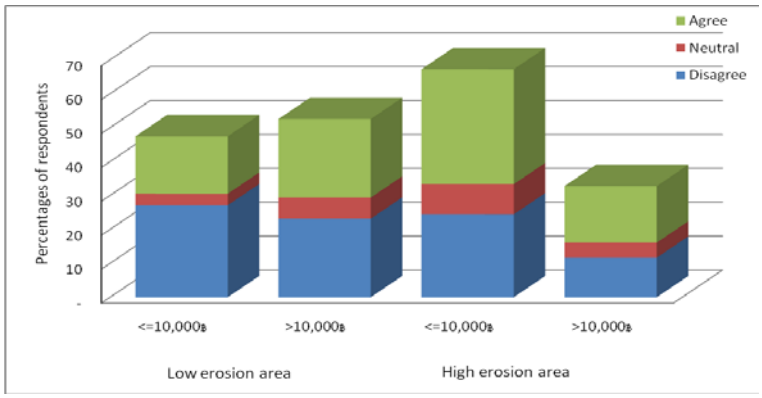


Figure 5-13: Participants with different groups of income responding to the statement "you could ask soneone to give information to help you make a decision in your community"

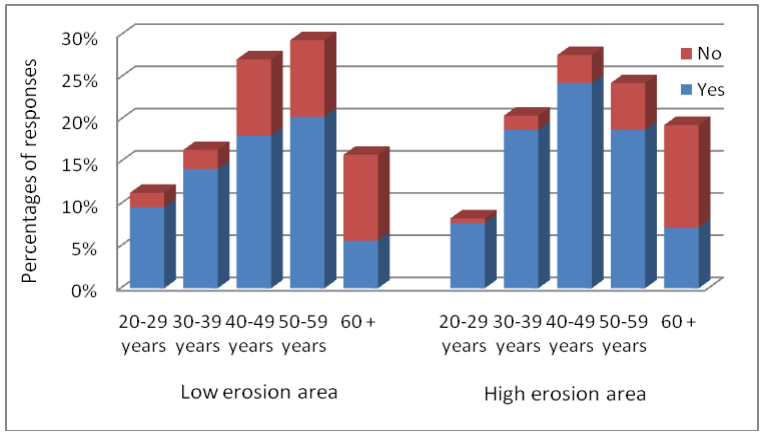


Figure 5-14: Participants with different age groups responding to the statement "you are interested in seeking information to improve a village"

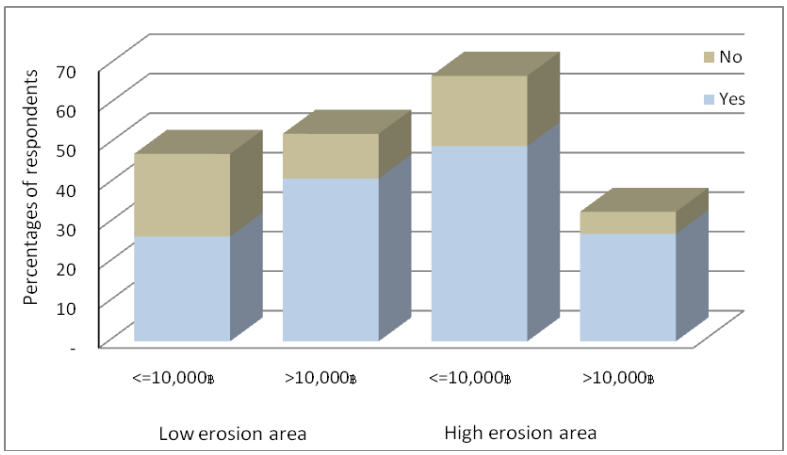


Figure 5-15: Participants with different groups of income responding to the statement “you are interested in seeking information to improve your village”

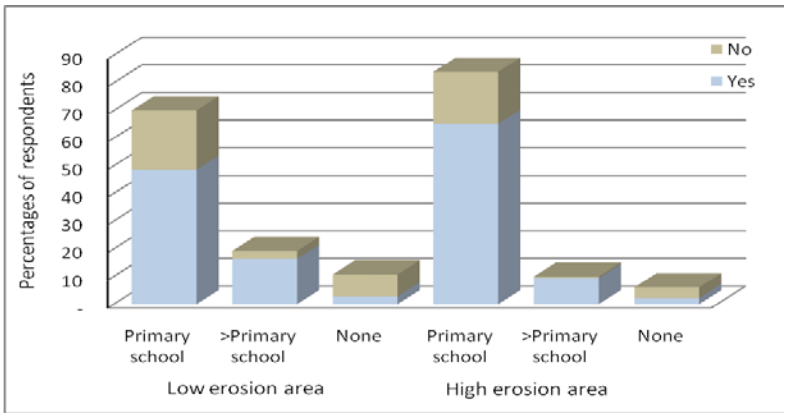


Figure 5-16: Participants with different groups of educational qualification responding to the statement “you are interested in seeking information to improve your village”

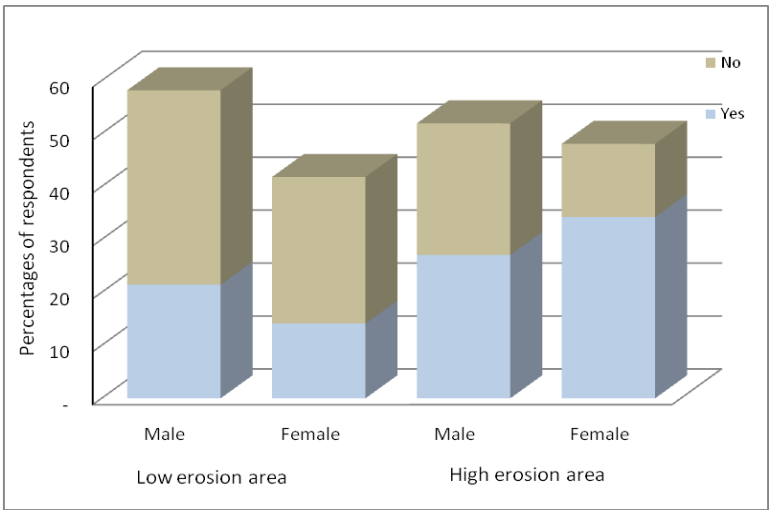


Figure 5-17: Participants with different genders responding to the statement “you had attended training programs to develop your village in the past 12 months”

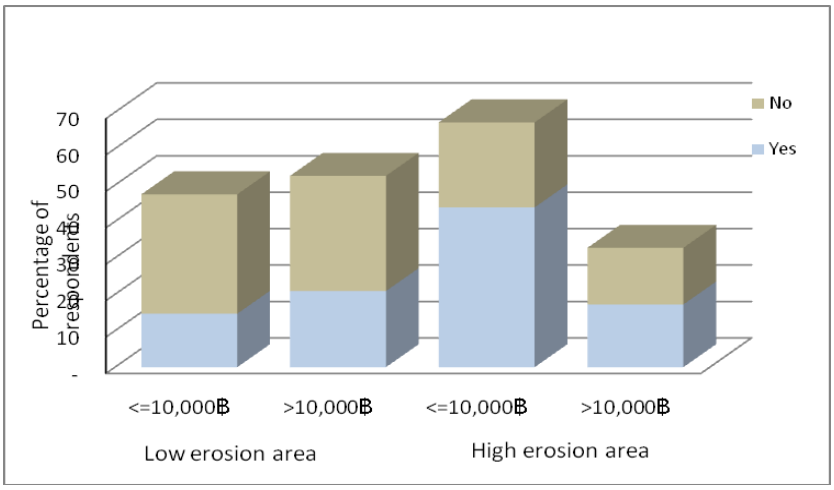


Figure 5-18: Participants with different income groups responding to the statement “you had attended training programs to develop your village in the past 12 months”

Appendix 5-5: Graphs of response on statements about participation between low and high erosion areas

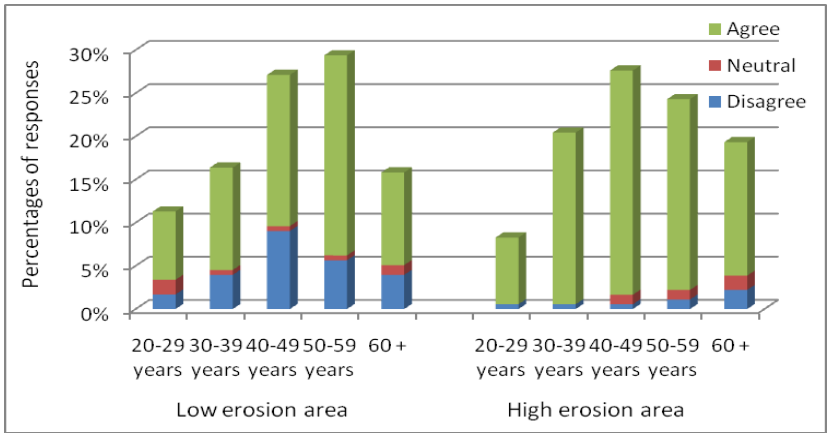


Figure 5-19: Participants with different age groups responding to the statement "you have opportunity to participate in decision-making about development projects in your village"

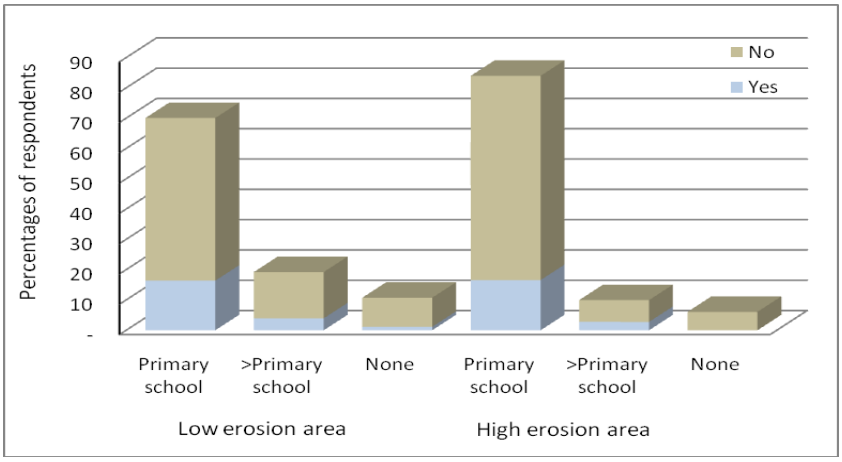


Figure 5-20: Participants with different groups of educational qualification responding to the statement "you have opportunity to participate in decision-making about development projects in your village"

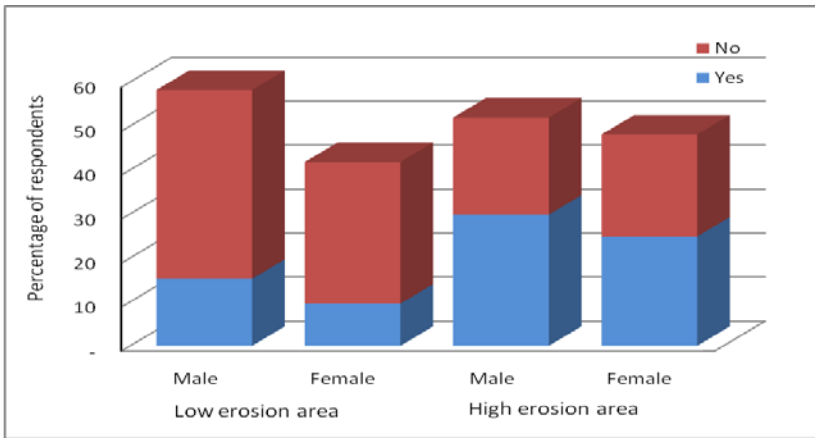


Figure 5-21: Participants with different genders responding to the statement "you are a member of a group in this community"

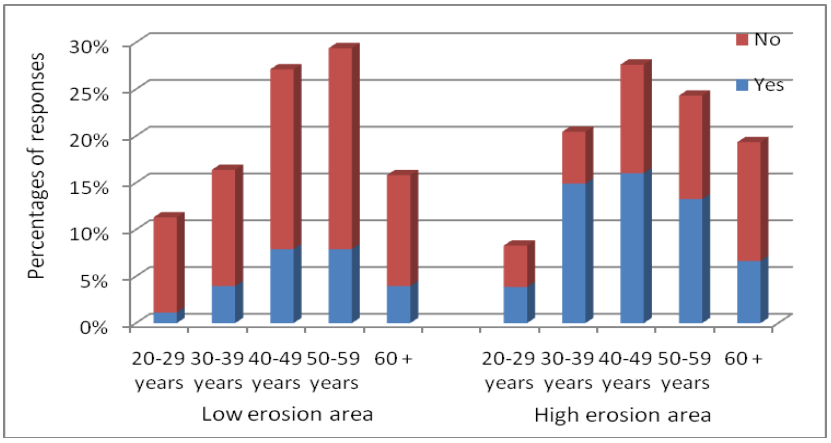


Figure 5-22: Participants with different age groups responding to the statement “you are a member of a group in this community”

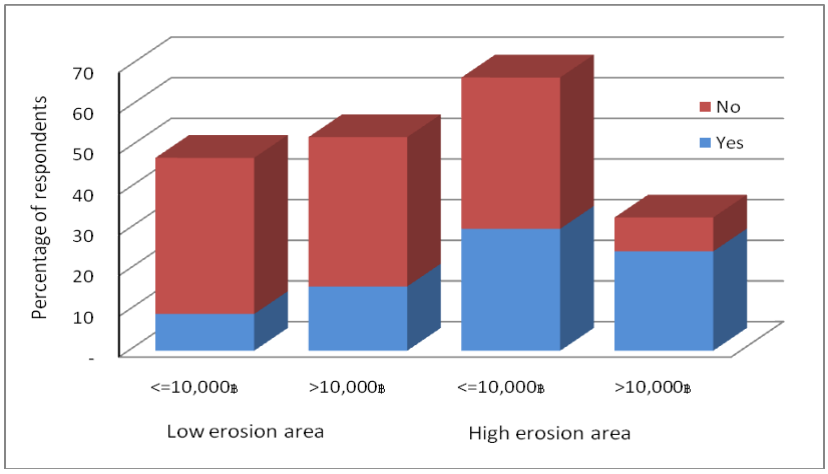


Figure 5-23: Participants with different groups of income responding to the statement “you are a member of a group in this community”

Appendix 5-6: Graphs of response on statements about leaders and leadership between low and high erosion areas

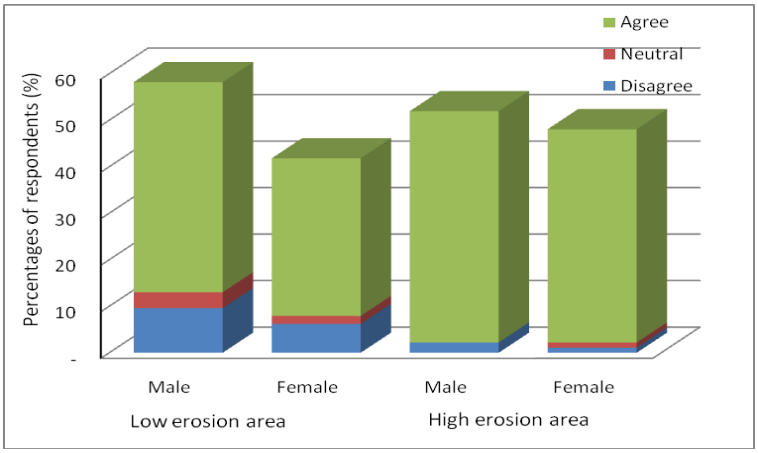


Figure 5-24: Participants with different genders responding to the statement "women were accepted when they work as leaders in a community"

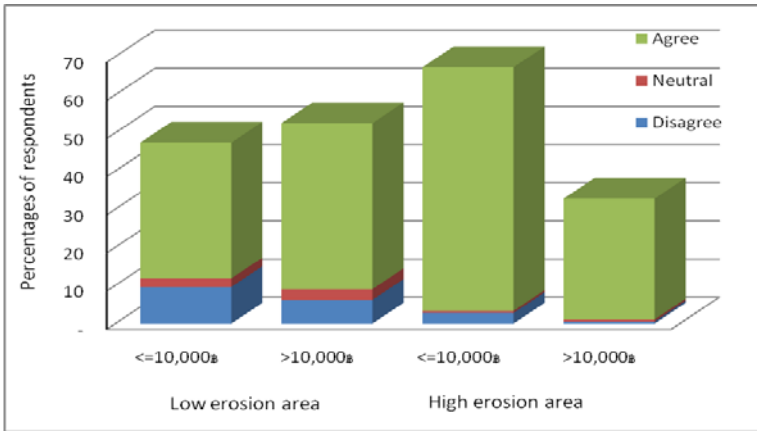


Figure 5-25: Participants with different groups of income responding to the statement "women were accepted when they work as leaders in this community"

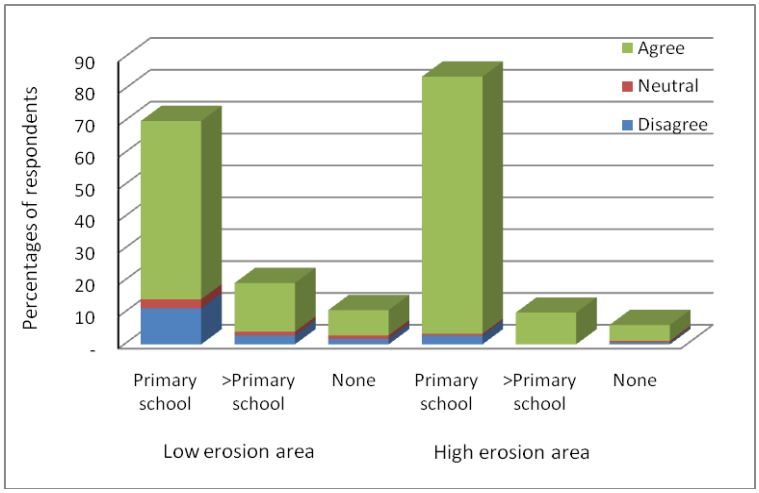


Figure 5-26: Participants with different groups educational qualification responding to the statement "women were accepted when they work as leaders in this community"

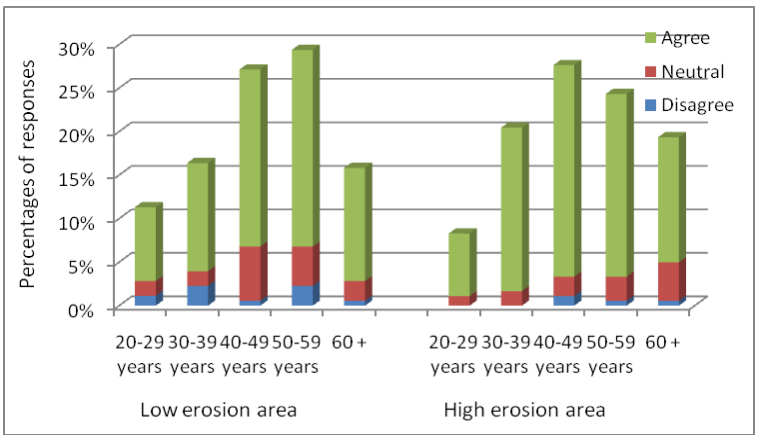


Figure 5-27: Participants with different age groups responding to the statement "community leaders were interested in solving every problem in a community"

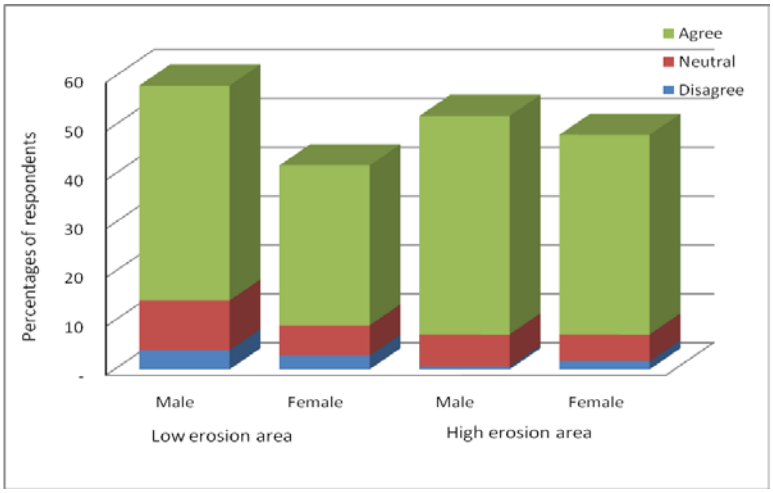


Figure 5-28: Participants with different genders responding to the statement 'community leaders were interested in solving every problem in a community'

Appendix 5-7: Graphs of response on statements about resources between low and high erosion areas

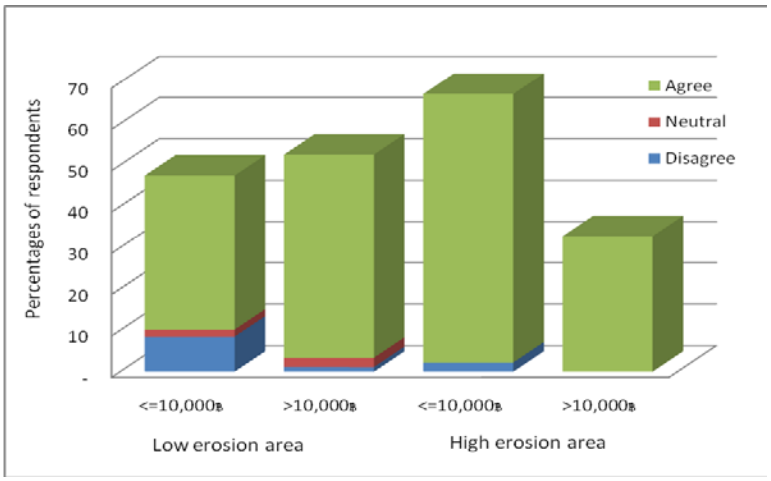


Figure 5-29: Participants with different groups of income responding to the statement “you always supported the village through donation of money”

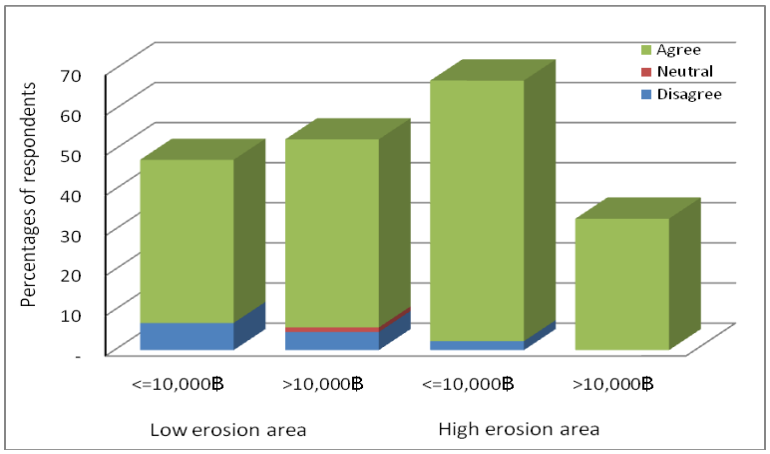


Figure 5-30: Participants with different groups of income responding to the statement “you always supported the village through donation of time by participating in community activities”

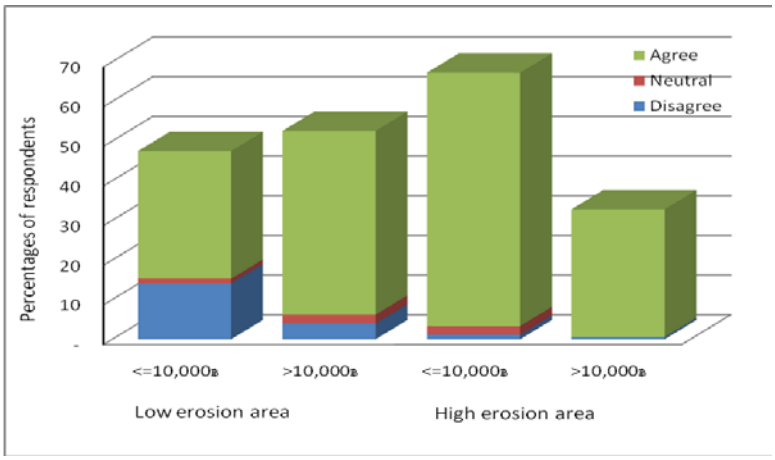


Figure 5-31: Participants with different groups of income responding to the statement “you always supported the village through donation of goods”

Appendix 5-8: Graphs of response on statements about networks between low and high erosion areas

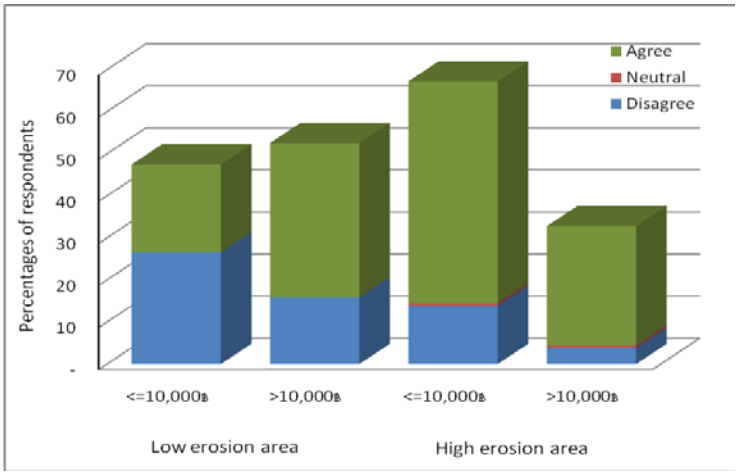


Figure 5-32: Participants with different groups of income responded to the statement "you usually went to other villages to visit friends"

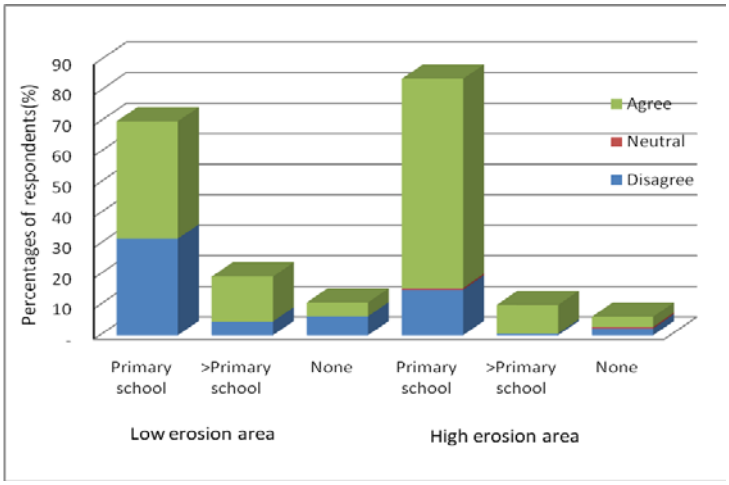


Figure 5-33: Participants with different educational qualification responded to the statement "you usually went to other villages to visit friends"

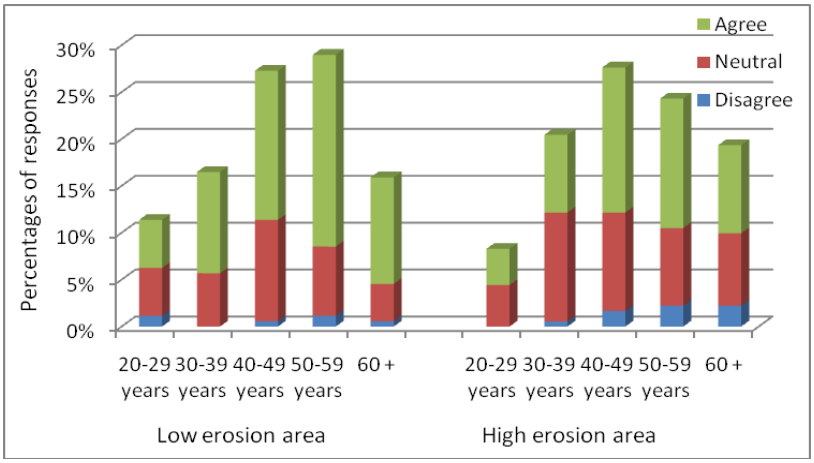


Figure 5-34: Participants with different age groups responded to the statement "the local authority carefully used funding to develop new projects"

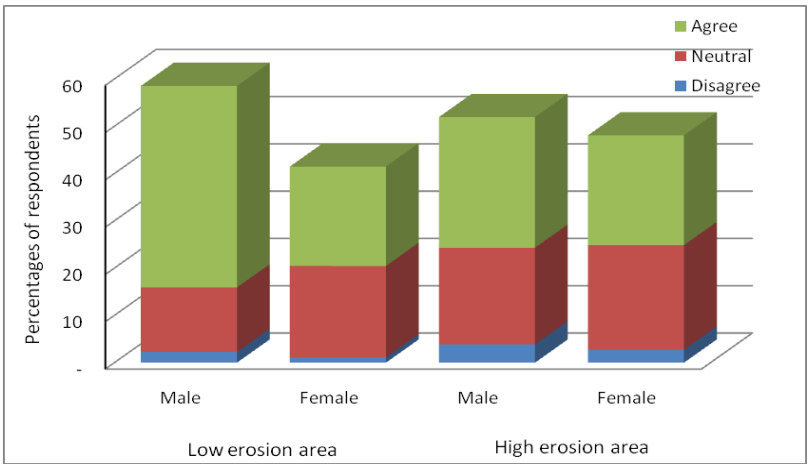


Figure 5-35: Participants with different genders responded to the statement “the local authority carefully used funding to develop new projects”

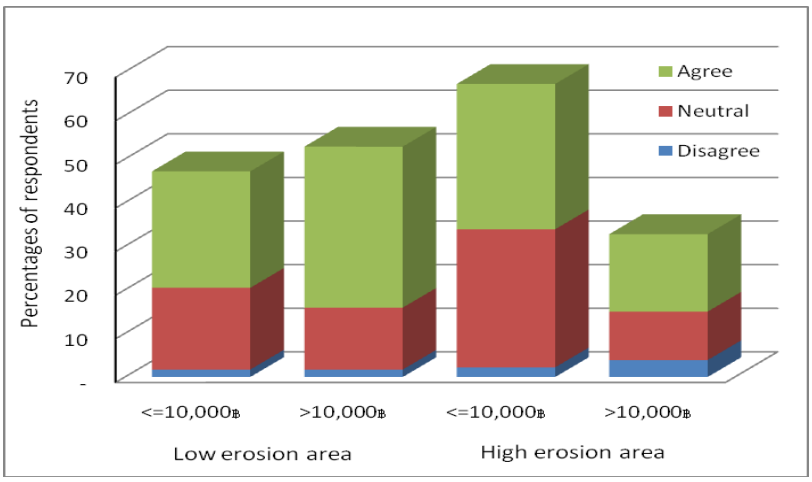


Figure 5-36: Participants with different groups of income responded to the statement “the local authority carefully used funding to develop new projects”

Appendix: Chapter 6

Appendix 6-1: Correlation among items

Items	0)	03)	05)	07)	08)	4)	5)	8)	13)	14)	16)	18)	22)	24)	26)	30)	46)	48)	50)	54)	56)	61)	63)	67)	69)
0)	1.00	-.09	-.19	-.19	-.56	.07	.17	.21	.22	.09	.13	.06	.20	-.08	-.41	-.18	.15	.21	.13	.32	.42	.30	.04	.27	.00
03)	-.09	1.00	.00	-.04	-.01	-.08	-.05	-.12	-.06	-.04	.01	-.06	-.09	-.06	.03	.04	-.07	-.09	-.07	.13	-.01	.01	.10	-.01	-.03
05)	-.19	.00	1.00	.19	-.01	-.04	-.09	.13	.03	.07	.09	-.20	-.21	-.06	.04	.07	.08	-.01	.12	-.18	.02	-.09	.09	.14	-.12
07)	-.19	-.04	.19	1.00	.20	-.16	-.04	.15	.21	.00	-.01	.05	-.01	.02	.03	.08	.23	.23	.03	-.01	-.05	-.09	.01	.11	.00
08)	-.56	-.01	-.01	.20	1.00	-.05	-.14	-.18	-.28	-.12	-.16	.05	-.05	.03	.47	.12	.02	-.12	-.04	-.31	-.32	-.08	.06	-.02	-.02
4)	.07	-.08	-.04	-.16	-.05	1.00	.22	.16	-.10	.20	.25	.16	.27	.09	-.09	-.12	-.03	-.02	.03	-.02	-.04	-.13	-.06	.01	.14
5)	.17	-.05	-.09	-.04	-.14	.22	1.00	.11	.07	.55	.21	.07	.18	.21	-.05	.15	.06	.01	.00	.13	.07	.01	-.16	-.01	.25
8)	.21	-.12	.13	.15	-.18	.16	.11	1.00	.30	.11	.19	.04	.04	.06	-.14	.04	.11	.30	.07	.08	.28	.19	.10	.17	.08
13)	.22	-.06	.03	.21	-.28	-.10	.07	.30	1.00	.12	.23	-.07	-.11	-.07	-.34	.00	.07	.29	.04	.13	.17	.23	-.10	.08	-.03
14)	.09	-.04	.07	.00	-.12	.20	.55	.11	.12	1.00	.32	-.04	.05	.13	-.02	.09	-.03	.06	-.06	.02	.15	-.06	-.16	.01	-.02
16)	.13	.01	.09	-.01	-.16	.25	.21	.19	.23	.32	1.00	.23	.14	.16	-.29	.23	.11	.22	-.03	-.03	.17	.18	-.12	.15	.14
18)	.06	-.06	-.20	.05	.05	.16	.07	.04	-.07	-.04	.23	1.00	.49	.38	-.14	.10	-.04	.37	-.02	.00	-.12	.06	-.16	.08	.43
22)	.20	-.09	-.21	-.01	-.05	.27	.18	.04	-.11	.05	.14	.49	1.00	.37	-.08	-.01	.05	.33	.06	.17	-.03	.14	-.03	.19	.28
24)	-.08	-.06	-.06	.02	.03	.09	.21	.06	-.07	.13	.16	.38	.37	1.00	.05	.21	.05	.23	.06	.01	-.04	-.01	-.02	-.01	.46
26)	-.41	.03	.04	.03	.47	-.09	-.05	-.14	-.34	-.02	-.29	-.14	-.08	.05	1.00	.04	.06	-.05	.02	-.17	-.29	-.23	.15	-.13	-.09
30)	-.18	.04	.07	.08	.12	-.12	.15	.04	.00	.09	.23	.10	-.01	.21	.04	1.00	.09	.14	.00	-.11	-.02	-.05	.05	.03	-.04
46)	.15	-.07	.08	.23	.02	-.03	.06	.11	.07	-.03	.11	-.04	.05	.05	.06	.09	1.00	.30	.20	.13	.12	.15	.22	.41	-.02
48)	.21	-.09	-.01	.23	-.12	-.02	.01	.30	.29	.06	.22	.37	.33	.23	-.05	.14	.30	1.00	.13	.10	.20	.16	-.03	.35	.12
50)	.13	-.07	.12	.03	-.04	.03	.00	.07	.04	-.06	-.03	-.02	.06	.06	.02	.00	.20	.13	1.00	.03	.10	.13	.26	.32	.02
54)	.32	.13	-.18	-.01	-.31	-.02	.13	.08	.13	.02	-.03	.00	.17	.01	-.17	-.11	.13	.10	.03	1.00	.33	.07	.04	.01	.09
56)	.42	-.01	.02	-.05	-.32	-.04	.07	.28	.17	.15	.17	-.12	-.03	-.04	-.29	-.02	.12	.20	.10	.33	1.00	.40	.08	.18	-.05
61)	.30	.01	-.09	-.09	-.08	-.13	.01	.19	.23	-.06	.18	.06	.14	-.01	-.23	-.05	.15	.16	.13	.07	.40	1.00	.17	.32	.14
63)	.04	.10	.09	.01	.06	-.06	-.16	.10	-.10	-.16	-.12	-.16	-.03	-.02	.15	.05	.22	-.03	.26	.04	.08	.17	1.00	.34	.00
67)	.27	-.01	.14	.11	-.02	.01	-.01	.17	.08	.01	.15	.08	.19	-.01	-.13	.03	.41	.35	.32	.01	.18	.32	.34	1.00	.01
69)	.00	-.03	-.12	.00	-.02	.14	.25	.08	-.03	-.02	.14	.43	.28	.46	-.09	-.04	-.02	.12	.02	.09	-.05	.14	.00	.01	1.00

Appendix 6-2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.644
Bartlett"s Test of Sphericity	Approx. Chi-Square	919.789
	df	300
	Sig.	.000